Abstract

The case study examines two questions on the lexical acquisition of a language-delayed child with Autism Spectrum Disorder. The language development of the child, Graeme, from his birth to the age of three years, one month, is primarily sourced from naturalistic data collected in a daily diary by the mother/researcher.

The first research question concerns the relationship between the child’s social/cognitive development and the major transitions in his earliest acquisition of comprehension and production. The major transitions in Graeme’s early word learning were the onset of comprehension, the onset of production, the onset and growth of intentional communication, the production of his initial idiosyncratic word/signs, the word spurt in comprehension, the semantic re-organisations during that period, and, at the end point, learning words spontaneously in comprehension. The milestones in Graeme’s social/cognitive development that were found to correlate with the transitions in his lexical acquisition were the naming insight, symbolic representation, exhaustive categorisation, and the joint attention abilities of gaze and point following, pointing, intersubjectivity, and initiating joint attention. These joint attention skills provided Graeme, a nonverbal child, with a means to ask for the names of things (his name question).

The second research question examines the current definitions of the earliest words in production. A case is made for an extended definition of early words to include the acquisition of the earliest meaningful idiosyncratic productions of vocalisations and gestures of children with the language delay characteristic of autism.
Preface

The renewal number for the Behavioural Research Ethics Board certificate of “approval-minimal risk” is H08-00542-A003. The Annual Renewal for Study for research involving human subjects was approved on December 12, 2010.
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<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AoA</td>
<td>Age of Acquisition</td>
</tr>
<tr>
<td>ASD</td>
<td>Autism Syndrome Disorder</td>
</tr>
<tr>
<td>ASL</td>
<td>American Sign Language</td>
</tr>
<tr>
<td>CDI</td>
<td>Communicative Developmental Inventory</td>
</tr>
<tr>
<td>CHDC</td>
<td>Children’s Hospital Diagnostic Centre</td>
</tr>
<tr>
<td>CV</td>
<td>Consonant Vowel</td>
</tr>
<tr>
<td>F</td>
<td>Graeme’s Father</td>
</tr>
<tr>
<td>IDP</td>
<td>Infant Development Programme</td>
</tr>
<tr>
<td>IJA</td>
<td>Initiating Joint Attention</td>
</tr>
<tr>
<td>IPA</td>
<td>International Phonetic Alphabet</td>
</tr>
<tr>
<td>IQ</td>
<td>Intelligence Quotient</td>
</tr>
<tr>
<td>MLU</td>
<td>Mean Length of Utterance</td>
</tr>
<tr>
<td>SCD</td>
<td>Social/Cognitive Development (list)</td>
</tr>
<tr>
<td>SVO</td>
<td>Subject Verb Object</td>
</tr>
<tr>
<td>TD</td>
<td>Typically Developing</td>
</tr>
<tr>
<td>WE</td>
<td>Word Event (list)</td>
</tr>
</tbody>
</table>
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Dedication

To my son, Graeme.
Chapter 1: Introduction to the Study

The scope and purpose of the study and the research questions

This dissertation is an examination of the early lexical acquisition of a toddler with Autism Spectrum Disorder (ASD), my son Graeme, whose word learning was delayed in both comprehension and production. It is based on a case study of his development from birth over a three-year period, primarily sourced from a diary collection of naturalistic data. There are two research questions addressed in this dissertation.

1. What is the relationship between the delayed and unusual early lexical acquisition, in both comprehension and production, of my son Graeme with ASD, and the major developmental milestones in his cognitive and social growth?

2. Can the meaning and function of his early idiosyncratic productions justify the inclusion of these in his lexicon as word/signs and, if so, how does this inclusion explicate the definition of what comprises a word in the lexical acquisition of children with ASD?

In this study, a qualitative analysis of the linguistic and social-cognitive data is designed to reveal the temporal connections between Graeme’s developmental streams in language, cognition, and socialisation. A linguistic analysis of the phonological, pragmatic, and semantic aspects of his word learning in its initial phase covers three developmental periods. The first is the prelinguistic period from birth to the onset of comprehension at 02.06.00, the second is the period of slow word learning in both comprehension and production from 02.06.00 to 02.09.28, and the third is the period of the word spurt in comprehension. The analysis identifies the transitions that signalled reorganisations in Graeme's word learning. These include: the onset of comprehension, the re-emergence of babble, the onset and growth of intentional communication, the production of the early word/signs, and the word spurt in comprehension. Other structural

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1 The shorthand format for ages is given as 02.06.13, meaning two years, six months, thirteen days of age. A variation is the format 02.02, meaning two years, two months of age.
changes identified by the analysis are two semantic reorganisations. The first is in extensions of meaning during the period of rapid word learning in the comprehension lexicon and the other is in lexical groupings of both the comprehension and production lexicons².

The analysis of Graeme’s emerging and continuing behaviour reveals his social/cognitive developments such as categorisation, symbolic representation, the naming insight, and joint attention abilities. Joint attention (attention to a shared referent) is a pivotal development in lexical acquisition in children with ASD. Descriptions of Graeme’s social/cognitive developments and his autistic characteristics are based on data drawn from the context of Graeme’s daily life. His lexical acquisition is examined in relationship to his social/cognitive growth.

Like that of typically developing (TD) children, Graeme’s comprehension evolved from slow, context bound, case-by-case word learning to spontaneous, efficient, and rapid acquisition. Graeme’s full and partial acquisition of form and meaning in the unusual early words of his small productive lexicon occurred within the continuum of his production of babble, intentional vocalisations and gestures, onomatopoeic and idiosyncratic words, and context bound word-object associations.

Theoretical issues

The issue of what constitutes a word in a child’s early vocabulary is central to the discussion of lexical acquisition. My second research question addresses the definition of a word in child language acquisition research, and the criteria for the point of entry into the early lexicon in production. The various interpretations in previous research of when an infant speech production gains the status of being a word, and some of the theoretical questions that these interpretations raise, both in theory and in the practise of data-based studies of vocabulary acquisition, are investigated in the light of my findings. The

² The two data sets of Graeme’s comprehension and production comprise his lexicons.
application of these interpretations to a child with ASD who may not acquire every criterion for word status is explored.

Other theoretical issues discussed in this study are the differences, if any, between Graeme’s lexical acquisition and that of TD children.

**Rationale for the study**

Although a primary diagnostic feature of ASD is the delayed acquisition of lexical comprehension and production (Lord, Risi, & Pickles, 2004), there have been few studies of early word learning of children with ASD (Bailey, 2006), few longitudinal studies of language acquisition of verbal children with ASD, and no detailed daily diary studies of lexical acquisition with concentrations on comprehension and on the earliest impressions of lexical emergence and early pre-speech intentional communication productions for this population. Tager-Flusberg writes,

> Little is known about the development of language in autism. There have been few longitudinal studies conducted during the critical period when children with autism are in the process of acquiring language …. Such longitudinal studies can encompass both an individual difference approach and a comparative approach to explore variation in the development of language among children with autism (including when children begin to speak, growth patterns within and across different components of language, developmental rates and end points) …. These kinds of studies are crucial for a more complete understanding of language and communication in autism that will inform basic research on underlying etiology and will ultimately lead to the development of new treatments that can improve the lives of children with autism, all of whom have significant deficits in this domain (Tager-Flusberg, Paul, & Lord, 2005 p.79).

In addition, there have been few longitudinal studies using natural language data at this level of detail on the processes of lexical acquisition in the earliest word learning in comprehension and production of TD children.
Outline of the chapters

The dissertation is organised into seven chapters and an afterword. The first chapter is this introduction to the research questions and the scope and purpose of the study. Chapter 2 reviews literature on early lexical acquisition research in TD children, including the prerequisites and conditions for the onset of word learning, and aspects of the acquisition of the lexicons in comprehension and production, such as the rates of learning. It also discusses theories and models of word learning and investigates definitions for early words. Chapter 3 reviews literature on early lexical acquisition research on children with ASD that examines characteristics of language development and impairments in this population, along with predictors of language outcomes.

Chapter 4 contains a description of case study and diary study methodology, details the design and the methods of data collection in the present study, and lists other sources of data. This chapter defines the categories of analysis for Graeme’s linguistic and social-cognitive developmental streams, the criteria used for Graeme’s lexical acquisition in comprehension and production, and the design and rationale for the two taxonomies that are the analytical tools.

In Chapters 5 and 6 the data are presented and interpreted with reference to the relevant literature. The chapters are organised chronologically, and include journal entries from the diary. Chapter 5 examines the correlation of Graeme’s linguistic growth, social behaviour, and cognitive abilities in three periods: the prelinguistic period from birth to 02.06, the period of slow word learning in comprehension until 02.09.28, and the onset of early word production in this period. Chapter 6 examines the correlation of Graeme’s lexical acquisition with his social-cognitive development during the period of the word spurt in comprehension. The discussion in Chapter 6 covers the pragmatic functions of his intentional communication, semantic reorganisations in comprehension during rapid word learning, the relationship of new areas of lexical knowledge in comprehension to symbolic representation, and the additions to Graeme’s productive vocabulary, including the phonological contrasts he employed.
Chapter 7 addresses the conclusions that can be drawn from the findings with regard to the two research questions, examines the limitations of the study, and summarises implications for current theories and for further research.

The afterword is written and titled (*Afterward!* by Graeme himself, and has not been edited. It demonstrates his current language ability while describing his involvement in this project and his current life.

There are three Appendices. Appendix A contains the complete entries from the daily diary for the excerpts used in this study, a tape transcript, and an assessment from Graeme’s preschool. Appendix B contains samples of data from different periods in Graeme’s word learning from the taxonomies of the Word Event list and the Social/Cognitive Development list, as well as a list of Graeme’s complete lexicon in comprehension, in the order of the age of acquisition (AoA). Appendix C contains the letter of consent given to Graeme for his participation in this study.

With a data set from a child with language delay and ASD, a focus on comprehension acquisition, and a fine-grained detailed set of the earliest lexical acquisitions analysed at varying levels of specificity with which to answer the research questions, this study hopes to contribute to the research on the lexical acquisition of children with ASD.
Chapter 2: Research and Theory on Early Lexical Acquisition

Introduction

Research and theory on early lexical acquisition reflects the complexity of both child language development and of the nature of words themselves. The various threads of social, conceptual, perceptual, cognitive, phonological, semantic, and communicative knowledge emerge and are woven together in word learning. This chapter will examine the major empirical research and theory on the onset of lexical acquisition in the comprehension and production modalities of TD infants and toddlers. The focus will be on research in the areas that apply to the two research questions in this dissertation; one, the relationship between early lexical acquisition and social/cognitive development, and two, the definition of what an early word is.

Theoretical research in these areas attempts to explain the circumstances and processes in which infants first learn to perceive speech, perceive adult intentions, communicate their own intentions, establish joint attention, and attach meaning to adult words. Theoretical and empirical research also offers explanations for how infants achieve cognitive milestones, develop semantic categories, transition into rapid lexical comprehension, produce their first, idiosyncratic, non-systematic words and gestures, and acquire symbolic, referential words.

The areas of research and theory covered in this chapter are the following: theories of word learning; defining early words; prerequisites for learning words; acquiring the comprehension lexicon; acquiring the early production lexicon; the transition to reference; and age, rate, and the entry point of acquisition. The first section looks at contemporary theories of lexical acquisition that provide models of word learning: the intentional models of the social-interactionists, attentional associationist models, the cognitivist, hybrid, and developmental models. The section on the prerequisites for learning early words discusses proposals put forward by various theoretical viewpoints: social interaction, categorisation, a priori constraints on word learning; perceptual
salience and motor maturation; and the child’s contents of mind, and caregiver’s input. Research on the acquisition of the comprehension lexicon includes an overview of major data-based studies, research on speech perception, the comprehension word spurt, and the rate of comprehension acquisition. The section on the acquisition of the early productive lexicon consists of studies on acquiring intentional communication, gesture and sign, babble, the phonetic form of early words, onomatopoeic words, context bound words, acquiring meaning, and early semantic categories. The section on the transition to reference examines research on acquiring referential words, exhaustive categorisation (spontaneously sorting objects into groups), and symbolic representation. The final section looks at age, timing, and rate of production acquisition, and determining the entry point of acquisition into the lexicon. Research in the lexical acquisition of TD children in both the comprehension and productive lexicons informs my first research question:

What is the relationship between early lexical acquisition in both comprehension and production and the major developmental milestones in cognitive and social development?

Definitions and terminology for the early meaningful productions of TD children are many and various, depending to some extent on the theoretical point of view. In this section, the criteria for word status of the earliest productions are considered in terms of form, meaning, and function. This involves research on phonetic form, variations in word learning, pragmatic functions of intentional communication and gestures, and the acquisition of meaning from context bound to symbolic words. Gestured and/or vocalised early forms with context dependent meanings traverse the fuzzy border of what defines a word in child language, whereas the transition to reference has an agreed-upon definition. Examining the criteria for word status applies to my second research question:

Can the meaning and function of the initial idiosyncratic productions justify the inclusion of these in the early lexicon as word/signs and how does this inclusion explicate the definition of what comprises a word in the lexical acquisition of children with autism?
Theories of word learning

Introduction

In the field of study of early word acquisition, two contemporary theoretical issues emerge. One debate is over the primacy of social or cognitive factors in the ontogeny of word learning and in the development of the comprehension and production lexicons: which factor best prepares prelinguistic TD infants in their first year to identify words, and propels toddlers in their second year through the slow beginnings of acquisition to the transition to reference? The second debate concerns which explanation best accounts for the continuum of development in lexical acquisition. The relative importance of social and cognitive developments and the developmental aspects of word learning are differently weighted according to the theoretical views of researchers in the field. These views can be summarised as social-interactionist, associationist, cognitivist, hybrid, and developmental.

While theories of word learning are mostly directed towards the acquisition of referential words in production, there are implications for comprehension and for acquiring early pre-referential words. The following sections look briefly at these theoretical models of lexical acquisition. Key theoretical claims will be discussed further in the sections on prerequisites for learning early words and acquiring the comprehension and production lexicons.

Social-interactionist theories

Broadly, interactionist theorists regard linguistic, maturational, cognitive, and social variables as both affecting and being affected by language acquisition. For a comparison of theories in the process of lexical acquisition, the social-interactionists will be discussed separately from the cognitivists and developmental theorists. The social-interactionist theorists focus more on social aspects of word learning. Researchers Akhtar and Tomasello (2000) argue that the prime instruments of word learning are the social-pragmatic abilities of joint attention and knowledge of communicative intentions. This
theoretical position contends that words are learned in the context of interpersonal communication and attentional engagement (Estigarribia & Clark, 2007). Functionalist theorists similarly claim that word learning results from the pragmatic needs of the child (Halliday, 1975). Social-interactionists and functionali
ts propose descriptions of the onset and the developmental nature of lexical acquisition, as determined by the child’s motivation to function and communicate, the child’s contents of mind, social and pragmatic cues, and the input the child receives in social interaction (Adamson, Bakeman, & Deckner, 2005; Adamson, Deckner, & Bakeman, 2010; L. Bloom & Tinker, 2001; Diesendruck, Markson, Akhtar, & Reudor, 2004; Halliday, 1975; Markson, Diesendruck, & Bloom, 2008). These theories are sometimes termed “intentional” as they suggest that from infancy on, children access the intentions of others in social interactions through goal-directed action in order to determine word meaning (Woodward, 2004; Woodward & Needham, 2009). From this viewpoint, the entire process of word learning can be seen as inherently social.

**Cognitivist theories**

The cognitivist position is that lexical acquisition is in itself a cognitive process. Many researchers in psycholinguistics claim that domain-general conceptual abilities (those tailored to process general knowledge such as attention, memory, and association) are precursors to, and necessary for, the onset of lexical acquisition and for rapid word learning in comprehension and production. Cognitive abilities specific to language that are necessary for lexical acquisition are categorisation (Clark, 2003; Gopnik & Nazzi, 2003), the naming insight (Dore, Franklin, Miller, & Ramer, 1976) and symbolic representation (Lifter & Bloom, 1989; Piaget, 1962). The acquisition of these abilities causes qualitative shifts in the child’s word learning. Some proponents of cognition-based lexical acquisition propose that children have innately determined linguistic constraints that narrow the search space in order to deduce word meaning (Booth, Waxman, & Huang, 2005; Cimpian & Markman, 2005; Dromi, 1999; Kuczaj & Barrett, 1999; Merriman & Evey, 2005). Waxman (2010) proposes a word learning model that considers the diverse and flexible developmental relationship between the lexical
linguistic system and conceptual organisation, with its roots in generative linguistics and cognitive psychology. She argues against a perceptually and attentionally based associationist view of the links between words and concepts, proposing that conceptual knowledge permits inductive references for noun, adjective, and verb labels (Waxman & Lidz, 2006; Waxman & Gelman, 2009).

**Associationist theories**

Associationist learning theories from the field of cognitive psychology promote the associative basis of all attentional learning; namely, that associations between cues and outcomes are learned. The attentional model rejects the induction process and hypothesis testing as irrelevant to experiential development, instead accounting for word learning through attentional mechanisms such as perceptual saliency, association, prior learning experiences, and frequency (Kruschke, 2003; Plunkett, Karmiloff-Smith, Bates, & Elman, 1997; Samuelson & Smith, 1998; Samuelson & Smith, 2005; Sloutsky, 2003; L. B. Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002). As babies learn which cues to attend to and become expert at word-object pattern recognition, they become able to generalise across exemplars to deduce the meanings of words (Tan & Schafer, 2005; Yoshida & Smith, 2005). L. Smith (2000) claims that the term association most precisely describes the attention babies pay to three sets of circumstances. These are: one, relations between forms and referents, and actions and intentions; two, triadic joint attention (the ability to maintain the interaction of two-way communication in eye contact, alternating gaze, and gestures of pointing and showing); and three, syntactic cues and meaning in social exchanges that emphasise gestures and ostensive object handling. These three associations develop through accrued learning experiences into biased learning mechanisms, enabling children to construct assumptions such as the shape bias (a predisposition to categorise same-shaped objects, generalising word meanings based on shape) (Houston-Price, Plunkett, & Harris, 2005). Proponents of the associationist theory claim that it offers a unified theory of internal mental states and processes of cognition though the mechanisms of prediction and forming expectations (Regier & Carlson, 2002; Samuelson & Smith, 2005; Woodward & Hoyne, 1999). Akhtar and Tomasello (2000)
criticise the associationist model for its failure to account for the social aspects of communication such as reading intentions and manipulating attention.

**Hybrid theories**

The emergentist coalition model is a hybrid theory specific to word learning. These theorists propose that both intentional and attentional cues are necessary for word learning (Golinkoff et al., 2000; Hirsh-Pasek, Golinkoff, Hennon, & Maguire, 2004). The emergentist coalition model combines aspects of both the social developmental and cognitive positions, stating that neither cognitive developments nor social understanding alone can explain the nature of lexical acquisition over time (Golinkoff & Hirsh-Pasek, 2006). Hybrid theorists Hollich, Hirsh-Pasek, and Golinkoff disagree with the associationist claim that children’s word learning abilities derive solely from their prior contingencies of word learning leading to systematic expectations about form-referent relationships (Golinkoff et al., 2000). They argue that this claim does not account for knowledge of social-pragmatic cues that enable the child to determine which cues are relevant. Nor do these claims explain how the child decides which aspect of the word meaning to extend: similarity, function, or taxonomic membership. Golinkoff, Mervis, and Hirsh-Pacek (1994) propose that children both actively attend to input and experience. They employ emerging (not innate) principles and biases to construct better strategies for lexical acquisition. This theory regards lexical principles as the product rather than the means of word learning, changing in character as the baby develops into a mature language learner. Reilly (2007) suggests developmental hybrid models of lexical acquisition are best able to incorporate the multiple levels of processing in sound and meaning involved in lexical acquisition, rather than theories which lean towards either solely cognitive or social-interactionist explanations.

**Developmental theories**

Theorists in developmental models of word learning claim that a model must account for the gradual, continuous nature of language learning. The emergentist coalition model proponents contend that word learning is embedded in concurrent social, emotional,
cognitive, and motor growth. Therefore, a word learning theory must explain the changes in developmental processes and behaviour from pre-speech origins through to the qualitatively different acquisition of words during the vocabulary spurt (Akhtar, 2005; Hirsh-Pasek et al., 2004; Hollich et al., 2000; Pruden, Hirsh-Pasek, & Golinkoff, 2006). Dynamic system theories, in which early words gradually enable the development of underlying concepts through the child’s input and experiences, are supported by several researchers (Baldwin & Tomasello, 1998; Dromi, 2008; L. B. Smith, 1999; Tomasello & Akhtar, 1995). The connectionist model is a contemporary developmental model which proposes that gradual, complex, continuous maturation in neurophysiological functions, such as articulatory and phonological ability, influence changes in lexical comprehension and production processes (Clark, 1993; E. &. K. Kaplan G., 1971; Kent, de Schonen, Jusczyk, McNeilage, & Morton, 1993; Mills, Coffey-Corina, & Neville, 1997). Kent (2001) presents a model describing children’s sensory-motor neural development, which, in combination with their language exposure, underlies speech. This development adapts as vocal tract motor control, and auditory and visual perception are established. The connectionists use a quantitative approach to show that if acquisition data are modelled by the acquisition of a small number of new words rather than by age, a more gradual curve of growth is apparent, rather than the shift to a more rapid acquisition, known as a word spurt[^3] (David Ingram, personal communication, March 13, 2006). Ingram suggests that cognitive shifts can be gradual, as can the resulting lexical development.

Connectionist theorists using the competition model view cognition as united to the body, the brain, and the social context (Bates & Benigni, 1979; MacWhinney, 2005b; MacWhinney, 2006). The functionalist model that connectionist researchers espouse is the competition model, which focuses on the word learning mechanism rather than the outcome of the learning process. Multiple, probabilistic cues of varying strength compete to interpret word meaning according to the interrelations of the underlying conceptual structures of previous learning and processing (Bates & MacWhinney, 1987; MacWhinney, 2005a; MacWhinney, 2006; MacWhinney, 2008).

[^3]: An extended discussion of word spurts will be offered below.
Supporters of theories in which each new development emerges out of prior learning argue against instance-based learning and the notion of discrete language learning stages (P. Bloom, 2004). Clark (2003) regards the onset of word production as a period of continuous development in which children learn to produce increasingly intelligible utterances. Earlier researchers, however, proposed two distinct phases in the single word stage of the lexicon in production. First, there is an initial slow emergence from onset of production of meaningful communication until around 50 words, and next, a later period when symbolic words appear just before the vocabulary spurt (L. Bloom, 1973; L. Bloom, 1993; Ingram, 1989). Differing definitions of what constitutes a word influence the 50-word total, as does individual variation in children. Nelson (1988) proposes a second phase after the first 30 words, when children acquire a sign/sound for what’s that?, which corresponds to the naming insight, and a third phase between 03.00 and 04.00, in which words are combined.

The continuum of lexical acquisition is shown in data-based studies. M. Robb, Bauer, and Tyler (1994) show that symbolic words overlap with children’s early word vocalisations throughout the one-word period, just as reduplicated babbling overlaps with canonical babbling prior to word use (B. L. Smith, Brown-Sweeney, & Stoel-Gammon, 1989; Stoel-Gammon & Cooper, 1984). Bates (1979) proposes that context bound performatives evolve into context-flexible referential use. Data-based studies also provide evidence for discrete stages (Fenson, Dale, Reznick, & Bates, 1994; Nelson, 1988; Rescorla, 1984). Dromi’s case study revealed her daughter’s gradual restructuring of her earliest words in production to categorical, referential words (Dromi, 1987; Dromi, 1999; Dromi, 2008). Tager-Flusberg, Rogers, Cooper, Landa, Lord, Paul, Rice, Stoel-Gammon, Wetherby, and Yoder (2009) provide the criteria for overlapping and developmental in nature language acquisition stages in children with ASD. Children with ASD will often present a mixed profile, with proficiency in one domain such as vocabulary, and weakness in others; typically, pragmatics.

Although theories and models of word learning have excited the greatest attention in the field of lexical acquisition recently, researchers including Benedict, Bloom, Clark,
Dromi, Goldin-Meadow, Halliday, Ingram, and Nelson, to name a few, have based their theoretical views on data-based studies of naturalistic child language. Ingram states that “in order to determine word meaning in young children we need to know both the specific words children acquire, and their contexts of usage.” (Ingram, 1989).

Summary

As child language acquisition is a pre-paradigmatic field (Kuhn, 1996), many theories of word learning are proposed, including the social-interactionist, the cognitivists, and developmental theories. One current theoretical debate is over the primacy of social or cognitive factors to account for the onset of lexical acquisition in comprehension as well as in production, and for the transition from the slow learning of early words to referential symbolic words. Another theoretical debate is between instance-based models of word learning based on qualitative shifts in cognition and developments in social interaction, and the developmental models, which view lexical acquisition as a gradual process in a continuum of maturing physical and cognitive skills in a language context. Research into aspects of lexical development will be discussed in regard to these theories.

Defining early words

Introduction

Defining what a word is, in the child’s earliest lexicon, is a key methodological issue in child language studies (Vihman & McCune, 1994), and is a focus of research in this dissertation. Central to an examination of lexical acquisition in the one-word stage is the notion of when an infant vocalisation, gesture, or intentional communication gains word status, which determines its point of entry into the acquired lexicon. Researchers have often excluded the earliest meaningful utterances and gestures at the inchoate beginning of word learning from studies on lexical acquisition. While most agree that the initial meaningful productions in a child’s spoken or signed lexicon differ qualitatively from the words acquired later in the one-word stage, what to call and how to define the earliest utterances and gestures has had many different interpretations. The beginnings of a
child’s lexicon are so individual, the concepts of what defines an early word so various, and the terminologies from different theories of language acquisition so numerous, that the field of language acquisition has resorted to using scare quotes on ‘word’, an indication of a provisional and contested term. ‘Word’ is the name and form used for the earliest words and intentional communications, to differentiate them from later, ‘real’, symbolic referential words.

The following are some questions that research in lexical acquisition has considered with regard to including the earliest forms of meaningful communications under the rubric word. What are the various criteria for distinguishing vocalisation from word on the continuum between the onset of intentional vocalisations and the word spurt? Is the definition of a word in child language acquisition determined by form or consistent meaning, or both? If by form, how close to adult pronunciation does it have to be to be a word? Can an unconventional or onomatopoeic non-speech vocalisation be a word, even if it falls outside the speech sounds of the native language or of any human language? Can a word consist of a gesture? Or must it be a recognisable approximation of adult pronunciation, albeit subject to the motor articulation skills and emerging phonological rules of the child? Can it be accepted as a word if it is comprehensible to only the child’s intimates, or must it be understood beyond the child’s immediate circle?

If being a word depends on having a regular extension (the range over which a term applies) of the word’s meaning, will a non-speech sound or gesture with consistent meaning that is understood by the child’s intimates qualify? Will a context bound speech-sound vocalisation that possesses irregular and underextended extensions of the adult meaning meet the criteria? Or must the utterance have conventional adult extensions of meaning? The following sections will examine various answers to these questions with regard to the terminology, definitions, and criteria for word status for early meaningful productions.
Form, meaning, and function criteria for identifying early words

The first meaningful productions are generally referred to by what they are not: not real or genuine, not systematic, non-categorical, non-symbolic, non-differentiated, non-arbitrary, non-referential, and pre-lexical or non-lexical. In contrast, later words acquired in the one-word stage are positively defined: they are symbolic, referential, categorical, representational, arbitrary, and systematic. The definition and properties of symbolic referential words that children acquire on their way to using conventional words are more or less agreed upon in the field. The criteria for what constitutes the earliest pre-referential words is variously defined (or sometimes undefined) by form, function, and meaning.

Dromi refers to the beginning of the one-word stage as the “emergence of systematic, repeated productions of comprehensible (by the caregivers at least) phonetically consistent forms produced in expected contexts.” (Dromi, 1999). Werner (1963) used the term *vocables* for these productions, while Bruner called them non-systematic phonetically underspecified early forms (Bruner, 1975). These early utterances, which precede recognisable attempts at single words such as *mama*, are recognised by a familiar listener as linguistic units that convey meanings. Throughout the one-word stage these productions are modified in their phonetic form to become more comprehensible.

M. Robb, Bauer, and Tyler (1994) followed the trajectories of six infants’ word production using a strict criterion for what counted as a real word compared to a non-word, based on 100% agreement between the researcher and caregiver. In their study, the child’s word is defined by its phonetic closeness to the adult form, taking into account children’s common phonological reduction rules. A non-word in their definition is an intelligible, phonetically transcribable vocalisation such as babbling or phonetically consistent vocalisation. The definition of words (and possibly even of non-words) in this study excludes onomatopoeic utterances with non-speech sounds, on the grounds that these are not phonetically transcribable. Marginal (non-dictionary) forms are included as words; for example *uh-oh*, and *beep-beep*. However, since these are words in an adult lexicon they pose no difficulty in their acceptance as words by any standards. An
example of an early word whose form is far from an adult target is *mm-mm* to refer to a specific object (Deuchar & Quay, 1999), which would not be accepted as a word in M. Robb et al. (1994).

Vihman and McCune’s (1994) definitive publication, “When is a word a word?” specifies that early words do not depend on a close relationship with either the adult form or meaning. Their definition is a balance between an inclusive definition that accepts non-adult words but runs the risk of false positives, and a more exclusive narrow definition that restricts words to those that sound like adult words but risks missing productions that are words in the child’s communication system (McCune, 2009). In their 1994 study, determining whether a vocalisation has word status depends on three factors:

2. Vocal shape criteria: phonetic resemblance to the adult form by matching at least two segments of the adult form, having a prosodic match, and phonetic stability of invariant phonological shape.
3. Relation to other vocalisations criteria: imitation by the child, reformulation by mother, and no inappropriate uses.

This study presents an explicit procedure to recognise the earliest words through the degree and type of point-to-point phonetic match to an adult word. Vihman and McCune (1994) note that an awareness of a child’s phonetic patterns (vocal motor schemes) helps the researcher identify an utterance as a word, just as the context of use and function helps to ascertain meaning.

Vihman and McCune’s (2001; 1994) definition of a word includes the predecessors to symbolic words. Non-dictionary items such as *vroom, ow, whee,* and *yum* have word status, as do onomatopoeic forms, including animal sounds; however, inappropriate uses, homonyms, favourite sound patterns, and global, loosely defined, or uninterpretable utterances in their data do not (McCune & Vihman, 2001). Their studies confer word
status on context dependent utterances. These are differentiated from symbolic words that are used spontaneously with multiple occurrences over a range of various contexts.

In two studies, Hirsh-Pasek (1999) and Golinkoff (1999) have also proposed a useful definition for identifying a child’s first words, derived from commonly accepted criteria in different theoretical perspectives. According to their definition, children have acquired a word when it is used with the intention to communicate, has a consistent phonological shape, has a consistent meaning, and is extended to multiple exemplars. In this definition, context-bound words therefore are not words, since they are underextended and do not have an underlying referential meaning (Golinkoff et al., 1994).

The distinction between intentional communications and words can also be determined by function. Most researchers in the lexical acquisition of TD children have distinguished early gestured or vocalised intentional communications from symbolic words, though the latter of course also convey intentional communication. Halliday (Halliday, 1975) regarded his son Nigel’s first consistent vocalisations, which he termed protowords, as the foundation for lexical development. He hypothesised that protowords occur within a protolanguage, defined as a set of basic communicative functions derived from the internal ability of the infant to express pragmatic intentions, rather than from the adult language. Halliday regarded protowords as non-words with no syntax, only a direct mapping from sound to the meanings that Nigel had created himself, as opposed to those he had learned from his language environment. Nigel produced 29 protowords when he was 01.01.05. Bauer (1986), however, includes pragmatic functioning as an early word criterion. M. Robb et al. (1994) note that non-words in their study might have been pragmatically functioning as words because they were identified as such at later age periods. This illustrates a core problem with defining early words from testing samples of data rather than from systematic, longitudinal, naturalistic daily diary collection. That is, the dilemma associated with filtering symbolic words from the earliest words persists without a naturalistic context or the pragmatic and developmental history of the particular words, and with the additional difficulties inherent in the general unintelligible nature of young children’s vocalisations (Vihman & Miller, 1988).
Not words

Terminology and theory used in psychology and psycholinguistics help to identify the limitations of the earliest words in terms of cognitive development. The earliest words are said to lack categorical properties, in that they do not represent an underlying concept. For example, the word *car* is not specific to one object; it represents a number of exemplars that make up its underlying concept. Carter (1979) employs the term *sensori-motor communicative schema* to describe how the infant maps its phonetics onto schemata (Piaget’s term for the infant’s cognitive structures), as opposed to having concepts and categories. Like Halliday (1975), Bates, Camaioni, and Volterra (1975) describe early words as performatives without underlying meanings because children do not have concepts at this stage. Mandler and McDonough (1993) likewise make the distinction between schematic and categorical structures of representation in cognition, describing early meaningful productions as phonetically consistent forms that display intentional meaning and have some phonetic variation in form. Nelson calls the first 30 productions of the child *pre-lexical terms* (Lucariello & Nelson, 1985), describing them as holistic labels only, inseparable from the child’s undifferentiated representations of reality, such as people, objects, and actions (Lucariello, 1987; Nelson, 1982; Nelson, 1988).

Barrett (1989) also does not regard very early words as true communicative symbols but as “frozen linguistic strings” with the characteristics of sensori-motor action schemata; that is, an absence of stable object concepts and an inability to represent reality in symbolic terms. Early utterances, in his view, are “behaviorally conditioned mimicry”, unanalysed representations of habitual situations devoid of communicative intent. They are merely a response associated with specific external stimuli consisting of physical objects, settings, and ostensive behaviours. These early productions are elicited by a familiar context; sometimes even by a sound pattern of a similar word. Dromi (1993) terms the earliest words as situational words, which link a phonetically under-specified sound pattern (Bruner, 1975) to a specific object.
Lexemes

Because word is such an ambiguous and difficult term to define, the field of morphology employs the term lexeme. Lexemes are the minimally distinctive unit of lexical meaning in word formation, an abstract unit that underlies the set of inflected forms taken by that word (Aronoff & Feldman, 2000; Crystal, 1987). The term lexeme, however, is not synonymous with an early word in a child’s lexicon, although there are similarities. A single lexeme may in fact contain more than one word, as in the idioms take off, and all gone. This parallels narrowly context bound expressions such as this little pig, no way, and put up with, which may each function as one early word in the child’s early lexicons in comprehension and production. Another overlap between lexemes and early words is that a child also will use one form for word variations of a lexeme or related set of lexemes, such as using yum to mean eat, ate, eating, eaten, and eat up (Ammon & Slobin, 1979). A case can also be made that there is an even wider set of meanings for one lexeme in comprehension. The toddler might understand yum to include the meaning for feed, food, meal, dinner, good, open wide, and swallow as well.

Although it may be argued that children’s earliest utterances are composed of single lexemes, lexeme theory does not account for the temporal variation in phonetic form and meaning of early words in child language. Nor do the inflectional and derivational lexeme functions apply usefully to the early lexicon. More centrally, the claim cannot be made that children at the onset of speech have an underlying abstract unit of fundamental reference for their earliest words.

In this dissertation, considering the lack of agreement on the definition of an early word, and for the sake of simplicity, intentional productions at the start of children’s speech production that have a consistent meaning and form will be described as early words. Arguments to support this decision will be further elaborated in Chapter 4, in the section on the criteria for lexical acquisition status in production; in the findings Chapter 5, Part 2, in the section on the onset of Graeme’s lexicon in production; and in the discussion on the findings in Chapter 7. These arguments will propose an answer to my second research

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4 Take, off, all, gone, this, little, and pig are also all single lexemes.
question: what is the definition of a word in the lexical acquisition of children with ASD, and can the meaning and function of Graeme’s early idiosyncratic productions justify the inclusion of these in his lexicon as word/signs?

Summary

Early pre-symbolic words in the one word stage usually do not have the full adult form or meaning, nor are they understood by many outside the child’s intimate circle. Researchers’ definitions of early words agree that they must be consistent in meaning and shape. However, criteria for word status varies, including the stipulation that early words must be used in multiple situations, and resemble adult words phonetically in at least two segments though they may be underspecified phonetically (Vihman & McCune, 1994). Words that are context bound in meaning and do not extend to other exemplars are accepted by some researchers as words, and not by others. Less universally accepted as words are onomatopoeic utterances, non-dictionary child forms, homonyms, gestures by hearing children, and vocalisations that are unintelligible or made with non-speech sounds (though these may be intentional communications in that they have pragmatic functions and are interpretable). What to call these earliest of words is problematic. While many terms have been suggested, in the absence of agreed terminology the most commonly used is ‘word’, with scare quotes, which is how they are informally referred to in online discussions of the first meaningful productions of researchers’ own children. The sections below on intentional communication, gestures, the phonetic form of the earliest meaningful productions, and the acquisition of symbolic capacities will examine research on and theories about the precursors to formally designated referential, symbolic words.

Prerequisites and conditions for learning words

Introduction

Different theoretical models propose various prerequisites for early word learning in both comprehension and production. This section will examine these necessary prelinguistic
conditions for lexical acquisition. These include social, cognitive, and physical
developments in social interaction, categorisation, a priori constraints on word meaning,
perceptual salience, linguistic input, and articulatory maturation. These prerequisites for
language readiness are of particular importance to the onset of lexical acquisition in a
language-delayed child.

Social interaction and shared attention

Social-interactionists emphasise the importance of prelinguistic infant/adult interactions
in preparation for the beginnings of lexical acquisition (L. Bloom, 2000; Gopnik &
Meltzoff, 1992; Gopnik & Meltzoff, 1997). They theorise first, that early word learning is
a process that occurs in a natural social and cultural context where language is used
relevant to shared activities (Nelson, 2007a; Snow, 1999); second, that increases in
perceptual and conceptual knowledge, such as recognising faces and objects and
identifying recurrences of prior sensual experiences, help the infant to perceive
similarities and to sort like with like (Clark, 2003); and third, that infants begin to pay
attention to people and objects, initially responding to the adult’s acts with both actions
and with some utterance of sounds (Akhtar & Montague, 1999). Harris (1988) suggests
that the non-linguistic setting of predictable, consistent contexts and the linguistic input
of the caretakers’ frequent modelling enable the child to find a way into speech.

The social foundations for word learning are joint attention and intersubjectivity (the
child’s awareness that attention on an external entity is shared)\(^5\) (Baldwin, 1993b).
Social-interactionist research on word learning has focused on attention, gaze, and
gesture in order to predict rate of growth, the emergence of new linguistic abilities, and
eventual outcomes. In infancy, children learn to communicate and collaborate through the
social-cognitive skills of shared intentions and responsive joint attention in eye contact
and gaze monitoring (Mundy, Sullivan, & Mastergeorge, 2009; Tomasello, 2007). Neural
brain imaging studies show children using responsive joint attention by 00.05, and
initiating joint attention prior to 00.09 (Mundy & Van Hecke, 2008; Mundy & Jarrold,

\(^5\) Research in joint attention, intentional communication, gesture and sign, and context bound words in
children with ASD will be more fully examined in Chapter 3.
Baldwin and Sabbagh (2005) suggest that babies actively pursue this social coordination in order to gain information about referential intentions. The shared attentional focus of gaze and point following enables the infant to begin to infer referential intentions, and, with the aid of parents’ frequent ostensive labelling (presenting an object or event in such a way that attention is drawn to it) of perceptually salient whole objects, to begin to identify word meaning (Baldwin, 1995; Baldwin & Tomasello, 1998; Houston-Price, Plunkett, & Duffy, 2006; Meltzoff & Brooks, 2009; Sabbagh, Henderson, & Baldwin, 2007). Dare (1993b) refers to responsive joint attention as a self-reference that reduces error.

The more highly developed pre-verbal social-cognition skill of triadic joint attention (intersubjectivity) is the ability to initiate and maintain the interaction of two-way communication through the employment of the visual and auditory cues of eye contact, alternating gaze, gestures of protodeclarative pointing and showing, intonation, and emotional displays (Charman, 2003; McCathren, Yoder, & Warren, 1999; Tomasello, 1995). These abilities, also known as initiating joint attention (IJA), are precursors of language development, enabling the child to determine which object, action, or attribution is being labelled. IJA, therefore, has a central importance in word learning, producing a greater likelihood of learning a new word than responsive joint attention does (Mundy, Gwaltney, & Henderson, 2010).

Another link between joint attention and word learning is in the acquisition of the social foundations of symbolic representation. Kaplan (2006) proposes that children overtly practise responsive joint attention for six to 18 months before it becomes internalised, enabling the development of symbolic representation. Symbols in the form of pictures elicit joint attention, and, conversely, joint attention, in improving the depth of processing, may improve a child’s memory for pictures (Hirotani, Stets, Striano, & Friederici, 2009).
The child’s motivation to learn and caregiver input

Social-interactionists have investigated the relationship of adult input to children’s vocabulary acquisition. The social factors that assist children in discovering word meanings are the input the child receives, along with responsiveness to and understanding of the child (Baldwin & Meyer, 2007). Nelson (2007c) states that learning to talk is a process emerging from characteristics of the individual child, the linguistic and social context, and, most likely, also from unspoken adult expectations and the child’s opportunities for expression. Clark (2003) notes that children form hypotheses about word meanings in conversational settings. They identify and make inferences about conventional meanings from the reactions of other speakers to their own usage, in order to restrict, expand, and fine-tune the definitions and pronunciation of the new words they are mapping.

In Bloom’s view (2001) the development of the child’s contents of mind (the child’s reality as an internal motivation for word learning), plus the agency and action of the child, are the central mechanisms driving lexical acquisition in the first two years. In her view, the cognitive developments of symbolic capacity and conceptual structures are products, rather than prerequisites, of word learning. Like Halliday, (1975), Bloom (Golinkoff et al., 2000) believes word learning originates within the context of the whole reality of the child, rather than from adult input (as Clark suggests) or from internal word-learning principles. Bloom, Margulis, Tinker, and Fujita (1996) argue against the idea that it is the caregiver who directs and constrains conversation as the mechanism for word learning, proposing that children employ moment to moment thinking and intentional states when they are comprehending and producing language. Akhtar and Tomasello (Golinkoff et al., 2000) concur with Bloom, stating that since language learning takes place for the purpose of communicating, word learning occurs because of the child's increased motivation for social communication, to understand what their addressee is saying and attending to. From this point of view, children are active agents in word learning, as evidenced by their learning words in complex, non-ostensive interactions where they are not directly addressed (Akhtar & Tomasello, 1998). Evidence for the child’s contents of mind being central to word learning comes from children taking the
lead in vocal interactions with adults and in their play activities in turn-taking, when at least two-thirds of the time adults are responsive rather than directive in word-learning situations (L. Bloom et al., 1996). Joint attention assures that the adult’s responsiveness to the child is relevant to the child’s thinking (Harris, 1992). Bloom (1993; 1998; 2000) argues that theories solely dependent on either social context or on specific principles are both reductionist and isolated from the rest of language development. She claims that word acquisition is primarily driven by the child’s contents of mind and the development of cognition, emotion, and social connectedness.

Perceptual cues

Many researchers concur that early words are learned in an attentional and associative manner that links perceptually salient objects with sounds (Akhtar, 2005; Dromi, 1999; Hirsh-Pasek et al., 2004; Nazzi & Bertoncini, 2003). In early word learning the child pays attention to the cues of temporal continuity, perceptual salience, and prosody (Hollich et al., 2000). The novice learner needs numerous overlapping and interactive perceptual cues like ostensive handling, bright colours, and frequent labelling. They use their own perspective to attend to what they find perceptually salient (Hirsh-Pasek & Golinkoff, 2008). Tan (2005) notes that the frequency of parents’ ostensive naming, accompanied by preferential looking, influences word learning. Associationists account for lexical acquisition through attentional mechanisms such as perceptual saliency, association, prior learning experiences, and frequency (Kruschke, 2003; Plunkett et al., 1997; Pruden, Hirsh-Pasek, Golinkoff, & Hennon, 2006; Samuelson & Smith, 1998; Samuelson & Smith, 2005; Sloutsky, 2003; L. B. Smith et al., 2002).

Categorisation

Ingram (1989) states that there is no well-defined theory of linguistic readiness; rather, there is an assumption that the order of language acquisition in a TD child is a reflection of sequences of cognitive developments necessary for language, including categorisation. The ability to categorise objects and actions develops throughout infancy from being perceptually based at 00.04 (Quinn, Eimas, & Rosenkrantz, 1993). In Piagetian terms
(1962), the child realises that though two objects are distinct they can be sorted by whether they behave or look alike, or have a similar function. The ultimate development of perceptual categorisation is the child’s realisation that every object belongs to a category⁶. A dissenting view, however, claims object categories are primitive conceptual notions that need not be learned (Huttenlocher & Smiley, 1987). Hall (2009) proposes that the ability of young children at the onset of lexical acquisition to learn proper names as well as count nouns is evidence of their conceptual biases to perceive people as individuals and objects as instances of a category. Recent research in the relationship of words and object categories provides evidence that parents’ labelling aids infants in associating words with categories (Cohen & Brunt, 2009).

### A priori constraints on word meaning

_A priori_ constraints are cognitive developments that cognitivists propose as assisting word learning after its onset. The theory is that innate, domain-specific constraints on word meaning assist the child in narrowing down the possible meanings of a word (Gelman & Greeno, 1989; Merriman & Evey, 2005; Newcombe, Huttenlocher, Drummey, & Wiley, 1998; Waxman, 1991; Woodward & Markman, 1998). Constraint theories for early word learning include the whole-object assumption and the shape bias. The whole-object assumption is a child’s predisposition towards interpreting new words as labelling objects as wholes rather than as their parts or properties (Golinkoff et al., 1994; Hall, Waxman, & Hurwitz, 1993; Imai & Gentner, 1997; Landau, Smith, & Jones, 1988; Markman, 1989). Gentner (1982) claims that this is the most perceptually apparent level of analysis for babies, providing rich conceptual information. In addition, cognitivists claim a bias towards words referring to objects rather than events or actions. Social-interactionists Akhtar and Tomasello (Golinkoff et al., 2000), however, assert that children are predisposed to actively search for cues to what is most relevant to a speaker’s referential intent rather than to whole objects.

⁶ The further development of exhaustive categorisation will be discussed in the section on the transition to reference.
Waxman (1991) proposes that children have a predisposition to categorise same-shaped objects and hence to generalise on shape. Booth (2005) documented findings that infants at 01.06 were influenced by whether a test object was described as a thing, in which case they extended their meanings on the basis of shape; or an animal, in which case they used both shape and texture. These findings show that both perceptual and conceptual information influences word learning at an early age. Dewar (2009) found that infants of 00.10 expect different labels to refer to different kinds of objects, rather than shapes of objects, as demonstrated by the fact that their expectations about the internal sound-producing properties of the objects were influenced by how they were labelled. Social-interactionists (Markson et al., 2008) argue that because the shape bias emerges early and is related to categorisation, it originates in children’s understanding of language and the world, rather than from mechanistic associations between categories of objects and names. Another argument against the shape bias as the sole mechanism accounting for word learning is that it is specific only to object labels. The shape bias and the noun bias (Gentner, 1982) therefore do not account for the full range of words that are learned from the start of lexical acquisition, such as social greetings, event terms, spatial words, and question words.

Akhtar and Tomasello (2000) query the failure of innate constraint theory to account for why language emerges when it does. They propose instead that words are learned only in interaction with other people and are constrained by children’s understanding of what is going on in the social situation in which they hear a new word (Akhtar & Montague, 1999). Ingram (personal communication, April 4, 2006) questions whether constraints are real and empirical, noting that constraint theories do not come out of data-based studies. Hirsh-Pasek, Golinkoff and Hollich (Golinkoff et al., 2000) also stress that it is essential to use data to validate models and demonstrate the evolution of principles for word learning, from early word use to the sophisticated and rapid word acquisition of later word learning.
Perceptual salience and motor maturation

Researchers have identified perceptual salience and motor maturation as other factors necessary to lexical acquisition. The connectionist model proposes that the gradual maturation of the neurophysiological functions of articulatory and phonological ability, as the child develops control of the vocal tract interacts with auditory and visual perception and language input to underlie speech (Kent et al., 1993; Kent et al., 2001).

Summary

Theoretical models of early word learning propose various social, cognitive, environmental, and physical prerequisites for both comprehension and production. These include social interaction, perceptual salience, categorisation, a priori constraints on word meaning, input, and articulatory maturation as necessary prelinguistic conditions for lexical acquisition.

Social theories suggest that joint attention and intersubjectivity are the foundation for lexical acquisition. Gaze following reveals speakers’ referential intentions in order to determine which object, action, or attribution they are labelling. Children are often the leaders in word learning situations, motivated by their intentions and contents of mind. Parents’ ostensive handling and labelling of perceptually salient objects and events, presented repeatedly in familiar contexts, is widely regarded as necessary for early word learning, in order for a child to associate the sound of a word with an object or event.

Cognition-based researchers regard categorisation abilities as fundamental to the onset of language. Prelinguistic perceptual categorisation develops into the realisation that every object belongs to a category. Social-interactionists suggest that increases in perceptual and conceptual knowledge such as recognising familiar faces and objects and identifying recurrences of previous experiences in familiar contexts assist the child in perceiving similarities and sorting similar relations. Cognitivist theorists propose that a priori constraints and probabilistic assumptions reduce the reasoning required for a child to interpret an unfamiliar word. These include the whole-object assumption and the shape
bias. Developmental theories propose models that account for the gradual nature of word learning.

This dissertation will examine the applicability of this research to the data, in order to answer the first research question on the relationship between the delayed and unusual early lexical acquisition of my son Graeme and the major developmental milestones in his cognitive and social growth.

**Acquiring the lexicon in comprehension**

**Introduction**

Though there are differences of emphasis, most researchers in lexical acquisition agree upon a recognition of sequential milestones in word learning. The onset of language comprehension co-occurs with the child’s expressions of pragmatic intentions through vocalisation and gesture, and the earliest consistent meaningful productions emerge at the same time as rapid word learning occurs in the comprehension lexicon. This is followed by the production of symbolic words, the vocabulary spurt in the productive lexicon, and, shortly after, the first word combinations. This sequence unfolds in language-delayed children as it does in TD children, though the timing of word learning differs in children with language delay. Studies of infants’ first systematic responses to adult word sounds show that their lexical acquisition begins early in the first year of life. The comprehension lexicon emerges through the comprehension of the adult words and signs of the native language. The lexicon in production has its origin in the emergence of the earliest productions of intentional communication, with word production typically emerging in the second year of life.

Used as an index of word learning, an examination of the acquisition of comprehension reveals what it is that babies know when they begin to produce words. How babies form hypotheses about the meanings of the many words they hear is a central issue in theories of word learning. While many theoretical models of word learning are directed towards
production, the child’s acquisition of word meaning is a comprehension-based process (Kuczaj & Barrett, 1999). The focus in this section will be on research in the onset of speech perception, the acquisition of the comprehension lexicon, including rates and timing, and the word spurt in comprehension in TD infants, in order to be able to compare these with Graeme’s lexical development.

**Speech perception**

This section presents a brief overview of research on speech perception. Jusczyk (1995a) proposes that in the first year, speech perception develops from unspecified language-general processes to processes specific to the infant’s native language. Lexical acquisition, a higher level of language learning, is a language-specific development. Infants show a preference for their mother’s voice at 00.01 to 00.01.15, and for child-directed speech by 00.04 (Fernald & Kuhl, 1987). Perceptual and conceptual developments in the first year prepare infants to recognise and identify some words in their linguistic input. The infants’ perceptual systems build from their sensitivity to speech to their perception of the language-specific acoustic properties of a word (Gervain & Werker, 2008; Hirsh-Pasek, Tucker, & Golinkoff, 1996; Werker, 2004). Infants develop their ability to segment the speech stream of their native language and to perceive speech sounds as distinct in order to attach preliminary meaning to recurrent phonetic forms (Ingram, 1989; Werker & Yeung, 2005). Infants’ pre-verbal knowledge in conceptual organisation and in the linguistic domain enables them to perceive distinct words and to map them to meanings (Waxman, 2009).

Acoustic perception is necessary for phonemic perception, the complex cognitive ability to discriminate speech sounds as phonemic and to link sounds to meaning (Ingram, 1999; Jusczyk, 1995b; Jusczyk, 1995a; Werker & Yeung, 2005). Tincoff and Jusczyk (1999) contend that some of the phonological forms of adult words begin to have meaning for the child at 00.06. Yeung and Werker (2009) demonstrate that infants at 00.09 can learn the sound patterns of meaningful contrasts in phonetic categories in their native language before they have acquired many words in production, by learning to discriminate contrastive pairings through visual cues in social situations where words are labelled.
Children gradually develop the perceptual ability to identify single segment differences between language specific words at around 01.00 (Ingram, 1989).

Infants are highly attentive to many levels of speech processing relevant to word recognition, such as positive and negative affect conveyed through intonation, exaggerated intonation contours, and prosodically specified sound patterns in word-size speech segments (Fernald, 1989; Jusczyk, Hirsh-Pasek, Kemler, & Kennedy, 1992; Nazzi & Bertoncini, 2003). Ferry (2010) provides evidence that infants at 00.03 to 00.04 categorised words comprised of labelling phrases more successfully than with tone sequences. Infants at 00.06 can utilise familiar names to segment fluent speech (Bortfeld, Morgan, Golinkoff, & Rathbun, 2005). Signs and a wider range of sounds, such as whistles, are accepted as names for objects by babies of 01.01, whereas by 01.06 they do not accept non-speech sounds as readily as speech sounds for labels (Namy & Waxman, 1998; Woodward & Hoyne, 1999).

Developmental theories speculate that there is a continuum of learning between phonological processing and lexical acquisition as babies learn to identify words through perceptual mechanisms (Fisher, Church, & Chambers, 2004). Werker and Tees (2002) present the theory of a specialized perceptual-motor system of infant processing that has evolved to serve human speech, but which functions concurrently with other developing abilities in babbling and word learning. Kuhl (2009) notes that cognitive, linguistic, and social abilities contribute to early speech perception, with individual variance in infants' phonetic learning predicting both their first language development patterns and second language learning.

**Research on acquiring lexical comprehension**

Studies in word production greatly outnumber those in comprehension, which are limited by the difficulty in maintaining the interest and attention of infants. Word comprehension is commonly assessed by longitudinal data-based studies using both parental diaries and word checklists, or by daily observations of naturalistic data. In addition, scoring infants’ responses can be problematic in terms of determining whether and to what degree they
understand the word in the same way adults do. Commonly used methods to determine comprehension include: presenting the child with alternatives that are systematically varied; attempting to get responses in controlled circumstances; using several scorers; and a cautious interpretation of responses. In Benedict (1979) the criteria for determining a word’s point of entry into the lexicon in comprehension was that the child must show a correct and consistent response to the word, verified by repetition within the following days. A discussion of several longitudinal studies in comprehension acquisition follows.

Nelson (1973) published an analysis of the content and semantic structure of the first 50 words of 18 TD children between 01.00 and 02.00 collected in a longitudinal study. In 1979, Benedict modified the classification in order to better analyse comprehension, in the first controlled study of the initial 50 words comprehended and produced in TD infants. Comparing the onset of comprehension and production, Benedict found that comprehension began in the pre-linguistic period at around 00.09 and reached the 50-word level at around 01.01, preceding production by almost four months. The rate of acquisition for the first 50 words in the lexicon in comprehension was twice that of production, which began at 01.01.21 and reached 50 words at 01.09.15. Her subjects took around two weeks to acquire their first 10 words in comprehension, but four weeks in production. These are averaged over the eight children studied, but Benedict’s and subsequent studies show there can be great variation in the sizes of an individual child’s vocabulary in comprehension and production.

Huttenlocher (1974) presented data from a longitudinal investigation of comprehension development, looking at the first stages in systematic responses to word sounds in three TD children aged 00.10 to 01.06. Her data also provide evidence that comprehension precedes production. Huttenlocher concludes that there is not a simple relationship between children’s lexicons in comprehension and production, and that there is an increasingly complex progression within the child’s response to words in the pre-linguistic period before speech.

Oviatt (1980a; 1980b) investigated babies’ comprehension of recently taught items. She found that babies younger than 01.00 who were taught words learned very little; that
much word repetition was necessary, and that they retained only the highly salient items such as the most recently taught words. However, between 01.03 and 01.05, there was both immediate and longer-term comprehension of newly acquired terms for objects and actions, suggesting advances in cognition.

Rescorla (1984), in a longitudinal study, investigated individual differences in lexical comprehension of six children from ages 01.00 to 01.10. She examined the size, rate, order, and timing, finding that individual differences in the rate of early word comprehension had emerged by 01.02. These were highly predictive of large differences in language skill, IQ score, and play development at 02.00 and 03.00. Early progress in comprehension acquisition was associated with a referential language style (acquiring primarily naming words), greater use of overextension as a production strategy, a more highly differentiated early category development, and greater reciprocity in mother-child interaction.

The benchmark data-based large sample studies that provide definitive measurements of lexical acquisition are based on the MacArthur Communicative Developmental Inventories (CDI) (Fenson, 1989). In the CDI, parental checklists of the verbal production of 1,803 TD children from 08.00 to 02.06 were developed to provide data on the lexicons in comprehension and production of TD children. The infant scale was designed to collect data between 08.00 and 01.04 and the toddler scale between 01.04 and 02.06. This study measured the lag between acquisition of comprehension and production, finding that babies understand between 50 and 100 words at 01.00, when they produce fewer than 10 words, and that by 01.01 babies can acquire a new word in comprehension with relatively little exposure. In 1994, Fenson et al. analysed the CDI data in the infant scale to show the variability in early communicative development in comprehension, and in gestural and vocal production (Fenson et al., 1994). The high rate of variability was attributed to a combination of maturational and environmental factors such as the talkativeness of the mothers, but not to demographic factors of gender, social class, birth order, and parent’s education. A 1996 study used the CDI infant scale results to provide
monthly lexical developmental norms for both the comprehension and production of 396 words (Dale & Fenson, 1996).

While most studies on context dependent words are directed towards production, words restricted to specific contexts are present in the comprehension lexicon. At the onset, comprehension is scaffolded by an adult’s ostensive labelling and frequent repetition of a word in familiar routines (Nelson, 1988; Rescorla, 1980). A longitudinal study of the development of lexical comprehension and production observed six TD children from 00.06 every two weeks for 18 months in order to determine whether their vocabulary items were contextually flexible or context bound (Harris, Yeeles, Chasin, & Oakley, 1995). The researchers found a close relationship between the two types of words in both early lexicons, with evidence of contextually flexible comprehension emerging very early. They observed that the contextual variance differed in the extent to which comprehension preceded production and in the rates of acquisition in both lexicons.

**Rates and timing of comprehension acquisition**

Individual variation in TD children is documented in the ages, rates, and times of acquisition, but not in the sequence of emergence. Benedict’s (1979) eight subjects had no words in comprehension at a mean age of 00.10.14. At around 01.00, subject to individual variation, children consistently understand words of the adult language to have some meaning, though not necessarily the exact meaning of the adult definition (McCarthy, 1954). The rate of comprehension acquisition is the same as, or greater than, that of production (Benedict, 1979; Ingram, 1989). For most TD children, the onset of the 20th word produced precedes the 100th word comprehended, although both TD and language delayed children can have a lag between the word spurt in comprehension and the onset of language production (Benedict, 1979; Gibson & Ingram, 1983). Most TD children have at least 100 to 200 words in comprehension before they produce their 50th word, estimated to be around the same time as their first word combinations (Ingram, 1989).
The word spurt in comprehension

Many researchers in lexical acquisition have described periods of accelerated change, both quantitative and qualitative. These periods of rapid word learning have been termed word spurts, when the slowly acquired repertoire in comprehension and production of the novice word learner suddenly increases as words are added to the child’s lexicon at the rate of a more expert word learner. The existence, conditions for, and causes of the vocabulary spurt are the subject of debate among researchers in lexical acquisition. Ganger (2004) reanalyses data from earlier studies to question whether a word spurt occurs in every or indeed in any child, proposing a more gradual acquisition process. Among researchers who espouse the notion of word spurts, the social-interactionists claim that development in the child’s social-pragmatic abilities, contents of mind, attentional engagement, joint attention abilities, and communicative needs are the underlying causes of the engine that drives rapid and efficient increases in understanding novel words. The driving forces of the word spurt, according to cognitivist arguments, are exhaustive categorisation, symbolic representation, and the emergence of cognitive constraints on the possibilities of word meaning.

Studies of word spurts in lexical acquisition have been mainly limited to production and not all researchers agree that word spurts occur in comprehension. However, several studies show evidence of a word spurt in comprehension in many TD children, beginning between 01.03 and 01.04 after a few months of an initial slow growth from the first to around the 50th word understood and lasting for several months (D. Bauer, Goldfield, & Reznick, 2002; Benedict, 1979; Fenson et al., 1994; Gibson & Ingram, 1983). Bauer, Goldfield and Reznick (2002) measured vocabulary in comprehension in TD male and female children at two month intervals from 01.02 to 01.10, in order to analyse individual and gender differences in the rate of early vocabulary development. They showed that although the lexical development of girls outpaced that of boys, there were distinctive fast and slow trajectories for both comprehension and production that were not exclusively segregated by gender. The presence of a surge in the comprehension lexicon was associated with the presence of a production spurt occurring around 01.08 to 01.10. Children from 01.03 to 02.00 developed greater proficiency in the speed and accuracy of
their word recognition from continuous speech, making rapid gains in verbal processing and in extracting lexical information prior to and concurrent with the production spurt (Fernald, Pinto, Swingley, Weinberg, & McRoberts, 1998). A study of children at 01.08 found that those with large lexicons in production recognised novel words after two repetitions, while those with smaller lexicons needed five repetitions (Torkildsen et al., 2009). These results suggest a relationship between the rate of receptive familiarity and the onset of the word spurt in production. An earlier study of this group indicated that the efficiency of fast-mapping (the linguistic ability to rapidly and efficiently associate unfamiliar terms for objects with real-world concepts through the process of elimination) was substantially greater in children who have entered the word spurt than in those who had not (Torkildsen et al., 2006).

Summary

The acquisition of lexical comprehension begins early in the first year of life with the perception of language-specific acoustic properties of a word, and the developing abilities to segment the speech stream and to pay attention to intonation and familiar names. These abilities lead to phonemic perception of meaningful contrasts which link sounds to meaning. Long term data-based studies confirm that comprehension generally precedes production and is acquired at a faster rate, although there is much individual variation in rate and timing of the onset and acquisition of both comprehension and production. The first words in comprehension are context dependent. They are learned slowly, with ostensive labelling, in interactive linguistic environments. After advances in perceptual mechanisms and attentional engagement, rapid word learning in comprehension co-occurs with several key areas of social-cognition related to lexical acquisition. These are social-pragmatic ability (Charman, 2003), contents of mind (L. Bloom & Tinker, 2001), attentional engagement (Meltzoff & Brooks, 2009; Sabbagh et al., 2007), joint attention abilities (Tomasello, 2007), symbolic representational ability (Lifter & Bloom, 1989; Piaget, 1962), categorisation (Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Mervis & Bertrand, 1994), and the naming insight (Dore et al., 1976). The connectionist model proposes that gradual, continuous maturation in children’s sensory-motor neural
development influences changes in lexical comprehension and production processes, and results in a more gradual curve of growth than a word spurt.

Further discussion of research on delays in the acquisition of the comprehension lexicon common to children with autistic spectrum disorders is in Chapter 3. Additional research on comprehension using diary studies is in Chapter 4.

**Acquiring the early lexicon in production**

**Introduction**

This section will examine research on the form and content of the earliest productions. The form of the early productive lexicon includes initial utterances, such as babble, that lead to meaningful gestured and vocalised intentional communication; early idiosyncratic words; and onomatopoeic words. Theories on the content of early words include acquiring meaning through context bound words, and on semantic classes. These studies apply to my second research question regarding the inclusion of Graeme’s early idiosyncratic, gestured, onomatopoeic, and context bound productions in his lexicon as acquired word/signs. Theories of early word learning are also relevant to the definition of what constitutes a word in the lexical acquisition of children with autism.

**Mechanisms for learning early words in production**

Many researchers regard the earliest and later words to be acquired through very different mechanisms (Dromi, 1993; Nazzi & Bertoncini, 2003). In this view, children learning their first words initially employ an associationist mode of learning, mapping phonetically underspecified sound patterns to a perceptually salient event or object in simultaneous repeated context bound situations (Hollich et al., 2000; Nazzi & Bertoncini, 2003; Werker, Cohen, Lloyd, Casasola, & Stager, 1998). Early words are acquired slowly, and may be child-generated and idiosyncratic. A few of the more familiar early words develop into referential words as these links are extended to exemplars of the target category on a case-by-case basis. Referential words, in contrast, evolve smoothly
into conventional adult words through phonetic modifications and semantic extensions (Dromi, 1993; Dromi, 1999; Dromi, 2008; Lucariello, 1985).

**Intentional communication**

Prelinguistic intentional communication emerges concurrently with the acquisition of the vocabulary in comprehension and joint attention skills when TD children from 00.09 to 01.02 are finding a way into the system and becoming sensitised to the forms of language (Bates et al., 1975; Nelson, 1991). Children develop the ability to communicate their intentions in a variety of pragmatic contexts by actively using attention-directing behaviours such as facial expressions and gestures, as well as intonation patterns and vocalisations (Bates et al., 1975). Although these initial communications have a consistent meaning, they are non-standard in the adult language (Halliday, 1975). TD children first touch, then point at objects they are interested in, use eye-gaze to attract attention to what interests them, and reach persistently towards objects they want (Drew, Baird, Taylor, Milne, & Charman, 2007; Namy & Waxman, 1998). Evidence for the intentionality of these communications is that the infants will persist until their intentions are recognized (L. Bloom & Tinker, 2001). Studies on normative development of pre-verbal and early verbal communication describe the intended meanings of early social-communicative acts, such as dumping a toy at an adult’s feet, as a request for help or as a comment on the object (Bates & Benigni, 1979; Bruner, 1975; Bruner, 1981; Volterra, 1981).

Bates et al. (1975) define the vocalisations and gestures that convey the infant’s intentions and enable the child to achieve ends, such as food, attention, and objects, as *performatives*. Bates and Benigni (1979) regard performatives as a procedural part of a child’s routine action. They are, therefore, direct reflections of the child’s intentions, rather than words that have underlying meanings, since the child lacks concepts at this stage. Their study identifies two functions of performatives: proto-declarative, (demonstrative, meaning *there it is*) and proto-imperatives, (volitional, meaning *there it is*).

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7 Research in joint attention, intentional communication, gesture and sign, and context bound words in children with ASD will be examined in Chapter 3.
and I want it.]. Greenfield and J. Smith (1976) also refer to the initial semantic functions as performatives. They define these speech acts as the first semantic relations, whose purpose is to express volition and indicate objects; for example, saying /dat/ and clapping to play pat-a-cake.

**Gesture and sign**

Because children have limited means to convey their intentions as they first start to use recognisable words, they augment their first words with a few communicative crutches, relying on joint attention, gestures, and context for mutual understanding. Gestures supplement, assist, and substitute for speech in hearing children. The inclusion of research on gestures relates to Graeme’s early use of gesture and sign. Children first use gestures without accompanying vocalisation (Goodwyn & Acredolo, 1993). Initially, the verbal and gestural modalities are regarded as separate systems, not used concurrently or with a shared semantic system (Sowden, Perkins, & Clegg, 2008). The use of gesture with vocalisation, together with spoken words, increases in temporal synchrony as children acquire their productive lexicons (Goldin-Meadow & Butcher, 2003). Using gesture with complementary speech has a reinforcing function; for example, by the child pointing at a car while saying car. At this point, semantic coherence (sharing of semantic systems) is established and the verbal and gestural modalities are integrated (Alibali & Goldin-Meadow, 1993; McEachern & Haynes, 2004). The next development is that the child combines elements from each modality to make one semantic and communicative whole; for example, pointing to a toy and saying mine.

Early gestures are deictic, though they may become representational (Bates et al., 1975). Goodwyn and Acredolo (1988; 1993) examine the gestures that hearing children use to name and ask for things early in their second year, suggesting that this use may assist children as they begin to use words in a symbolic system. Most of these gestures have some metonymic (part-for-whole), nonarbitrary, indexical relation to the meaning: for example, a pacifier represented by sucking, or a flower represented by a sniff. In verbal children these gestures are later replaced by the corresponding words. Slobin refers to early creative gestures in hearing and deaf children as visual icons in the motor modality.
and compares them to onomatopoeic words (Slobin, 2007). Casadio and Caselli (1989) propose that, like words, representational and deictic gestures emerge from early interactional routines and gradually separate from specific contexts to become symbolic.

Gestures are the earliest signs for signing children, and can be regarded as early words for hearing as well as deaf children. For example, Pearson (2006) noted that her daughter’s first ‘word’ at 00.07 was “a very elaborate and unmistakable sign for ‘all gone’.” Researchers have looked at the function of gesture in single-word speakers. Tomasello and Carpenter (2007) suggest that when a child of 01.00 points, the child is trying to influence the adult’s mental state through shared intentionality with a motivation for cooperation. These are social skills unique to humans and form the prelinguistic basis for early language development. Morford and Goldin-Meadow (1992) found that TD children from 01.02 to 02.04 not only spontaneously produce gestures in combination with speech, but that gestures also supplement and substitute for speech in comprehension. Non-verbal children, in the absence of exposure to conventional spoken or signed language input, will invent gestures to communicate (Goldin-Meadow, 2009).

Gesture use can predict later language skills. Rowe and Goldin-Meadow (2009) investigated TD children’s gestures at 01.06, finding that the number of different meanings that were conveyed gesturally predicted production at 03.05, whereas the quantity of gesture plus speech combinations was not predictive. Goldin-Meadow (2009) noted that children who use non-synonymous gesture plus speech combinations will produce earlier word combinations, proposing that gesture use therefore assists children with the next linguistic stage. The manual modality has linguistic properties when it is used communicatively (Volterra, Iverson, & Castrataro, 2006). Capirci and Volterra (2008) regard the strong link between actions, gestures, and early words at the origin of language as support for the neuro-physiological models of lexical acquisition. Prelinguistic gestures co-evolve on the continuum of language development with symbolic representation abilities, closely related to speech acquisition (Volterra, Caselli, Capirci, & Pizzuto, 2005).
Studies on gestural input show that it facilitates word learning. Grassmann and Tomasello (2010) found that children of 02.00 and 04.00 disambiguate adult acts of reference by following the pragmatic information shown through adult pointing. Parents’ gesturing when verbally labelling in joint attention situations with children of 01.02 to 01.03 was predictive of their children’s gestural production (Namy, Acredolo, & Goodwyn, 2000). Yu, Ballard, and Aslin (2005) examined input from the intentional referential deictic body movements of speakers, presenting a computational model to show how gestures facilitate the making of word-meaning associations in infants.

Studies of hearing infants of 00.11 show that when parents model and encourage referential gestures (baby signing) it speeds children’s lexical acquisition (Goodwyn & Acredolo, 1993; 2000). The children learn to express needs and feelings, to label objects, and to differentiate concepts, which provides a mental framework for speech when their articulation has developed (Acredolo, 2010). When American Sign Language (ASL) is taught to hearing children who adopt early signs, the signs fall out of use as speech develops (Abrahamsen, 2000; Goodwyn & Acredolo, 1993). This has relevance for hearing language-delayed children who are taught to sign. G. Morgan suggests that in situations where the deaf child appears to have invented a sign, it is more likely that the parent and child together have created an idiosyncratic form (G. Morgan, 2006). Abrahamsen (2000) supports this observation in hearing children, noting that babies adopt and symbolically use their parent’s idiosyncratic and referential gestures. The early hand shapes of children were phonologically unmarked (in a less defined form), in a study of children who were exposed to or taught sign language (G. Morgan, Barrett-Jones, & Stoneham, 2007).

**Babble**

Babble is distinguished from the earliest words because it is not meaningful. The inclusion of research on babble relates to the findings in this dissertation, both in Graeme’s unusual development of babble and in the typical use of early babbled sounds in the early words. Babble and early vocalisations of the pre-linguistic period are the precursors to lexical acquisition expressed in speech, and to social-communicative
development. Caregivers actively encourage their babies in the development of turn-taking in speaking, listening, and responding to the infants’ sounds. From birth, infants’ sounds are reflexive only, until around 00.02 to 00.03, when the infant begins to interact in response to a partner, reacting to sound stimulus by smiling and cooing (Stoel-Gammon, 1998). Whether produced in interaction or solitude, these coos consist mostly of vowel-like sounds with some primitive supraglottal consonant-vowel (CV) of initial velar [k, g] sounds (B. L. Smith & Oller, 1981; Snow, 1977; Stoel-Gammon, 1998). Some infants produce more CV than vocalic syllables when adults are turn-taking verbally. From 00.02 until 00.10, reactive vocalisations scaffolded by interaction make up 40% of the baby’s sound production (Stark, Bernstein, & Demorest, 1993).

A new function of vocalisation, activity sound-making, starts at 00.04 to 00.05 in TD children, with the infant exploring the possibilities of the vocal tract for sound by producing playful yelling and screaming, squeals, trills, growls, yells, raspberries (expelling air through the lips to create a vibrating sound), and friction noises (Stark et al., 1993). They also produce vowel sounds containing some of the phonetic features of adult speech. Production varies greatly in individual children and from day to day. Though predominantly vowel, some CV sequences with velar consonants occur when the infant is interacting with the environment but not with a partner (Stark et al., 1993; Stoel-Gammon & Stemberger, 1994). For the first six months, the infant attends either to an object or to a partner, but not to both, in all interactions (Stoel-Gammon & Cooper, 1984).

The next new vocal behaviour, communicative sound-making, emerges at 00.06 to 00.07, co-occurring with the milestone of intentionality, with the acquisition of the pragmatic functions of requesting, protesting, and interacting (Stark et al., 1993). At this age the infant starts to produce canonical syllables, which are reduplicated strings of alternating CV syllables timed like adult speech: for example /bo ba bo ba/ (Stark et al., 1993; Vihman, Ferguson, & Elbert, 1986). Initially more monosyllables occur than multisyllables. Variegated strings, for example, /ba mo gu/, appear around 00.09 to 00.10

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8 Consonants produced above the glottis.
(B. L. Smith et al., 1989). There are individual production patterns, in place and manner of articulation, syllable shape, and vocalisation length in babble, which continue to be found in the earliest words. A small number of speech sounds (stops, glides, nasal consonants and lax vowels) occur, though more vowels sounds than consonants are produced (Stoel-Gammon & Cooper, 1984). Increases in vocalisations with a consonant and the number of consonants used indicate babble development. The frequent practise of their phonetic repertoire helps infants to prepare the oral motor control to produce easy and automatic sounds in their early words (Oller & Eilers, 1982; Paul, 1998; Stoel-Gammon & Cooper, 1984; Stoel-Gammon, 1998; Vihman et al., 1986).

Canonical babble is the basis for speech. It co-occurs with the earliest meaningful productions of TD children for 10 months. These earliest words have the same form as canonical babble in that they develop from reduplicated to variegated sequences (Stoel-Gammon & Cooper, 1984; Vihman & Greenlee, 1987). Stoel-Gammon (1998) suggests that the onset of canonical babble is a reliable marker for early identification of speech delay, because deaf babies never produce canonical babble (Oller & Eilers, 1988).

Around 01.00, jargon babble commences, which uses adult stress and intonation patterns. This co-occurs with canonical babble and the earliest words, when there is only a small proportion of intelligible speech in sound production. Children still produce more vowels than consonants at this point (Stoel-Gammon & Cooper, 1984).

**The phonetic form of early words**

The identification and definition of early words necessarily address their non-standard modified pronunciation, limited intelligibility, and phonetic form. Early vocalisations have varying degrees of phonetic closeness to adult words (Bates & Benigni, 1979; Menn, 1976; Vihman & Miller, 1988), and their forms may be indistinguishable from babble (Labov, 1973; Vihman et al., 1986; Vihman & Miller, 1988). One theory is that children use templates as they augment their early lexicon, in which their selection of target words is influenced by their existing phonetic patterns (Velleman & Vihman, 2002).
The second year of life for a TD child is the usual time of the onset of early word production, when children have lexical representations (Ferguson & Farwell, 1975) of phonetically consistent forms (Dore et al., 1976). Communicative grunts with no supraglottal constriction, in combination with joint attention to mother and object, precede referential word production in early speakers. Grunts with gestures are an indication of comprehension in slow talkers with a limited phonetic repertoire (McCune, Vihman, Roug-Hellichius, Delery, & Gogate, 1996). Both early and slow talkers use grunts for several months.

McCune and Vihman (McCune & Vihman, 2001) examined the relationship between the independent capacities of phonetic development and later referential word acquisition, in a longitudinal study of 20 babies from 00.09 to 01.04. The consistency and frequency of the babies’ vocal motor schemes (phonetic patterns) emerges in a complementary fashion with the process of symbol formation in their acquisition of referential words (Werner & Kaplan, 1963). McCune and Vihman found the use of at least two supraglottal consonants preceded referential word production for all children. The earliest users produced /p/b/ consistently and predominantly. While consonant preference varied with the individual child, the preferred consonants were used in almost all the child’s referential consonant-based words. The most common vocal motor scheme is /t/d/, followed by /p/b/, whereas /b/ is the most common consonant to be found in stable words across all children (Stoel-Gammon, 1998). In analysing order of development of target words in English on the CDI, Fenson et al. (1994) found that 22% of English words acquired between 00.09 and 00.11 include bilabials (sounds made with the lips). Mechanical (motoric) factors, in addition to visual and proprioceptive cues, differentiate bilabials from other consonants, making them perhaps easier to acquire. Studies provide evidence that consonants are more important than vowels in lexical acquisition and processing for English-learning children at 01.08 (Havy & Nazzi, 2009; Nazzi, 2005). Although children begin to acquire the phonological system of their language from 01.00 to 01.06, they vary greatly in their development of phonological contrasts, influenced by such variables as vocabulary choices, contexts, and preferences for objects and sounds (Ferguson, 1989; Pye, Ingram, & List, 1987; Schwartz & Leonard, 1982; Vihman et al., 1986).
Vihman and McCune (1994) state that the meaning for the earliest words in their data can be determined by the researcher through the function and setting, both linguistic and environmental, of its use, in combination with an awareness of the child’s phonetic patterns.

**Onomatopoeic words**

Onomatopoeic words may be used before the phonological system is established. Although all TD children use onomatopoeic words there is little published on this phenomenon (MacWhinney, 2007). Slobin (2007) describes these words as “iconic representation in the acoustic modality”. Hinton (1995) refers to onomatopoeia as imitative sound symbolism. It is not limited to the phonetic features and phonological processes of the native language, nor to speech sounds, but is drawn from the universal sound inventory of human voicing (Hojholt, 2008). There is a great variation in the frequency, amount and duration of use of these early words (MacWhinney, 2007). Some children have a specific proclivity for this form of idiosyncratic but non-arbitrary iconicity, in which form has a direct relationship with meaning (Gasser, Sethuraman, & Hockema, 2005). They may incorporate semantic broadening, and morphological tense and case markers in their onomatopoeic words, even combining them into sentences, but eventually transition from their idiosyncratic forms into conventional words (Hojholt, 2008; Morgenstern, 2007). One type of onomatopoeia is diagrammatic iconicity, in which the sound exemplifies the meaning; for example, using a vocal size, such as a deep loud voice, to represent a large size in the real world (Haiman, 1993; Klamer, 2001). A similar type is synesthetic sound symbolism in which phonetic features such as vowel lengthening, deep pitch, volume, and expressive exaggerated intonation patterns represent large or fearsome objects (Hinton, 1995). The largest class of onomatopoeic words in English is in words representing animal sounds (Rhodes, 1995). Other onomatopoeic words are vehicle (vroom) and action (bam, boink) representations. Fantini (1985)
describes his son's addition of graphic representations\(^9\), in the form of drawing the thoughts for his words, to his onomatopoeic vocabulary.

Rhodes (1995) uses a wild-tame scale to represent the continuum from wild sounds, which are accurate non-arbitrary mimicking of the real sounds, such as /?wQk? wQk?/ for a duck, to the tame conventional *quack quack*. Morgenstern notes that the onomatopoeic words of the child she studied (like those of Graeme) were so faithful to the environmental sound they mimicked that they were difficult to transcribe (Morgenstern, 2007).

A theoretical explanation for the phenomenon is Werner’s (1957) proposal that early symbol formation makes use of aspects of objects and events, and only gradually becomes differentiated from them. Hoejholt (2008) suggests that her son used the strategy of onomatopoeia to ease language processing, reinforced by his communicative success because speakers in his environment were eager to understand him. The inclusion of research on onomatopoeic and idiosyncratic words relates to my second research question, on the definition of Graeme’s early words.

**Idiosyncratic words**

Nelson explains onomatopoeic and other idiosyncratic usage as children making a distinction between their own alternative language and that of their parents (Nelson, 2007b). She notes that the adult speakers in her family used her daughters’ idiosyncratic words until the children were ready to use conventional words. Likewise, Peters (Peters, 1994) noted that the idiosyncratic words of the sight-impaired child in her study were validated, reinforced, and perpetuated until the child was ready to use more conventional forms. M. Robb et al. (1994) note the ratio of real words to non-words (meaningful vocalisations) was nearly equal at the 10-word mark whereas it was 2:1 within two months of the child producing 50 words.

\(^9\) Infants begin to develop the graphic modality with the ability to discriminate between simple visual patterns at 00.02 (Rosinski & Wheeler, 1972).
The early productions of gestures, grunt vocalisations, and idiosyncratic and onomatopoetic forms, while meaningful, are not considered by most researchers to be real words. For children with atypical language development, however, these may be all the words they have. Crutchley (2006) summed it up, saying, “It all goes to show (for me, anyway) that the science of establishing what exactly a first word is, and how we can be sure it is that for the child as well as for us, is still far from exact.”

**Context bound words**

Many researchers maintain that most early words (or pre-words) are understood and used in highly restricted ranges of meaning, often embedded within the perceptually salient events and contexts of specific circumstances, such as the social routines of frequent everyday experiences (Dore et al., 1976; Dromi, 1993; Ferguson & Farwell, 1975; Halliday, 1975; Nelson, 1988; Rescorla, 1980). These context-limited words are sometimes even restricted to a single specific instance. Barrett (1989) gives an example where duck was used initially only to signify the yellow toy duck when it was being banged on the edge of the bathtub.

McCune and Vihman (2001) define two types of referential words, nominal and relational, which refer to dynamic and reversible spatial and temporal events. Examples of context bound uses of relational words include down when used in a situation where the child only wants to throw an object, or more where he wants more food.

Most researchers consider context bound words to be a distinct and qualitatively different phenomenon from symbolic words (McCune, 2010), although Goldfield and Reznick (1990) do not distinguish them in their data. While not all early words are context dependent, all such words are acquired and used early in the productive lexicon (Barrett, Harris, & Chasin, 1991; Dromi, 1999; Dromi, 2008). Harris et al. (1988) found that over half of the first 10 words of their four subjects were context specific. McCune and Vihman (2001) found the mean onset of context limited words to be 00.11.15, preceding referential words by around three months, although other researchers also note they may be produced simultaneously (L. Bloom, 1993; McCune & Vihman, 2001; Vihman &
McCune, 1994). Snyder, Bates, and Bretherton (1981) found that the first 50 words were frequently contextually variable in meaning. Dromi (1999) refers to these words as situational. She notes that they co-exist with the later acquired conventional equivalents and that both versions can be used in a sequence of single word utterances. Barrett (1983) suggested that words rarely last as event bound more than a few weeks in TD children, although other studies observe that context limited words persist until the word spurt (Nazzi & Bertoncini, 2003; M. Robb et al., 1994).

**Acquiring meaning**

The content of the early productive lexicon is addressed in theories on acquiring meaning. Children begin to understand and to use their first words as soon as they have some meaning attached to them, though not the full conventional adult meaning. The meaning of a child’s very first vocalised words and gestures can differ from their later symbolic words in three ways: by being idiosyncratic to a given child, by being very broad and diffuse, or by being narrowly attached to the very limited context in which they learn the word.

The cognitivist position explores the links between the infants’ ability to conceptualise the events and objects in their world and their ability to perceive words. One useful way to look at early word meaning is through the theory of the child’s underlying concept of a word and its extensions and intensions of meaning (Anglin, 1970). For example, the word *elephant* denotes a range and variety of elephants, consisting of a category or class of all elephants. The extension of the word *elephant* is everything to which the term *elephant* applies; for example, African, Asian, toy, and pictures (Anglin, 1978). The word’s intension consists of all the necessary properties of an elephant for that word to be used. For *elephant*, these include having a trunk and being a very large animal. The concept of the word *elephant* consists of both its extension and intension.

Most words refer to categories, rather than to a single object, person, relationship, action, or event. Context bound words have an underextension of the regularly extended adult meaning (Anglin, 1970). When the word is regularly extended, it indicates that the child
has an underlying category of meaning for the word (Anglin, 1978). Barrett (1999) states that words are sorted into taxonomic categories when children perceive semantic relationships. At this point, categorical words with regular semantic extensions gradually replace the earliest schematic context bound words as the child develops the underlying principles for representing relations or sets of referents.

Overall, regularly extended words are the most prevalent category during the one word stage but not, however, for the earliest words (Dromi, 1999). Early uses of words often have idiosyncratic unstable meanings and are frequently underextended (Kay & Anglin, 1982). Dromi (1987; 1999; 2008) presents a detailed classification of the extension behaviours of early words in production based on her naturalistic data, in order to examine the subtle changes over the course of the one-word stage in the ways a particular word is used. She concludes that individual words take different routes as their meanings develop, and that the pattern of extension of a word is closely linked to the timing of its acquisition. Extension behaviours change most often when the initial extension is irregular and if the words are among the earliest acquired. During the first four months of typically developing production acquisition there is an unsteady rate in the acquisition of extensions, a pattern that changes just before the word spurt. Dromi (1999) notes that in her data, very early words learned in clear, ostensively defined contexts, such as pointing to a picture, or showing or giving an object or action, are the words used with regular extensions from their first use. Dromi (1999; 2008) suggests that the accelerated acquisition of words is directly related to children’s assigning of word meaning and to how they determine and acquire more regular extensions.

Overextensions, in which the word is generalised to inappropriate usage in unexpected contexts, such as the use of bear to mean all animals, occur later, within or shortly after the word spurt in production. While some words are overextended in comprehension, these are less frequent and obvious than they are in production (Ingram, 1989).

The social perspective includes social cognition and interaction in semantic acquisition. Babies’ speech perception, social cognition, and early concepts link to their learning of word meaning (McCardle, Colombo, & Freund, 2009). Clark (2003) proposes that there
are two sources for children’s initial assumptions about word meanings. The first is socially based: children pay attention to what is addressed to them and make inferences in context about the referents of these words based on their their joint attention skills, and the co-occurrence of the words and the objects. The second source of learning about what words mean is that children have the conceptual knowledge of some ontological categories through their experience. Children can categorise and conceptually organise objects that are identifiable by shape, types of substances, types of spatial, temporal, and causative activities and relations, and types of properties. Children gradually extend the meaning outside these contexts as they fine tune meaning through exposure to a range of exemplars (Clark, 2003). Support for this theory comes from other researchers (Goodman, McDonough, & Brown, 1998; Tomasello, Strosberg, & Akhtar, 1996). Lieven and Tomasello (2008) propose that children learn words from interactive usage based language experiences of initially frequent, consistent utterances that gradually increase in complexity and abstraction. Gopnick and Meltzoff (1993) propose that the context of participation in familiar repetitive social routines and the ability to perceive and understand intentional behaviour scaffold word learning.

Bloom (2000) suggests that language that has already been learned influences subsequent acquisition, because children accumulate inferences from different occasions, retain that information, and look for consistency over time in determining lexical meaning. Gleitman (1990) proposes that children’s repeated exposure to a word in multiple syntactic and pragmatic contexts helps them to narrow down its possible meaning.

**Early semantic classes**

The semantic categories of the earliest words in comprehension and production common to most TD children illustrate the first stages in the acquisition of meaning. The early lexicon is comprised of unrelated words from different semantic classes for people, food, clothing, animals, vehicles, toys, household objects, social routines, and sound effect (Dromi, 1987). Later symbolic words represent relations and sets of referents sorted into taxonomic classes (Barrett, 1999). In the transition to reference, children add to their existing classes of words. They also create new classes for body parts, qualities of
objects, transactions, changes of location, states, and actions (Dromi, 1987; Dromi, 1999). Nelson (1973) reports that children initially use words for small moveable objects that the child can handle in the semantic contents of their first 50 words. She noted that children used intermediate categories of words in their semantic domains; for example, *dog* rather than the specific *dachshund* or generic *animal*. Torkildsen (2006) found that children of 01.08 were sensitive to labelling incongruities between semantic categories, evidence of the semantic organisation of their mental lexicon.

Many of the semantic categories and the frequently acquired first 50 words in the production lexicon also apply to the comprehension lexicon (Benedict, 1979; Fenson et al., 1994). Cross-linguistic research shows that deaf children’s first signs have common semantic characteristics and use the equivalent first learned and frequently used forms to those used by speaking children: *mum, cat, milk*, and semantic classes, such as words for food (G. Morgan et al., 2007).

In Table 2.1, data are combined from several sources of diary and observational studies of TD children acquiring English, to show both the early semantic categories and the most frequently acquired first words (Clark, 1973; Dromi, 1999; Fenson et al., 1994; Ingram, 1989; Leopold, 1939; Nelson, 1973; Rescorla, 1981). Rescorla, Alley and Christine (2001) found a high degree of correlation with the vocabularies of late talkers with the data from their earlier study of high frequency words, which were compiled from parent diaries and classic diary studies as an assessment tool for late talkers (Rescorla, 1989). When the data were available from the monthly sampling in the CDI (Fenson et al., 1994), the ages at which the highest frequency first words are acquired between 01.00 and 01.06 are presented in Table 2.1. The most commonly acquired words in children’s first 50 production acquisitions, which were found in studies other than the CDI, are included in Table 2.1 without the ages at the time of acquisition.
### Table 2.1  Semantic classes and the most frequent first words

<table>
<thead>
<tr>
<th>Semantic class</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>People</td>
<td><em>Dada/daddy</em> (01.00), <em>mama /mummy</em> (01.00), <em>baby</em> (01.03), at least one proper name</td>
</tr>
<tr>
<td>Food</td>
<td><em>Banana</em> (01.04), <em>juice</em> (01.04), <em>cookie</em> (01.04), <em>cracker</em> (01.05), <em>apple</em> (01.05), <em>cheese</em> (01.05), <em>bread, drink, milk, toast</em></td>
</tr>
<tr>
<td>Body parts</td>
<td><em>Eye</em> (01.04), <em>nose</em> (01.04), <em>ear</em> (01.05) <em>hair, mouth, teeth</em></td>
</tr>
<tr>
<td>Clothing</td>
<td><em>Shoe</em> (01.04), <em>coat, diaper, hat, socks</em></td>
</tr>
<tr>
<td>Animals</td>
<td><em>Dog</em> (01.02), <em>cat /kitty</em> (01.04), <em>bird</em> (01.04), <em>duck</em> (01.04), <em>hen/chicken, cow, horse, sheep</em></td>
</tr>
<tr>
<td>Vehicles</td>
<td><em>Car</em> (01.04), <em>boat, train, truck</em></td>
</tr>
<tr>
<td>Toys</td>
<td><em>Ball</em> (1.03), <em>book</em> (01.04), <em>balloon, blocks, doll</em></td>
</tr>
<tr>
<td>Household objects</td>
<td><em>Bottle</em> (01.04), <em>keys</em> (01.05), <em>bed, book, clock, cup, light, spoon</em></td>
</tr>
<tr>
<td>Social routines</td>
<td><em>Bye-bye</em> (01.02), <em>hi</em> (01.02), <em>no</em> (01.03), <em>night-night</em> (01.04), <em>bath</em> (01.05), <em>peek-a-boo</em> (01.05), <em>upsy-daisy, yeah/yes</em></td>
</tr>
<tr>
<td>Activities (sound effects, motion, state)</td>
<td><em>Uh-oh</em> (01.02), <em>woof</em> (01.04), <em>moo</em> (01.04), <em>ouch</em> (01.04), <em>baa baa</em> (01.04), <em>yum yum</em> (01.04), <em>vroom</em> (01.05), <em>up</em> (01.05), <em>down</em> (01.05), <em>allgone, eat, back, cold, dirty, go, here, hot, more, out, off, there, up</em></td>
</tr>
</tbody>
</table>

### Summary

This section has examined theoretical and data-based research on many aspects of production acquisition: intentional communication, gesture, babble, early phonetic forms, and onomatopoeic words. The productive precursors to early words are babble, and gestured and vocalised intentional communication. Canonical babble precedes and co-occurs with speech, sharing the same phonetic forms. The acquisition of a phonological system and the development of contrasts are highly variable. Onomatopoeic words also vary in duration, frequency of use, and number.

The pragmatic acts of requesting, protesting, and commenting through shared attention in early intentional communication encourage labelling input. Gesture both supplements and substitutes for speech in early production, while grunts are an early meaningful vocalisation that both indicate comprehension and combine with joint attention to be intentionally communicative.
Context bound words in both comprehension and production have a restricted range of meaning that is dependent on the physical and linguistic environment. These emerge prior to referential words although they may co-occur. The extension theory of semantic acquisition describes the semantic features of a categorical word. Early words have unstable, idiosyncratic meanings, while context bound words are underextended.

The early lexicons contain unrelated words from different semantic classes. The semantic categories for the early lexicons consist of words for people, food, body parts, clothing, animals, vehicles, toys, household objects, social routines, sound effects, motion, and state. In the lexical acquisition of both comprehension and production, the transition to categorical, referential, symbolic words is a benchmark.

The transition to reference

Introduction

Although the focus in this dissertation is on the acquisition of the earliest words in comprehension and production, theory and research on referential symbolic words add to the defining criteria for the early words by examining which aspects of referential words they lack. The definitions of what a word is in studies of lexical acquisition were often based on symbolic referential words. This section will examine research in symbolic representation, referential words, exhaustive categorisation, and the social reasons for the referential development.

Symbolic representation

Symbolic capacities include the ability to form concepts (Piaget, 1962) and the ability to represent objects (Lifter & Bloom, 1989). There are differing proposals on how a child’s conceptual knowledge is organised. Nelson (1973) claims the child first forms a concept and then attaches a word to it, while Clark (1974) suggests the child first acquires the empty phonetic form and later the meaning. Dromi (1999) claims both occur, with the
child actively asking for names for concepts he has already formed, as well as trying to form concepts for new forms.

Various contentions centre on whether a child’s production of ‘real’ words commences with the first recognisable approximations of systematic and symbolic words from the adult language. Regarding children as symbol users from the start of the production of recognizable forms of words from the adult language, Bates and Benigni (1979) propose that linguistic and nonlinguistic symbolic capacities emerge around 01.01, at the onset of first vocalisations. They contend that symbols and indices are both learned through the perception of contiguity. Other researchers also support the claim that infants’ first words have categorical and referential uses (Gopnik & Meltzoff, 1984; Gopnik & Meltzoff, 1997; Huttenlocher & Smiley, 1987; Mervis, 1987). Many theorists, however, while referring to early productions as words, do not consider them to be used as symbolic tools with an ability to name and refer but, rather, indices of meaning (L. Bloom, 1973; Gillis, 1987). In the view of Hirsh-Pasek and Golinkoff (2000), words used indexically relate to what they represent through associations created in experience and memory by real events. They, therefore, represent a physical or temporal connection between a sign and an object; for example, a beeping dial tone for voice-mail message. Early words gradually become words with symbolic capacities as they become attached to underlying concepts of naming categories of actions and objects. Symbolism increases as decontextualisation continues. As word meanings become independent of extra-linguistic contexts and of the pragmatic function of the utterance, they develop into arbitrary terms of reference representing conventional meanings in adult forms (Bates & Benigni, 1979; Vygotsky, 1962). Lexical maturation and cognitive development correlate as words become symbolic and represent sets of referents or relations, with regular extensions and denotation properties (Dromi, 1999; Lucariello, 1987).

**Referential words**

After the onset of lexical acquisition, the next major transition is from the comprehension and production of the first early words to the qualitatively different process of acquiring referential words, which symbolise categories and refer to aspects of the real world. In
the cognitivist viewpoint, the efficiency of later word learning is determined by complex underlying interactions within language maturation: the development of symbolic representational capacities, the naming insight, and exhaustive categorisation (Dromi, 1999; Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Mervis & Bertrand, 1994). The naming insight occurs when children begin to realise that each category has a name (Dore et al., 1976). Representational abilities are acquired when children recognise that words have become symbolic representations of entities (Anglin, 1993; Bates & Benigni, 1979; Golinkoff et al., 1994; Mervis & Bertrand, 1994). Having a phonetic repertoire and the capacity for the pragmatic intention of gaining attention with vocalisation are relevant contemporaneous developments to referential word use (McCune et al., 1996; McCune & Vihman, 2001). In children’s lexicons, referential words have modified phonological forms and incomplete semantic extensions while they are developing into conventional adult words. Deaf children exposed to signing begin to use early signs around 00.08 and produce their first symbolic signs at around 01.00 (Abrahamsen, 2000; G. Morgan et al., 2007).

Referential use is indicated by a child’s understanding and use of a word to refer to at least two different objects or events. McCune and Vihman (2001) observed great variation in the timing of the acquisition of referential words in a longitudinal data-based study of 20 children from 00.08 on, where only 14 were using referential words by 01.04, with a range of onset between 01.02 and 02.03. In the 10 children studied until they combined words, the spread of their transition to referential word use was between 01.07 and 02.07 (McCune & Vihman, 2001). In the view of these researchers, the timing of this transition depended on skills in consistent consonant use over several months, and grunt communication. Pretend play, which precedes and enables rapid word acquisition in the productive lexicon (McCune, 2010), is further evidence that children have symbolic ability (McCune & Zanes, 2001).

**Exhaustive categorisation**

The use of referential words as symbols depends on the realisation that every label refers to a category (Dore et al., 1976) that has an underlying concept (Anglin, 1970).
Proponents of cognitivist theories have examined the cognitive skill of categorisation to predict language outcomes and the onset of new linguistic abilities (Colombo, McCardle, & Freund, 2009). The TD child undergoes a qualitative change between 01.06 and 02.00, from being initially prompted by familiarity to learn new words, to developing strategies for determining meaning of unfamiliar words by being able to categorise on the basis of identifying similarities (Clark, 2003). The taxonomic assumption is that novel names extend to members of a kind, and that most words refer to categories of objects rather than the original exemplar used in the restricted usage of early words (Markman & Hutchinson, 1984; Markman, 1989; Waxman, 1991). Mandler and McDonough (1993) regard this as a shift from a schematic cognitive structure of representation, in which structures are organised around contiguities of time and space, to a categorical representation based on relationships of similarity amongst members of a class. Around 01.06, children show the ability to sort entirely perceptually dissimilar objects together when they are given a common name, and to predict strong correlations between perceptual similarities and causal powers (Gopnik & Nazzi, 2003). The ability to spontaneously sort categories of objects and actions into groups on the basis of similarity relations is termed exhaustive categorisation (Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Mervis & Bertrand, 1994). Exhaustive categorisation is considered to be a milestone in cognitive development that is necessary for the enablement of fast-mapping.

**Social causes of referential development**

Researchers with a social-interactionist viewpoint on the transition to reference include Sabbagh (2007), who credits children’s understanding of the referential information in gaze direction as a basis for the rapid encoding of word and referent, drawing on the neurocognitive skills of semantic memory. Ninio (1993) suggests that children's earliest meaningful speech uses functions as intentional communication or as an expression of social meaning. Her perspective is that children are not limited by being context dependent or by a lack of cognitive or conceptual ability. Rather, their early words have the characteristics of discrete, independent, unmarked linguistic signs used by adults in
single-word utterances for social meanings, functions, or communicative intents; for example, no, this, and here. Along these lines, Hirsh-Pasek and Golinkoff (2000) specify that in order to be learned, symbols need the further perception of social cues that indicate intention.

Summary

The acquisition of referential words occurs when the child develops the ability to represent objects symbolically. Cognitivists credit the naming insight, exhaustive categorisation, and the development of symbolic capacities for this qualitative change in lexical acquisition, while social theories claim the additional need for the perception of social cues to infer intention. Referential word use is indicated by the understanding and use of a word for two or more different objects or events. There is wide variability in the timing of this transition, which depends on pretend play skills, the use of grunt communication, and consistent consonant use for several months. Lexical maturation and the cognitive development of symbolic representational abilities correlate as children acquire referential words with underlying concepts for categories of actions and objects sorted into taxonomic classes.

Ages, rates, and the entry point of acquisition

Other aspects of word production include research on determining a point of entry into the lexicon, and on the rate and timing of acquisition in production. Studies of these quantitative measures in TD children provide a basis for comparison to Graeme’s development.

Determining the point of entry into the lexicon

Various criteria are used by researchers to determine the point at which a lexical item is acquired in a corpus-based study. The first non-imitated, spontaneous use of a word is usually considered sufficient evidence of acquisition in production; a useful definition for a corpus that is based on most of a child’s output (Menn & Bernstein Ratner, 2000).
McCune (2009) states that both productivity and continuity are the primary means to determine a point of acquisition\(^\text{10}\), noting this must always be considered as a defined point of origin on a continuum of development (McCune, 2009). In Vihman and McCune (1994), productivity was the determining factor between referential and context bound words. To rule out accidental or limited examples, a referential word must have occurred a minimum of twice in a sampling session, in situations that were different enough to demonstrate generalisation (McCune, 2008; Vihman & McCune, 1994). Fleck points out a systematic bias in data collection that is not accounted for in many models of statistical sampling: namely, that vocabulary is strongly associated with situation, so that, for example, words used for food eaten only at home would not appear in a corpus derived from testing in sessions, despite their frequency of occurrence (Fleck, 2009a).

Estigarribia & Clark (2007) note a deeper theoretical issue in determining the point of acquisition from instance-based models of language learning. In a developmental model, acquisition occurs through a slow generalisation, from instance to construction to rules of productivity. Therefore, there is no sharply defined point of acquisition; rather, all elements of language are acquired in a gradual process.

**Age, timing, and rate in the production lexicon**

There is substantial individual variation in the age of onset of production as well as in children’s progress throughout the single word stage, from the earliest words to the transition to symbolic words and then to word combinations. Comprehension acquisition typically precedes production acquisition by almost four months (Benedict, 1979; Ingram, 1989). For most children, the 20\(^\text{th}\) word produced precedes the 100\(^\text{th}\) word comprehended, although there can be a long gap between the 100\(^\text{th}\) word comprehended and the 10\(^\text{th}\) word produced, as shown in an earlier study on Graeme’s lexical acquisition (Gibson & Ingram, 1983; Ingram, 1989). TD children, from around 01.00 to 01.06, when they understand around 100 words, begin to produce vocalisations in specific situations that usually only their immediate circle can understand. All novice word learners show a very slow rate of acquisition of repertoire in the first months of production. The CDI

\(^{10}\) See also criteria for defining a word.
revealed that the productive vocabulary of babies in this study from 01.00 to 01.04 months increased from median scores of just under 10 words to 40 words (Fenson et al., 1994). These data are consistent with those of other researchers, who found the age of acquisition in six children for productive vocabularies of 10 words was between 01.00 and 01.04, with an average of 01.02, and for 50 words was between 01.05 and 01.10, averaging 01.07 (Benedict, 1979; Ingram, 1989; M. Robb et al., 1994). Nelson found greater variability in when the 50th word is acquired, between 01.01, at the earliest, to 02.03 at the latest, for TD children (Nelson, 2009). For many TD children there is a change to a sudden increase in rate at the word spurt, usually seen near the approach of the 50-word level (Bates, Marchman, Thal, & Fenson, 1994; Benedict, 1979; L. Bloom, 1973; L. Bloom, Tinker, & Margulis, 1993; Dromi, 1999; Goldfield & Reznick, 1990; Mervis & Bertrand, 1995; Reznick & Goldfield, 1992; Torkildsen et al., 2009). Bauer, Goldfield, and Reznick (2002) found the largest number of production spurts occurring in the 01.08 to 01.10 interval.

The first multi-word utterance in production generally occurs when comprehension is between 100 and 200 words, and after production has reached 50 words (Benedict, 1979). Some children take a few months beyond the 50-word mark to move into the word combinations, while others take a full year to reach that point (Barrett, 1999; Benedict, 1979; Dromi, 1999; Fenson et al., 1994). However, there are children who learn language synthetically, in a gestalt fashion, rather than analytically. These children use unanalysed chunks of language initially, producing global phrases with melodic intonation as a single lexical item, then later break them down into their lexical components (Peters, 1983). Nelson referred to this as an expressive style of lexical acquisition (Nelson, 1973). Counts of early lexicons vary widely, due to both individual variation in children and to differences among scholars in defining symbolic words as opposed to early words.

Variations in the patterns of lexical acquisition beyond form and timing in the second year are common, especially in individual differences of numbers and kinds of words acquired, with most children not using conventional forms and meanings until their third year (Bretherton, NeNew, Snyder, & Bates, 1983; Nelson, 1982; Nelson, 2007c; Shore,
Dixon, & Bauer, 1995). Fleck (2009b) suggests that the extent of variation is underestimated in published work in the field.

Summary

The entry point of acquisition into the lexicon in production is determined by the first spontaneous non-imitated use of the word, if the corpus is based on most of the child’s output. In sampled data, frequency and continuity of use are the criteria. Sampled corpuses can miss words that occur in specific contexts such as home or preschool. A defined point of origin is part of a continuous process of acquisition, both in earlier attempts and subsequent refinements towards the conventional form. This is the gradual process proposed in developmental models, rather than an instance-based point.

There is considerable variation in children’s ages at the onsets of comprehension and production and at the word spurts (if they occur), as well as in the rate and pace of their word learning. Comprehension precedes production by variable times, and the initial 50 words are acquired slowly over several months. The average age of onset for productive vocabulary is around 01.02, and for 50 words is around 01.07. Production word spurts, if they occur, tend to happen around the 50th word level. The individual variation in children and the differences in defining early words result in a wide range of ages, rates, and counts of early lexicons.

Chapter summary

As child language acquisition is a pre-paradigmatic field (Kuhn, 1996), several theories of word learning are proposed and none is universally embraced. Views differ on the primacy of cognitive or social factors in word learning, and on which model best captures the interrelationship of factors driving word learning. The social-interaction position is that the child’s social abilities, contents of mind, and/or communicative needs motivate the child to learn words (Adamson et al., 2010; Markson et al., 2008; Woodward & Needham, 2009). The functionalists consider the pragmatic intentions of practical needs
in context to be the core driver of children’s language development (Halliday, 1975). The cognitivist position is that, as a cognitive process, language learning has innately determined linguistic constraints that enable children to determine word meaning (Merriman & Evey, 2005; Waxman & Gelman, 2010). The viewpoint of the proponents of the associationist model is that the child’s attention to word-object association facilitates lexical acquisition (L. B. Smith et al., 2002). The hybrid theories combine functional, cognitivist, associationist, and social-interactionist perspectives (Golinkoff et al., 2000; Hirsh-Pasek et al., 2004). Developmental models also combine other theoretical perspectives, proposing that gradual, continuous, neurological and physical maturation affects change in lexical comprehension and production processes (Kent et al., 2001). The connectionist theory proposes the competition model, which focuses on the word learning mechanism rather than the outcome of the learning process (Bates & MacWhinney, 1987; MacWhinney, 2005b).

These theories have two applications to my first research question. The first application is to the analyses and findings for this long-term developmental case study with its detailed cumulative data on linguistic, pragmatic, cognitive and social acquisition, physical maturation, and contextual information. The second application is to the findings on the relationship between Graeme’s early lexical acquisition and the major developmental milestones in his cognitive and social growth. Developmental models, including the hybrid emergentist theories, incorporate the streams of social, cognitive, linguistic, pragmatic, and physical development; as such, they may be able to account for the relationship among the many incremental, cumulative, dynamic components of development that constituted and underlay Graeme’s gradual acquisition of his lexicons in comprehension and production, over a three-year period (Akhtar, 2005; Bates & Benigni, 1979; Clark, 2003; Dromi, 2008; Hirsh-Pasek et al., 2004; Hollich et al., 2000; Pruden, Hirsh-Pasek, & Golinkoff, 2006). Cognitivist theories offer concrete milestones such as exhaustive categorisation, symbolic capacity, and the naming insight, that relate to lexical acquisition, which could provide a framework for Graeme’s word learning (Dore et al., 1976; Gopnik & Nazzi, 2003; Lifter & Bloom, 1989; Piaget, 1962); Social/interactionist theories (Baldwin & Tomasello, 1998; L. Bloom & Tinker, 2001;
Theories on the definition of early words apply to my second research question; investigating the definition of a word in child language acquisition research and the criteria for the point of entry into the early lexicon in production. Researchers are in agreement over defining referential symbolic words as categorical, representational, arbitrary, and systematic, even though these words may not have the full adult form or meaning, or be widely intelligible (Dromi, 1999; Hirsh-Pasek et al., 1999; Vihman & McCune, 1994). Early pre-symbolic words, however, particularly those at the onset of meaningful productions, have less clear defining criteria. A useful definition is that in order to be a word, a vocalisation must be consistent in meaning and shape, used in multiple situations, and resemble adult words phonetically in at least two segments, though it may be context bound and underspecified phonetically (McCune & Vihman, 2001). Not all researchers accept as words forms that are context bound in meaning and do not extend to other exemplars (Golinkoff, 1999). Less universally accepted as words are onomatopoeic utterances, non-dictionary child forms, homonyms, gestures by hearing children, and vocalisations that are unintelligible or made with non-speech sounds, even though they are interpretable and intentional communications with pragmatic functions and consistent shapes (M. Robb et al., 1994).

Research on the prerequisites for, and aspects of, early lexical acquisition in TD children provide a basis for comparison to Graeme’s word learning, with its differences of language delay and ASD. Prelinguistic increases in perceptual knowledge and interaction with adult speakers in the natural context of shared activities prepare infants for the beginning of word learning (Hollich et al., 2000; Kruschke, 2003; Samuelson & Smith, 2005). Joint attention and intersubjectivity are considered to be the foundation for lexical acquisition (Tomasello, 2007). Gaze following and monitoring, in addition to pointing, are precursors of the onset of language production (Charman, 2003; McCathren et al.,...
The child’s cognitive ability to categorise and sort like with like is perceptually based in infancy, and develops into the realisation that everything belongs in a category (Cohen & Brunt, 2009; Quinn et al., 1993). Innate constraints may narrow down possible meanings (Markman, 1989; Waxman, 1991; Woodward & Markman, 1998).

The acquisition of lexical comprehension begins early in the first year of life with the perception of language-specific acoustic properties of a word (Jusczyk, 1995a; Werker, 2004). Infants’ developing abilities to segment the speech stream and to perceive speech sounds as distinct lead to their phonemic perception of meaningful contrasts which link sounds to meaning (Ingram, 1999; Jusczyk, 1995b; Werker & Yeung, 2005).

There is wide individual variation in timing and rate at the onsets of lexicons in production and comprehension and at the word spurts, as well as in the rate and pace of word learning (Fenson, 1989; Rescorla, 1984). The initial 50 words in both lexicons are acquired slowly over several months (Nelson, 1973). Variation in acquisition has also been documented in the transition to referential word use in production, and in the presence of word spurts in both modalities (D. Bauer et al., 2002; Benedict, 1979; Fenson, 1989). Variation in form occurs in the preferred consonant patterns at the onset of speech, in the use of gestures, and in onomatopoeic words. These measures provide evidence of Graeme’s language delay.

Comprehension generally precedes production and is acquired at a faster rate (Benedict, 1979; Ingram, 1989). The usual age of onset of comprehension for TD children is between 00.10 and 01.00 (Benedict, 1979). The first words understood are usually context dependent (Harris et al., 1995), and acquired with the aid of ostensive labelling in interactive linguistic environments (Nelson, 1988; Rescorla, 1980). After advances in perceptual mechanisms and attentional engagement, rapid word learning in comprehension co-occurs with several key areas of social-cognition related to lexical acquisition. These are social-pragmatic ability (Charman, 2003), contents of mind (L. Bloom & Tinker, 2001), attentional engagement (Meltzoff & Brooks, 2009; Sabbagh et al., 2007), joint attention abilities (Tomasello, 2007), symbolic representational ability
exhaustive categorisation (Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Mervis & Bertrand, 1994), and the naming insight (Dore et al., 1976). These developments precede the word spurt in production.

Research on the productive precursors to early words, early vocalisation and gestures in both babble and intentional communication, applies to both research questions: Graeme’s lexical acquisition, and the inclusion of meaningful, functional productions as word/signs in his lexicons. Early intentional communication directs and shares attention through facial expressions, gaze, and pointing, in order to convey the pragmatic functions of requesting, protesting, and commenting (Bates et al., 1975; Halliday, 1975). These pragmatic acts encourage labelling input. Gesture both supplements and substitutes for speech in the early lexical in production, evolving from deictic and iconic to symbolic (Casadio & Caselli, 1989; Morford & Goldin-Meadow, 1992). Gestural input facilitates comprehension by disambiguating meaning (Grassmann & Tomasello, 2010). Babble relates to the earliest words phonetically and through social interaction (Stoel-Gammon, 1998; Vihman et al., 1986). The earliest meaningful vocalisations have limited intelligibility with consistent but underspecified phonetic forms that are pre-phonemic (Bates & Benigni, 1979; Menn, 1976; Vihman & Miller, 1988).

Early words emerge concurrently with the development of symbolic capacities prior to referential word use (Werner & Kaplan, 1963). Onomatopoeic words are iconic representations, not limited to sounds of the native language, or even to speech sounds (Slobin, 2007). Context bound words in both lexicons have a restricted range of meaning that is dependent on the perceptually salient situation of everyday routines and the linguistic environment (Ferguson & Farwell, 1975; Halliday, 1975; Nelson, 1988; Rescorla, 1980). They are qualitatively different from referential words in that they do not extend over multiple exemplars, nor do they appear to have an underlying symbolic concept (McCune, 2010). The meaning of a child’s very first words and gestures produced can differ from his later symbolic words by being idiosyncratic with unstable meanings, by being very broad and diffuse, or by being narrowly attached to the limited context in which he learns the word (Barrett et al., 1991; Dromi, 1999). The acquisition
of meaning depends upon the child’s development of concepts (Anglin, 1970; Anglin, 1978) and on the social context in which he uses joint attention to make inferences about meaning, and to extend meanings through exposure to different exemplars (Clark, 2003).

The entry point of a word’s acquisition into the production lexicon, while defined as a point of origin, is part of a continuous process of acquisition. This consists of the earlier imitations, including less intelligible forms and the underextended context bound attempts, and the subsequent refinements towards more conventional aspects of the word's phonological form, symbolic reference, and more regular semantic extensions (Anglin, 1970; Dromi, 1999; Kay & Anglin, 1982). One criterion for acquisition of a word is its first non-imitated, spontaneous use (Menn & Bernstein Ratner, 2000).

The early lexicons usually contain unrelated words from different semantic classes (Dromi, 1987). As children acquire later symbolic word productions that represent relations and sets of referents sorted into taxonomic classes, they add words to their existing classes, and add new classes (Dromi, 1999). Early words gradually become symbolic referential words as children acquire the underlying concepts for categories of actions and objects, and develop the ability to represent objects symbolically (Bates & Benigni, 1979; Vygotsky, 1962). As symbolism increases, linguistic, situational and pragmatic context-dependence decreases (Dromi, 1999). Referential word use is indicated by the understanding and use of a word for two or more different objects or events. Lexical maturation and cognitive development correlate as words become symbolic and represent sets of referents or relations, eventually becoming regularly extended, arbitrary, conventional adult forms (Dromi, 1999; Lucariello, 1987). This correlation applies to both research questions: the relationship between developmental milestones and the acquisition of lexical comprehension and production; and the definition of a word.

Views differ on the primacy of cognitive or social factors in word learning and on which model best captures the interrelationship of factors driving word learning, whether through qualitative shifts resulting from the passing of milestones in cognitive and social abilities, or through gradual overlapping developments in cognitive, physical, and social maturation. Theoretical differences also appear in the definition of a word in child
language, with varying acceptance of the developmental aspects of early words. This dissertation will consider these varying perspectives on the interpretation of the data.

This chapter has reviewed theories of word learning: the definition of early words, the prerequisites for word learning, the acquisition of lexicons in comprehension and production, the transition to reference, and ages, rates and the entry point of acquisition. The focus in the following chapter will be narrowed to lexical acquisition as it pertains to children with ASD.
Chapter 3: Research on Lexical Acquisition in Autistic Spectrum Disorders

Introduction

This chapter will review literature relating to Autism Spectrum Disorders (ASD), concentrating in particular on research in prelinguistic communication, early language development, lexical acquisition in comprehension and production, and on predictors of language outcomes. A brief overview of ASD, and the heterogeneous language abilities within the spectrum, will be followed by two sections on reviews of literature in the field. The first section covers research on early language and lexical acquisition in children with ASD in the areas of: language delay; characteristics of language development in the spectrum; pragmatic functions; intentional communication; phonological, lexical and semantic development; and rates and variability in production. The second section, on early predictors of language outcomes, looks at research in cognitive ability, joint attention, imitation, play skills, and environmental variables. The chapter as a whole gives an overview of the early language development of children with ASD, adding to the research on the lexical acquisition of TD children in Chapter 1.

Defining autism spectrum disorders

Autism spectrum disorder (ASD) is an umbrella term for similar disorders of brain development, including autism, pervasive developmental disorder-not otherwise specified (PDD-NOS), high-functioning autism, and Asperger syndrome (Fombonne, 2003b; Luyster & Lord, 2009). The Diagnostic and Statistical Manual of Psychiatric Disorders-IV (DSM-IV-TR) (First & Tasman, 2004) defines autism as a neurodevelopmental syndrome that is characterised by primary impairments in three behavioural domains: abnormal development of language with associated patterns of intact and impaired language functions; communication deficits in social interaction and reciprocity; and a desire for sameness that displays as repetitive, perseverative, stereotyped behaviours, difficulty with transitions, and highly circumscribed spheres of activities and interests (Tager-Flusberg et al., 2005; Walensi, Tager-Flusberg, & Ullman, 2006). Children with
ASD are presently considered to traverse a spectrum of severity in each of these areas and to display a pattern of deficits and strengths in cognitive ability, resulting in heterogeneity within the spectrum, especially within language development (Epstein, 2005; Lord et al., 2004; V. Smith, Mirenda, & Zaidman-Zait, 2007).

Sigman and Ruskin (1999) state that while no single deficit is both universal and unique to the disorder, key defining symptoms of autism are pragmatic impairments in communication, such as orienting and attending to social stimuli (Tager-Flusberg et al., 2005). The impairment of verbal and non-verbal communicative abilities is a major challenge faced by persons with ASD. A delay in the onset of language is the most frequent referral concern, often being the first symptom noted by parents (Siegal & Blades, 2003; Tager-Flusberg et al., 2005). The significance of this is reflected in the current inclusion of global language and communicative impairments as a primary diagnostic feature of ASD (Rice, Warren, & Betz, 2005; Wetherby & Prizant, 2005).

In Canada, approximately one out of every 165 children, approximately 80% of them male, will be diagnosed with ASD (Fombonne, 2003a). Recent research indicates ASD to be strongly genetically determined (Vitiello & Wagner, 2007).

**Characteristics of language development in ASD**

**Introduction**

This section includes research on the heterogeneous language abilities in the autism spectrum, with a brief overview of language regression.

**Heterogeneous language abilities in ASD**

As noted, there are several separate diagnoses within the spectrum of autism disorders, each associated with differing language abilities, ranging from the non-verbal population to those individuals displaying the highest level of verbal skills, this usually associated with Asperger’s syndrome. A study of 31 children with PDD-NOS, a milder form of
autism, demonstrated that they had more intentional communication in their second year than those diagnosed with autism, along with a more rapid rate of production acquisition and joint attention skills as a consequence of more directed vocalisations, facial expressions, and social smiling (Chawarska, Klin, Paul, & Volkmar, 2007). Those with Asperger’s syndrome may display a high intellectual level, with no discernible language impairment or delay, but with a social-communicative deficit in interpreting nonverbal cues to determine other speakers' intentions (Prior et al., 1998; Sciutto & Cantwell, 2005).

At the other end of the spectrum, children deemed to be non-verbal have functional speech consisting of fewer than six words a day or with less than a 30-word vocabulary. Functional language is defined as the production of frequent, communicative, spontaneous, non-imitative, and intelligible speech (Kobayashi, 2003; Tager-Flusberg et al., 2005). However, a recent study by Tager-Flusberg et al. (2009) provides stringent criteria\(^{11}\) for defining word stages for children with ASD in order to replace the loosely defined term *functional speech*.

A longitudinal study of 110 children on the spectrum, of 02.00 or younger, found that language impairments improved over time, 40% attaining fluency, and 45% gaining some functional language by late childhood (Lord et al., 2004). A further study of 983 people with ASD (from 04.00 to 52.00) found that in spite of early language delay only 9% remained nonverbal in early adulthood (Hus, Pickles, Cook, Risi, & Lord, 2007). Cantwell, Baker, Ruter, & Maywood (1989) suggest that cognitive ability may influence whether or not the non-verbal children make the transition to linguistic communication, because cognitive deficiencies may preclude an understanding of language as an intentional symbolic system, so preventing the development of language comprehension and joint attention. Luyster and Lord (2009) note that our ideas about language impairment in ASD are changing as many children thus identified do not have profound deficits in either language structure or fluency. They speculate that this could be either a

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\(^{11}\) Specified in the section on the criteria for lexical acquisition status in production in Chapter 4.
result of earlier diagnosis and improved intervention programmes, or a cohort effect of the inclusion of less impaired children who show more marked gains over time.

**Early atypical language development within ASD**

Language disorders associated with ASD range widely, because of the individual variability on the spectrum from severe dysfunction to mild idiosyncrasy. The effects of ASD on language range from the complete absence of functional language to fluency and normal scores in basic form and content of word knowledge on standardised language measures, based on a study of 89 children with an age range of 04.00 to 14.0012 (Kjelgaard & Tager-Flusberg, 2001). Within the broad spectrum of ASD there is both language disorder and preservation of language skills in specific language domains. Children on the spectrum can display early language delay, language regression, or neither, according to a study of 27 toddlers, aged 01.03 to 02.01 (Paul, Chawarska, Cicchetti, & Volkmar, 2008).

Word regression, unique to but not universal across the spectrum of autism, is one characteristic that occurs within (or possibly before) the single word stage (Pickles et al., 2009). In about 20% of children with ASD, early lexical growth is deviant and marked by language loss, with a decline in the use of early words before the word spurt, typically around 01.00 to 01.06, based on a study of 110 children of 02.00 or younger (Lord, Shulman, & DiLavore, 2004). Some of these children use a few words for about a month, then use no words for about a month, regaining their words at the same age as those children with delayed onset of word use (Lord, Shulman et al., 2004). Language loss may be concealed by language delay as it was reported much less often in these cases (Pickles et al., 2009). Children with word regression can also lose their former communicative routines and other social skills, according to a study of 44 children with a mean age of 06.00 (Goldberg et al., 2003).

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12 Unless otherwise specified, the studies in Chapter 3 are based on children with ASD.
Social communication in ASD

Introduction

This section focuses on research in the area of social communication in children with ASD. Research is discussed on joint attention impairments in early lexical acquisition and in fast-mapping, on gestural and vocalised pre-speech intentional communication, and on semantic acquisition, along with the predictive relationship between acts of social communication and lexical acquisition.

Joint attention impairments

The studies reviewed in this section present research on abilities and deficits of children with ASD in social communication and pragmatic functioning. The predictive influence on language outcomes in these areas is also reviewed. Although as noted there is a wide range within ASD in the degree of language impairment, all children with autism are considered to have at least mild pragmatic impairments, irrespective of whether they have a general language delay or other disorders associated with ASD (Lord & Paul, 1997; Rice et al., 2005; Tager-Flusberg, 1999; Werker et al., 1998). The core and earliest aspect of pragmatic ability affecting children with ASD is joint attention, an aspect of intentional communication uniquely affected in autism, according to a study of infants tested at 01.10 and at 03.06 (Charman, 2003). Joint attention is the ability to maintain the interaction of two-way communication through progressively complex pre-language developments in eye contact and gestures. It occurs in the environment of most early word learning, recruits linguistic input from others, and is considered to be a prerequisite for language development in all populations (Carpenter, Akhtar, & Tomasello, 1998; Carpenter, Pennington, & Rogers, 2002; Jones, 2003; Schertz & Odom, 2004; Yoder & Warren, 2001).

The development of joint attention occurs both before, and concurrently with, lexical acquisition. In TD children these early non-verbal social-cognitive skills emerge in a developmental sequence over a period of 18 months, with infants first learning to share,
then follow, then direct others' attention and behaviour. Curcio (1978) first identified the joint attention deficit in ASD in a study of 12 children aged 04.00 to 12.00, in which affected children used eye contact and pointing as a comment to self, but did not respond to or initiate joint attention. Joint attention deficits in children with ASD include delays in gaze and point following; imperative and declarative gesture; vocalisations; social orienting of shared affect, attention, and understanding others' communicative intentions; spontaneous engagements; orienting to speech; and imitation of actions. These delays occur prior to the delays in comprehension and production (Paul, 2008) and affect a child’s ability to take a social perspective (Mundy & Newell, 2007). Deficits in the foundational skills of joint attention can therefore be among the earliest indicators of ASD.

Research on 15 children at 01.00 (Mitchell et al., 2006) and 65 children at 02.00 (Zwaigenbaum et al., 2005), later diagnosed with ASD, found that they displayed the following characteristics indicating attentional impairments: lack of eye contact, lack of orienting to name, lack of imitation, and minimal social smiling and social interest. Children at this age, later identified as being on the ASD spectrum, are less responsive to their names, or to someone speaking (Lord, 1995) (30 children at 02.00), or even to their mothers’ voices (Klin, 1991) (12 children at 04.00 to 06.05). Leekam and Ramsden (2006) found a significant relationship between language impairment and fewer responses of children with ASD to attention bids of name-call and touch. Attention-following abilities and the child’s compliance with adult directives were positively related to speech outcomes in 29 children with ASD at 02.00 and 03.00 (McDuffie, Yoder, & Stone, 2005). Bono, Daley, and Sigman (2004) demonstrated that the biggest vocabulary increases among a group of 40 children were seen in those with high attention-following abilities. Rollins, in two separate studies of five and six preschool children, suggested that variability in the rate of vocabulary acquisition was associated with deficits in both the type and diversity of the pragmatic skills of joint attention and communicative intent (Rollins, 1995; Rollins & Snow, 1998).
Mundy (2010) reports that deficits in IJA (initiating joint attention) last longer than those in responding. In order to assess children on the spectrum whose joint attention development is delayed, early developments in non-verbal joint attention communicative acts were coded as meaningful communicative acts in the Social Communication Assessment for Toddlers with Autism (Drew et al., 2007). These initial IJA bids include looking without making eye contact, and bringing objects to dump at the feet of a parent, as a means of asking. These actions precede the skills of gaze following and pointing, which are later developments in many toddlers with ASD.

A more mature development in joint attention is triadic gaze switching, in which social information is accessed through two people using their direction of gaze, as well as vocalisations and gestures to co-ordinate attention to an event or object. Gaze switching shares engagement through verbal and non-verbal cues, and shows the referential intention and focus of attention of the conversational partner (Baldwin & Moses, 1996; Hollich et al., 2000; Tomasello, 2003). Baron-Cohen, Baldwin, and Crowson (1997) found that TD children, and children with cognitive delays who were not autistic, were much more likely to use the speaker’s direction of gaze to identify the object referent when presented with a novel word than were children with autism. Luyster and Lord (2009) examined 21 toddlers on the ASD spectrum who had intact skills at using the strategy of speaker’s direction of gaze to map a new word, to determine whether children with joint attention strengths could apply these to word learning. They found no difference between their subject group and a group of TD children matched for production level and verbal mental age in word learning when required to use social information, and concluded that word learning in children with ASD is not inherently different from typical development, given environmental supports. Gaze following deficits have been found to be related to the development of social interaction, meaningful language, symptom severity, and higher order cognitive abilities in children with ASD (Charman, 2003; Leekam, Hunnissett, & Moore, 1998; Mundy, Sigman, & Kasari, 1994; Sigman & Kim, 1999). Leekham studied children between the ages of 05.05 and 12.06, and Mundy looked at 90 preschoolers, 30 of whom had autism. The skill
of gaze switching at 03.00 predicts concurrent and later language ability at 04.00 (Dawson et al., 2004).

There are two diagnostic criteria for acquiring IJA in ADOS (Autism Diagnostic Observation Schedule), according to a study of 223 individuals from 01.03 to 40.00 (Lord et al., 2000). The first is spontaneously seeking to share experiences, and the second is showing joint attention with a positive affect.

**The effect of attentional impairments on fast mapping**

Attentional impairments also affect later word learning in preverbal children with ASD. Impairments in the ability to follow the conversational partner’s indicating behaviours, in infants later diagnosed with ASD, have been linked to production, to the rate of word acquisition, and to fast mapping (the ability to rapidly match novel words to unnamed items) (Charman et al., 2003; Landry & Loveland, 1988; Mitchell et al., 2006). P. Bloom (2002) suggests that the ability to infer the referential intentions of a speaker facilitates fast mapping in TD children. For this reason, atypical patterns of behaviour and attention, such as focusing on partial or irrelevant features of an object, are considered to imply core deficits in the word-learning strategies of fast mapping and gaze following (Bailey, 2006; Baldwin, 1991; Baldwin, 1993a; Baldwin, 1993b; Fernald et al., 2001). Preissler and Carey (2005) found that, though children with ASD were impaired in monitoring referential intent, they did as well as TD children at fast mapping in conditions of referential ambiguity.

Joint attention impairments affect the ability of children with ASD to integrate linguistic, social, and cognitive knowledge into their communication, and are the purported cause of their language impairment, including language delay, and disassociation in connecting social behaviour to words (Bono et al., 2004; Carpenter & Tomasello, 2000; Charman, 2003; Dawson et al., 2004; Delinicolas & Young, 2007; Leekam, López, & Moore, 2000; Rogers, Hepburn, Stackhouse, & Wehner, 2003; Stone & Yoder, 2001). Delinicolas looked at 51 children with ASD between the ages of 02.00 and 06.05, Rogers at 24 children with ASD, and Stone at 35 children at 02.00 and again at 04.00. Several
longitudinal studies have identified joint attention as the strongest predictor of concurrent language ability (Charman et al., 2003; Dawson et al., 2004) and of long term gains in speech production in children with autism (Mundy, Sigman, & Kasari, 1990; Sigman & Kim, 1999; Sigman & McGovern, 2005). Mundy based his study on 15 children with a mean age of 03.09. The sections below on intentional gestural and vocalised communication, pragmatic acts, and comprehension further discuss research in joint attention impairments that affect the acquisition of these aspects of lexical acquisition.

**Gestural intentional communication**

This section will look at studies of differences affecting language acquisition in gestured intentional communication in children with ASD. In TD infants, gestures are a transition between language comprehension and speech, but there are both delays and differences in gestural development in ASD children (Charman, Drew, Baird, & Baird, 2003). The use of fewer gestures at 01.00 may offer an early indication of ASD (Mitchell et al., 2006). Gestures used by TD children such as nodding or shaking the head, waving, or pretending to steer a car are used less frequently by ASD children, and mainly within taught social routines (Camaioni, Perucchini, Muratori, & Milone, 1997). However, TD and ASD children (based on a study that included two children with ASD under 03.00 appear to follow the same developmental trajectory in gesture and speech, with the systems initially developing independently, then combining temporally and semantically in the single word stage (Sowden et al., 2008).

In infants with ASD, the production of early gestures involving shared reference is delayed in comparison to their later gestures using objects at 01.06, based on a study of 26 children tested at 02.00, 03.00, and 07.00 (Charman et al., 2005). Children with autism, in a study of 15 children from 03.00 to 13.00) (Landry & Loveland, 1988), employ fewer conventional attention-directing actions, such as declarative pointing and showing, than TD children do (Carpenter et al., 2002). They tend instead to use imperative pointing for requests (nonverbal asking for an object or action) (Tomasello & Camaioni, 1997). Parisse (1999) found that children with autism produce fewer pointers
to objects and events than any other group of children, and also fewer than their parents, whereas other groups of children either match or exceed their parents' use of pointing.

Curcio (1978) noted that nonverbal children used imperative pragmatic acts or gestures to demonstrate needs and desires, but did not employ declarative acts of using objects to gain attention from an adult or to direct the adult’s attention towards the object (Baron-Cohen, 1989; Tomasello & Camaioni, 1997). In TD children, these communicative acts usually emerge concurrently. Rather than using conventional attention-directing pointing or eye contact to demonstrate their wishes and to request help, children with autism may touch an object, bang an object in frustration, tantrum and self-injure, or guide a parent’s hand as a tool (Donnellan & Mirenda, 1983; Loveland & Landry, 1986; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997; Tomasello & Camaioni, 1997). Stone’s study is based on 26 children at 02.00. Sowden et al. (2008) looked at gestures in two boys in their second year, finding that their gestures were predominantly used to request, rather than to comment on objects or actions. In both boys, the integration of speech and gesture was delayed.

Research has shown links between gesture use and language outcomes in this population. Leekam and Ramsden (2006) noted a significant relationship between language impairment and fewer acts of child-initiated pointing and showing. The frequency of the pragmatic acts of commenting (sharing a positive affect about an object or event) and requesting predicts later production in children with ASD (McDuffie et al., 2005; Sigman & Kim, 1999). Calandrella and Wilcox (2000) observed that intentional communication, both with and without vocalisation, with referential gestures and co-ordinated visual attention to an adult, was a predictor of word production; and that gestural indicating behaviours were predictive also of language comprehension, in a population of 25 developmentally delayed children aged from 01.07 to 03.02. V. Smith, Mirenda, and Zaidman-Zait (2007) reported that the number of gestures used to initiate joint attention was predictive of later growth in word production in a longitudinal study of 35 children from 02.07 to 05.11. Gestures initiating joint attention, responsiveness to others' bids for joint attention, and the frequency of requesting behaviours at 01.03 to 01.06, also
predicted language outcomes in adolescents and young adults with autism (Poon, 2005; Sigman & McGovern, 2005).

The relationship of gestures to concurrent and future language use has been demonstrated. Mundy, Sigman, and Kasari (1990) observed that the marked and persistent deficits of gestural joint attention in pointing and showing that occur in the prelinguistic to early one-word stage are predictive of delayed language development a year later. Luyster et al. (2008) found gestures to be related to concurrent language in comprehension and production in 164 toddlers with ASD. Kim (Kim, 2005) noted that the more gestures the preschool children in her study had, the more words they had.

Vocalised intentional communication

Prelinguistic vocalisations, though less efficient and effective than words, occur in both the non-verbal and preverbal communication of all children with ASD. Intentional nonverbal communication behaviours continue after the first words appear in children with ASD, as with all humans who have intentional communication (Wetherby, Cain, Yonclas, & Walker, 1988). Likewise, the rate of growth in non-speech vocalisations increases until the onset of lexical acquisition, and decreases after the initial words (Cantwell et al., 1989; Wakstein, 1969).

Fewer vocalisations in social situations have been found in children with ASD at 02.00 compared with TD children, and these were less often accompanied by shifts of gaze, gestures, or changes in facial expression. Plumb (2009) compared vocalisations in children aged 01.06 to 02.00, later diagnosed with ASD, with chronologically age-matched TD children to investigate concurrent and predictive relationships between developmental level and age. She found that children with ASD employed significantly fewer vocalisations, containing fewer consonants, but more atypical and distress vocalisations than the TD children. The developmental level of the ASD group correlated with both the overall frequency of vocalisations and the frequency of those containing speech sounds.
The rate of vocalisation, both non-directed and interactive, with and without gestures, predicts productive language ability in children with ASD (McCathren et al., 1999). In this study, speech at 03.00 was predicted by communicative vocalisations near to 02.00. Yoder (2006) found that the amount of intentional communication predicted lexical density in children with ASD. Lexical density, the number of nominative words used, is a measurement of useful speech and fluency in children with ASD, and is dependent on the child’s productive lexicon and talkativeness, according to a study of 36 preschool children (Yoder & Stone, 2006). At the onset of lexical acquisition in this population, the initiation of spontaneous communications, which are associated with early language comprehension and production abilities, is very infrequent (Stone & Caro-Martinez, 1990). There are also more occasions of no response, and fewer affirming turn-taking vocalisations (Landry & Loveland, 1988; Sigman & Ungerer, 1984). Instead, persistent and perseverative questioning are employed to initiate interaction or to get attention, rather than information seeking and giving (Hurtig, Ensrud, & Tomblin, 1980).

**Social-communicative acts**

Children with autism in the one-word and multi-word stages have less frequent and varied social communicative acts in free play, such as requesting information, commenting, initiating social interaction, or acknowledging a listener (Landry & Loveland, 1988; Wetherby & Prutting, 1984). This relates to their restricted communicative repertoire (Rollins, 1995) and to impairments in referential communication (Ziatas, Durkin, & Pratt, 2003).

Social acts of intentional communication are predictive of language outcomes. In toddlers with ASD, an increase in the frequency and functions of these acts, along with initiations of interactions and comments, predicted later skills in comprehension and production in a study by Drew et al. (2007). Requests and responses, however, were not predictive. Yoder (2006) demonstrated that the initial frequency of intentional communications was one predictor of lexical density (the number of different nominative terms) in low-verbal and nonverbal children with ASD. A correlation was demonstrated between non-verbal
communicative acts at 02.00 and language and social outcomes at 07.00 (Charman et al., 2005).

Deficits in social communication, specifically in joint attention and in socially unresponsive behaviour, have the most severe impact on early language acquisition. These impairments affect gestured and vocalised intentional communication, and, as discussed below, occasion delays in lexical development, rapid word learning in production, and eventual language outcomes.

**Comprehension in ASD**

**Introduction**

This section will discuss research in the common comprehension delays in children with ASD and the predicted outcomes of such delays. It will also look at research that compares comprehension acquisition in children with ASD with that of TD children.

**Comprehension delays**

As noted earlier, research has linked comprehension delays to attentional deficits in social-cognitive abilities. Deficits in the ability to process social meanings impact the understanding of linguistic input (Lord, 1989). Joint attention impairments in social gaze (eye contact) and attention-following are associated with comprehension delay. Attention-following is essential to associating labels with objects and events in order to understand the meaning of words (Hollich et al., 2000). Social gaze is necessary for the face-processing skills of interpreting speakers’ intentions and emotions, particularly the nonverbal cues of facial expression and tone of voice, according to a study of 16 children from 01.05 to 06.06 (Loveland & Kelley, 1991), 14 children from 03.04 to 10.08 (Ozonoff, Pennington, & Rogers, 1990), and other studies (Mundy et al., 1994; Sigman & Kim, 1999; St. James & Tager-Flusberg, 1994). Difficulty in following verbal and non-verbal communications to direct attention is among the primary indicators of ASD, based on the diagnosis of 50 children with ASD from a screening of 16,235 children at 01.06,
03.00, 05.00, and 07.00, for the Checklist for Autism in Toddlers (CHAT) (Baird et al., 2000; Baron-Cohen, Cox, Baird, Swettenham, & Nighingale, 1996), and supported by observations in other studies (Carpenter et al., 2002; Landry & Loveland, 1988). In infants who were later diagnosed with ASD, a correlation was demonstrated between their ability to follow the conversational partner’s indicating behaviours and later impairment in lexical comprehension (Mitchell et al., 2006).

Delays in lexical comprehension can be an early indicator of ASD, according to studies of 26 people with ASD between 07.00 and 22.00 (Dahlgren & Gillberg, 1989), and 30 children tested at 02.00 and 03.00 (Lord, 1995), and supported by other research (Bartak, Rutter, & Cox, 1975; Rutter & Schopler, 1992). As early as 01.00, many children on the autism spectrum exhibit noticeably delayed comprehension of phrases and single words, as well as delayed production of first words, as shown in studies of 16 people with a mean age of 13.00 (le Couteur, Rutter, Lord, & Rios, 1989), 51 children from 02.00 to 05.00 (Lord & Pickles, 1996), and other research (Mitchell et al., 2006; Rice et al., 2005). Illustrating the heterogeneity of ASD, however, Rapin, Allen, and Dunn (1992) report that one third of children with autism in their study had no delays in word comprehension, while 67% had delays in the understanding of words and phrases, as well as in production. Twachtman-Cullen (1998) relates delays to impairments in the social-cognitive scaffolding of language comprehension and use, while Watson (2001) considers early delays in comprehension to be related to impairments in speech perception, in the construction of meaning in social interactions, and in symbol formation.

**Predicted outcomes of comprehension delay**

Many studies have examined delays in comprehension and their correlation with language outcomes. Luyster et al. (2007) examined the comprehension and production scores on the CDI of 81 children with ASD at 02.00 and 03.00 to predict outcomes at 09.00, finding that these scores predicted language skills as well as autism severity, adaptive functioning, and verbal and non-verbal IQ. In particular, production scores at 02.00 and comprehension scores at 03.00 were predictive of language outcomes, while comprehension scores at both ages consistently indicated degrees of autism severity.
Comprehension was predicted by non-verbal cognitive development, concurrent use of gesture, and joint attention response (Luyster et al., 2008). Paul, Chawarska, Cicchetti, and Volkmar (2008) showed that initial scores on comprehension of 37 children aged 01.03 to 02.01 were associated with better production outcomes over two years.

Comprehension and gestural development have also been linked in children with ASD. Children who were delayed in language comprehension produced fewer deictic and symbolic gestures in one study (Thal & Tobias, 1992), while another study demonstrated that the prelinguistic behaviour of commenting through pointing was positively associated with later word comprehension (McDuffie et al., 2005). Luyster et al.’s (2008) study of 164 toddlers with ASD found non-verbal cognition, gestures, and joint attention response to be concurrently related to language comprehension. Developmental motor milestone delays in general are associated with early language delay and lower comprehension abilities in ASD children, based on a study of 48 people (Eisenmajer et al., 1998) and supported by later research (Lord et al., 2004). Play skills were likewise associated with comprehension, with social cognition and pretend interactive play abilities more important for understanding language than knowledge about objects or sensorimotor skills such as object permanence in children between 02.06 and 05.00 (Reijonen, 1997; Sigman & Ungerer, 1981).

Comprehension of words in the second year was found to be delayed relative to word production in several studies of ASD, more at 02.00 than at 03.00 and 04.00 (Charman et al., 2005). J. Robb (1985) noted that her subjects at a mental age of 02.00 had low language comprehension scores, while object permanence skills were strong. Based on data from the CDI (infants’ words and gestures parent report), Charman et al. (2003) found that in children with ASD at 01.10 and at 03.06, as in TD infants, understanding generally precedes and exceeds speech. However, this study suggested that some infants who were later diagnosed with ASD had impairments in their ability to follow the speaker’s indicating behaviours that resulted in their production exceeding word comprehension.
Comparisons with comprehension in TD children

Further studies relating to language comprehension in children with ASD have shown some similarities with TD children. While Wilkinson (2005) found performance on word matching in comprehension differed from TD children, Ungerer and Sigman (1987) demonstrated that category knowledge of function, form and colour was not impaired in the 16 children with autism in their study between 03.03 and 07.02, whereas comprehension was adversely affected. Several studies showed that, like TD children, children with ASD over a mental age of 03.00 comprehend Subject Verb Object (SVO) word order (Kjelgaard & Tager-Flusberg, 2001; Paul, Fischer, & Cohen, 1988; Swensen, Kelley, Fein, & Naigles, 2007). Swensen et al. (2007) found that 10 children of 02.00 to 03.00 with ASD comprehended SVO word order before production, interpreting sentences when they were still single-word speakers. Charman et al. (2005) demonstrated that the acquisition order of word categories and forms is the same as in TD children. Ward (1996) claimed that lower-functioning ASD children also follow the developmental sequence of TD children in acquiring the basic speech discrimination skills necessary for language comprehension. Performance in tasks that indicated understanding a speaker’s intention was a more significant predictor of word learning in children with ASD than it was in TD children, however (Parish-Morris, Hennon, Hirsh-Pasek, Golinkoff, & Tager-Flusberg, 2007).

In summary, delays in word learning in comprehension, in association with abilities in social cognition, may indicate ASD, appear to be common in ASD, and can predict language outcomes. Once lexical comprehension has commenced, however, its acquisition in children with ASD is similar to TD children.
Production in ASD

Introduction

Areas of research on production in children with ASD discussed in this section include comparisons with TD children in sound perception and processing, and in phonological, lexical, and semantic development.

Speech perception and processing

The sound perception and encoding of children with ASD has been shown to differ from typical development in some aspects. It is suggested that at least some of the children with more severely autistic symptoms may have a deficit in auditory processing (the effective recognition and interpretation of sounds) (Siegal & Blades, 2003). Difficulties in speech perception (the hearing and interpretation of speech) experienced by individuals with ASD include recognising speech within a noisy environment and parsing transient differences in sounds (Cardy, Flagg, Roberts, & Roberts, 2005). A study that related social and linguistic development found that preschool children with ASD who had lower scores in the phonetic discrimination of syllable changes also showed a preference for non-speech sounds over motherese (Kuhl, Coffey-Corina, Padden, & Dawson, 2005). Oral motor skills, attentional systems, and auditory processing (Walenski et al., 2006) were found to be prognostic indicators for language development in children with ASD.

Phonological development

Sheinkopf, Mundy, Oller, and Steffens (2000) noted well-formed complex canonical babbling in babies later diagnosed with ASD. The onset of babbling was significantly correlated with first words in production in children with ASD (Kim, 2008). However, unusual vocal quality with atypical phonation was noted in preschool children with ASD, including tense high-pitched squeals, growls with creakiness, non-distress yells, whining, and abnormally long vowels (Sheinkopf et al., 2000). In general, most research indicates that verbal children with autism do not generally have protracted phonological
development (Allen, 1989; Mirak & Rescorla, 1998; Rapin et al., 1992). Articulation was found to be a relative strength across 89 heterogeneous subjects with ASD aged 04.00 to 14.00 (Kjelgaard & Tager-Flusberg, 2001). Wolk and Giesen (2000), however, found delayed and atypical phonological patterns in their investigation of four siblings with ASD, especially in those who were more severely language impaired. These findings consisted of: the persistence of some patterns beyond the expected age; some unusual sound changes, such as the frication of liquids; evidence of unusual development in the sequence of speech sound acquisition; and a restricted use of contrasts. Abnormal phonological production was also documented in minimally verbal children with autism (McCleery, Tully, Slevc, & Schreibman, 2006), but the more verbal ASD children in this study were found to have a typical developmental trajectory in their speech sound patterns. Some adults with autism also retained distortion of liquids and some fricatives (Shriberg, Paul, McSweeny, Klin, & Cohen, 2001).

The lexicon in production

This section will present research on aspects of productive lexical development in verbal children with ASD. Studies comparing aspects of lexical acquisition such as word knowledge, memory, processes, and vocabulary size with the same aspects in TD children show variable results, reflecting the heterogeneity of the spectrum. In general, verbal children with ASD have been shown to learn words easily, especially when the words are embedded in topics relevant to the child (Frith, 1989). Verbal children also differ only slightly in their lexical acquisition processes from TD children. Condouris, Meyer, and Tager-Flusberg (2003) found that in their sample of 44 children with ASD, aged 04.00 to 14.00, scores for lexical abilities were below the age-level mean. Kjelgaard and Tager-Flusberg (2001) showed that approximately one quarter of the 89 verbal children with ASD they studied had lexical knowledge and form matching their mental age. Many children with ASD develop substantial lexicons in production, including those who acquire remarkable lexicons relative to their IQ (Tager-Flusberg, 2007). Walenski, Tager-Flusberg, and Ullman (2006) demonstrated that abilities for learning individual words showed no impairment in lexical and semantic memory. A subsequent study of
subjects with autism aged 08.00 to 14.00 showed better than normal performance of word processing compared with TD control groups, suggesting that lexical/semantic memory (word processing) is a neurocognitive strength in ASD (Walenski, Mostofsky, Gidley-Larson, & Ullman, 2008).

Parisse (1999) reported that the lexicons of 6 children with autism at a mean age of 06.03 were closer to the adults’ than is the case for TD children. Hennon (2003) suggested that children with ASD may acquire their lexicons in the same associative manner in which TD children acquire their early words, that is, by associating the sound of the word with a perceptually salient object or event (Hollich et al., 2000).

Form class (parts of speech) and lexical diversity (the number of different words in production) are both similar to those of TD children. The longitudinal study of Tager-Flusberg et al. (1990) compared the spoken vocabulary of six children with ASD aged 03.03 to 06.09 to those of children with Down syndrome, showing parallels with TD children. While the rates of lexical acquisition in high functioning preschool children with ASD are below those of TD children, this study found a similar lexical development to that of TD children in lexical diversity and in form class distribution. Nouns dominated in the single word stage until the MLU increased, when function words and verbs began to increase. There was no significant difference in the form class distributions (nouns, verbs, adjectives) from the Down syndrome children, with only one child showing unusual development. Peralejo (Peralejo, 2008) examined trends in lexical development, including the change in use of nominals versus lexical predicates in the lexicon, and the emergence of meaning types, using longitudinal data over four years with 49 subjects, both TD children and those with ASD. Her study showed that, over time, children with ASD tend to follow typical patterns of lexical composition in the proportion of nouns and predicates in their production, despite significant delay in acquisition of words and specific word types. In Williams’ (1993) case study of a boy with autism from 02.06 to 03.09, the boy’s vocabulary in production, like that of TD children, consisted mainly of nouns; however, he used modifiers more frequently than action words. When learning a new word, TD children and children with ASD similarly show the noun bias in acquiring
referential words, mapping the word onto an object in preference to an action, as demonstrated in a study of 14 children aged 02.00 (Tek, Jaffery, Fein, & Naigles, 2008), supporting earlier research along the same lines (Eigsti, Bennetto, & Dadlani, 2007). Research on lower-functioning children notes their capability to acquire some vocabulary, particularly nouns (Chan, Cheung, Leung, Cheung, & Cheung, 2005; Charman, 2004; McDuffie et al., 2005).

**Semantic development**

Several studies with older children have looked at semantic development in vocabulary acquisition. Eighteen children with autism, ages 08.00 to 13.00, (Dunn & Bates, 2005) and eight children with autism, ages 07.03 to 10.07, (Dunn, Gomes, & Sebastian, 1996) were found to have a semantic processing impairment in their organisation of lexical categories. They gave fewer prototypical responses than the TD control group. Boucher (1988) found that seven children with ASD, ages 07.11 to 15.11, generated words more fluently in familiar semantic categories than they did in unfamiliar categories. Other studies, however, have shown findings of well-organised lexicons with the same semantic groupings in categorising as TD children. Ungerer and Sigman (1987) found that children with ASD were able to match objects into categories of colour, form and function as successfully as their mental age matched TD controls. In her study of semantic acquisition in 14 children with ASD (mean chronological age of 10.05; mean mental age of 05.02), Tager-Flusberg (1985) used tasks that selected typical and less typical exemplars (for example, *boat* versus *submarine*). She found that her subjects’ semantic knowledge in basic and superordinate categories of animals, food, and artefacts was organised similarly to that of TD children, with no deficits in their categorisation or representation of word meanings and underlying concepts. This study also reported the same errors in superordinate relationships, overextensions, and underextensions as in TD children. Vogindroukas, Papageorgiou, and Vostanis (2003), however, found that although semantic vocabulary errors were similar to the control group of mildly learning disabled children, underextensions were not used by the six children of 07.09 to 08.07
with ASD in their study. They also noted that the group with autism focused on parts of the object when they named an object that they did not recognise.

Tek’s (2008) study investigated the use of the shape bias (in which shape, rather than colour, size, or texture, is the determining referent for young children learning novel words). This study revealed that at 02.00, with lexicons of over 50 count nouns, the 15 TD children displayed the shape bias, while the 14 children with ASD did not, even when their large vocabularies reached 132 words (Tek et al., 2008). The findings indicate that the young children with autism had no difficulty in learning words and noticed shape matches in named words. However, in learning new words they did not employ the shape bias, which indicates different principles governing word learning that may reflect impairments or delays in abstracting ability of conceptual units (Tek et al., 2008).

**Rates and variability of lexical acquisition in production**

As discussed in the section above, most researchers agree that in verbal children with ASD the lexical system is relatively intact and is a comparative strength in their language acquisition in general (Mitchell et al., 2006). However, owing to the heterogeneous nature of the ASD spectrum there is substantial variability in different aspects of word learning: in the age of the onset of speech production, in the size of the vocabulary, based on children tested at 01.10 and at 03.06 (Charman et al., 2003), and in the patterns of growth (Roberts, Rice, & Tager-Flusberg, 2004; V. Smith et al., 2007). For this reason, Tager-Flusberg (2004b) recommends researching individual variation within specific language acquisition subgroups on the ASD spectrum.

The above studies show a range of abilities in children with ASD in acquiring the lexicon in production. Articulation and lexical/semantic memories are strengths, with some children acquiring substantial vocabularies. Children with ASD are similar to TD children in lexical form class and diversity. They employ the noun bias but may not always use the shape bias in learning novel words. There may be impairments in semantic processing and delay in the acquisition of referential words. The following section will
discuss research in the early language skills that are prognostic of language outcomes in this population.

**Predictors of language outcomes**

**Introduction**

In addition to the studies discussed above on the relationship of joint attention to comprehension and intentional communication, increasingly early diagnoses of ASD have led to recent research in two further prognostic areas. The first is the relationship between prelinguistic/early language acquisition and social cognitive skills as predictive of language outcomes in children with ASD; the second is the relationship between their social cognitive skills and concurrent language use. Predictive factors are: individual variation in the child’s abilities in cognition in verbal and motor imitation, pretend play skills, and social-affective behaviour, in addition to the environmental contributions of therapeutic intervention and linguistic input in language development.

The research of Paul et al. (2008) showed that in 37 children with autism, aged 01.03 to 02.01, two factors were predictive of production outcomes at 04.00: stereotypic behaviours and comprehension. At the initial evaluation, communication scores were lower than nonverbal IQ; however, two years later, they were equal. Luyster and Lord (2007) noted that in children with ASD at 02.00 the presence of productive language, even a single word, was a strong indicator of later verbal abilities. Lord, Risi, and Pickles (2004) found that the child’s age at the appearance of the first words is related to success in the rate of growth of words and of word use. A recent study on predictive early language abilities (Jokel, 2009) looked at language outcomes in 75 toddlers with ASD, with language delay, aged between 02.00 and 03.00, finding that 81% became verbal by school age, and that better earlier scores on language tests predicted higher scores by school age. Research by V. Smith et al. (2007) showed that the children (age 02.07 to 05.11) with the slowest vocabulary growth over two years in their study had no spoken words at baseline, and had the most severe autistic behaviours and developmental delays when tested six months after the baseline evaluation. Rollins (1995) found that at the start
of her longitudinal study of five children over 03.00, mean length of utterance (MLU), not IQ, determined the variation in the rate of growth of lexical skills. Peralejo (2008), using longitudinal data, looked at delayed onset of lexical acquisition by comparing the ages of children who had 75 words in their production. The average age of the ASD group was 04.02 and of the TD group was 01.04. Peralejo noted that the ASD group’s rate of lexical acquisition slowed after reaching a certain level, compared to the steady increase of the TD group. The ASD children lagged by 15 months from the TD group whose rate of learning accelerated while the ASD group’s rate slowed, pointing to a delay in the rate of growth of word learning. Sigman and Ruskin (1999) found that language skills at age 04.00 were prognostic of language development at age 10.00 to13.00 in a group of 51 individuals with autism. In the section below, research on the predictive value of cognitive ability for linguistic development is examined.

**Cognitive ability**

Researchers have examined the relationship between non-verbal cognitive ability in children with ASD and their lexical production. Some researchers consider cognitive abilities to be central to the prognosis for both linguistic development in attaining functional speech (Cantwell et al., 1989), and for the rate of growth in words (Lord, Shulman et al., 2004). For example, Luyster et al. (2008) found non-verbal cognitive abilities in toddlers, as defined by the Mullen Visual Reception domain from the Mullen Scales of Early Learning, were related to concurrent language use in both comprehension and production. These findings support Rutter’s earlier study (1978). V. Smith et al. (2007) noted that the cognition status of the children in their study did not predict their vocabulary growth until the children had had intervention for 6 months, though slower vocabulary growth was seen in the children who had greater cognitive delay and more severe autistic behaviours. Tager-Flusberg (2004a) found that most verbal children with autism had normal nonverbal intelligence. Tager-Flusberg and Joseph (2005), however, suggest that different mechanisms may be impaired in different children across the spectrum.
Leekam (2007) suggests that language impairment may be the source of other cognitive deficits in children with ASD. Other studies indicate that cognitive development, while necessary for linguistic growth, is independent of language ability. Joseph, Tager-Flusberg, and Lord (2002), found discrepancies between non-verbal and verbal abilities increased with the age of the child in 120 high-functioning children of 03.08 to 13.11. A somewhat different result was found in a follow-up study two years later of 37 children aged 01.03 to 02.01. Although the toddlers’ nonverbal IQ was initially lower than their communication, the follow-up revealed that both scores were similar, regardless of the production levels (Paul et al., 2008).

Imitation

Imitative ability, one aspect of cognition, has been shown to be a significant predictor of language in children with ASD. Difficulties with immediate imitation of movements, including actions on objects, hand and posture movements, and facial expressions, have been extensively documented in children with ASD (Rogers et al., 2003; Rogers, Young, Cook, Giolzetti, & Ozonoff, 2008; Stone, Ousley, & Littleford, 1997), while in TD children, the emergence of motor imitation varies less in development than the imitation of vocalisations (L. Bloom, Hood, & Lightbown, 1974). Charman et al. (2003) noted that the actions of children with ASD on objects were ahead of both their imitation skills and gestures initiating joint attention. Children with ASD showed limited ability to imitate simple actions and postures in a study by I. Smith and Bryson (1998), which was attributed to a possible difficulty in taking another’s perspective.

Studies have found imitation to be associated with language production skills in children with ASD (S. M. Boucher, 2008; Carpenter et al., 2002; Luyster et al., 2007; Luyster et al., 2008). V. Smith, Mirenda, and Zaidman-Zait (2007) noted that abilities in verbal imitation were related to later rapid vocabulary development in this population. The majority of children with ASD, especially those with lexical delay, appear to have at least some verbal and motor imitation impairments, but there is improvement over time in imitation skills in the more verbal children (Charman & Baron-Cohen, 1994; Charman et al., 2003). Eighteen children with ASD, tested between 01.00 and 04.00, who had high
IQs were noted to have greater ability in the imitation of gestures and facial expressions (Receveur et al., 2005). The ability to imitate facial expressions was found to be predictive of speech (Stone, Ousley, & Littleford, 1997). McDuffie, Yoder, and Stone (2005) demonstrated that commenting and motor imitation of actions without objects predicted word production more than attention-following and requesting behaviours did. Motor imitation was not found to be a predictor of later lexical density by Yoder (2006). It was, however, proposed as an alternative social learning mechanism to aid in the acquisition of referential words for children with ASD (Carpenter et al., 2002; Tomasello & Rakoczy, 2003).

Deferred imitation (imitation after the event) is a significant prerequisite skill for representational capacity, pretend play, and language onset, preceding mirror self-recognition in TD children (Nielsen & Dissanayake, 2004; Piaget, 1962). Deferred imitation in toy play in a study of 60 ASD preschoolers predicted the rate of communication development at 04.00 to 06.06 (Toth, Munson, Meltzoff, & Dawson, 2006). In children with ASD, deferred imitation has been shown to predict language growth over a two-year period; on the other hand, immediate motor imitation has been shown to predict concurrent language skills, as has verbal imitation in several studies (Sallows & Graupner, 2005; Stone & Yoder, 2001). Rogers et al. (2008) however found no evidence that young children with ASD had more difficulty with deferred than with immediate imitation.

Parisse (1999) showed that echolalia, the spontaneous imitation of words and phrases, common to children with ASD, does not increase verbal imitation rates in single words, only in phrases.

**Play skills**

Like imitation and nonverbal IQ, research has found correlations in the development of play skills and language acquisition in children with ASD. The type and diversity of play, play bids, and pretend interactive play have been associated with concurrent and prognostic abilities in areas including rapid word learning, symbolic word acquisition,
comprehension, and speech acts. In a study of two children under 03.00 play was observed to be repetitive, consisting of stacking and lining up objects in a precise order (Sowden et al., 2008). Functional and symbolic play skills correlated with language acquisition in a study of children from 03.02 to 06.03 (Mundy, Sigman, Ungerer, & Sherman, 1987). Five children with ASD in one study were at a sensorimotor level of play rather than at the more advanced functional and symbolic play of the control groups, demonstrating a delay in their functioning and development of symbolic activity (Blanc, Gomot, Gattegno, Barthélémy, & Adrien, 2002). Wetherby and Prizant (1993) noted a cluster of impairments in joint attention, symbolic play, social gestures, and signals in children with pervasive developmental delay. Functional play skills and the initiation and acceptance of play bids in preschoolers were seen to be predictors of language ability in adolescence and young adults (Sigman & Kim, 1999; Sigman & McGovern, 2005).

Less frequent and less varied speech acts were noted in free play in preschool children with ASD (Landry & Loveland, 1988; Wetherby & Prutting, 1984; Wetherby et al., 1988). O’Neill and Happe (2000) similarly found a difference between children with ASD and other groups of children in their initiation of commenting on new topics, and in the sorts of toys that they found of interest. Playing with a variety of objects fosters communication by providing more opportunities for linguistic input of two types: linguistic mapping (the labelling of nonverbal communication such as action referents) (Warren & Yoder, 2004), and descriptive talking (labelling the object of the child’s focus of attention) (Siller & Sigman, 2002). Yoder (2006) found the diversity of object play to be predictive of lexical density in children with ASD.

Interactive pretend play skills indicate the establishment of symbolic representation, considered a prerequisite for referential lexical acquisition (Sigman & Ungerer, 1984; Ungerer, Zelazo, Kearsley, & O’Leary, 1981). V. Smith et al. (2007) related pretend play with objects to rapid growth in vocabulary production. They found few instances of pretending to be a parent even in ASD children with the greatest advances in lexical growth. Deficits in spontaneous pretend play in children with ASD between 02.6 to 05.00 were associated with rate of language acquisition (Reijonen, 1997).
Other researchers, however, have found a weaker relationship between play skills and language development in children with ASD. Lewis (2003), in a review of previous research, suggests that although both language and play skills are impaired in this population, the relationship between them is weak or non-existent. B. Morgan, Maybery, and Durkin (2003), in a study of 21 children with ASD from 03.00 to 05.00, noted that while deficits in play skills can signal theory of mind impairments, lags in pretend play may not be an indicator of ASD.

**Social-affective behaviours**

Social-affective behaviours, such as motor and verbal imitation, initiating and responding to joint attention, and pretend play skills, are also prognostic indicators of vocabulary acquisition in children with ASD. Bopp, Mirenda, and Zumbo (2009) looked at children with ASD with a mean age of 04.02, both before intervention and 6 months after intervention, to determine the prognostic effect of problem behaviours on vocabulary and language skills over a 2-year period. These behaviours included inattention, such as distractibility and decreased awareness, and socially unresponsive acts, such as a lack of initiation, and a lack of response to smiles, eye contact, and to directed speech or gestures. Inattentiveness before intervention predicted delay in lexical production and development of comprehension. Social unresponsiveness predicted less lexical growth. Acting out behaviours, insistence on sameness, and repetitive stereotypic behaviours were found to have no predictive bearing on language development over this period in this study. Paul et al. (2008), however, found the presence of repetitive and stereotypic behaviours in toddlers with ASD to be associated with better production outcomes two years later.

In addition to cognitive ability, imitation, play skills, and social-affective behaviour, there are several other predictors of later vocabulary growth in pre-speech children with autism that depend on the individual variation in the child’s abilities. These include: the severity of the autistic behaviours, the age of the child at the first words, the age of the child and the number of words when intervention commences, and the prelinguistic communicative behaviours (Bibby, Eikeseth, Martin, Mudford, & Reeves, 2001; V. Smith et al., 2007;
Venter, Lord, & Schopler, 1992). Predictive language factors not associated with a child’s individual ability are the environmental contributions of therapeutic intervention and linguistic input in language development.

**Environmental variables: input and therapeutic intervention**

Environmental variables for predicting lexical development in children with ASD consist of linguistic input and speech-language therapy. Many studies have shown the positive effect of language input. Calandrella and Wilcox (2000) noted that parental response supports language acquisition in general, with the rate of growth in maternal response most closely paralleling the rate of growth of word use in children with ASD. Research demonstrates that the greater the linguistically contingent maternal responsiveness during spontaneous interactions, the larger the child’s vocabulary (Bornstein et al., 2004; Girolametto, Sussman, & Weitzman, 2007). Akhtar, Dunham, and Dunham (1991) noted larger vocabularies in children whose mothers commented on and labelled the objects of the children’s interest more than they directed the children’s attention. McDuffie, Yoder, and Stone (2006) demonstrated that verbal labelling of novel objects increased the child’s attention and facilitated word learning in 29 children with ASD at an early stage of lexical acquisition. Siller and Sigman (2007) contributed their findings that parents’ responsiveness to their ASD children’s attention bids and activity during toy play interactions facilitated later joint attention and language, as did the frequency of children’s bids for parents’ attention. Aldred, Green, and Adams (2004) found that when parents adapted their communication to their ASD child’s specific strengths, the children made gains in social interaction and productive language.

The other environmental variable in predicting concurrent and future lexical growth in children with ASD is language therapy, the most common approach to intervention. In fact, improvements in lexical acquisition can be measured by the degree of therapeutic intervention the children receive. The younger the child and the more words the child has when intervention commences, the greater the increase in vocabulary (Bibby et al., 2001; V. Smith et al., 2007). The number of hours of language and communication therapy
have also been shown to be a significant predictor of spoken language (Bono et al., 2004; Stone & Yoder, 2001; Turner, Stone, Pozdol, & Coonrod, 2006).

Social communicative skills in children with ASD, such as joint attention, intentional communication, and diversity of object play, have been reported to be readily malleable through therapeutic intervention (Kasari, Freeman, & Paparella, 2001; Lifter, Sulzer-Azaroff, Anderson, & Cowdery, 1993; Whalen & Schreibman, 2003; Yoder, 2006; Yoder & Stone, 2006). The development of joint attention skills has been shown to improve the lexical acquisition, the frequency and variety of spontaneous language, and the social-communicative abilities in these children (Charman, 2003; Jones, 2003). In a study of three non-verbal children with autism, individualised orienting cues (a modelled gesture or verbal identification of the object in which the child is interested) facilitated responding to and acquiring first words (Koegel, Shirotova, & Koegel, 2009).

Commenting on the child’s activity in order to initiate joint attention can be an efficient therapeutic strategy that facilitates lexical acquisition in children with autism. McDuffie et al. (2006), in a study with 29 children with ASD of 02.00, vocabulary-matched with a TD control group, suggest that children with ASD may use a simpler strategy of associative word learning as an alternative to attention-following in order to learn new word meanings. They may learn words most efficiently when the adult labels objects by describing what the child is already focused on, so the child does not have to determine the label-object correspondence.

Theories accounting for language outcomes

There is no single theoretical paradigm that includes the various proposals, from genetics, neurology, psychology, cognition, and social behaviour, to account for the heterogeneity in language outcomes in ASD (Danon-Boileau, 2006; Tager-Flusberg et al., 2005; Walenski et al., 2006). Theories explaining language disorders and delay in lexical acquisition in ASD include limited intentionality, impaired symbol formation, and the procedural deficit hypothesis, which accounts for deficits in executive functions and a weaker drive for the integration of information in central coherence (B. Morgan et al.,
One explanation of the social/cognitive origin of language impairments of people with ASD is a deficit in theory of mind, resulting in the inability to attribute mental states to themselves and others. Theory of mind research notes the relationship between social understanding and language development in children with ASD (Hale & Tager-Flusberg, 2005). Surian, Baron-Cohen, and Van der Lely (1996) propose that these communication deficits in autism result from a selective impairment in representing propositional attitudes, such as attributing the mental perspective, communicative intentions, and beliefs of the speaker. Rollins (1995; 1998) suggests that deficits in joint attention and communicative intent affecting rates of lexical acquisition correspond to a disordered development of theory of mind. P. Bloom (2002) maintains that theory of mind impairment in determining a speaker’s intentions accounts for difficulty in learning object names.

Another theory addressing language outcomes in this population is the hybrid theory of word learning (Hirsh-Pasek et al., 2004). This theory proposes multiple word learning strategies which change over time, from word-object association, to using salient social and perceptual attentional cues, to eventually using speakers’ intentional cues, in order to explain the large lexicons of many children on the spectrum (Parish-Morris et al., 2007).

Investigations into the language acquisition processes in both TD and ASD children have proposed that their similarities in learning processes suggest no inherent differences in word learning between them, in situations when the ASD children were given ostensive supports in the word learning task (Luyster & Lord, 2009). Swensen, Kelley, Fein and Naigles (2007) also noted similarities in language development processes, but suggest a different cause for the lexical acquisition problems of children with ASD; namely, that these may have arisen from social, motor, or cognitive deficits, rather than from linguistic impairments.
Summary

This chapter has concentrated on the research literature on early language and communication development in children with ASD; in particular, the delays, differences, variation, and similarities in word learning acquisition processes between TD and ASD children. The research in this chapter included studies on the acquisition of gestured and vocalised intentional communication in pre-speech, comprehension delays, and phonological, lexical, and semantic acquisition in production, as well as the predictive factors in language outcomes.

In these studies, deficits in social communication, specifically in joint attention and in socially unresponsive behaviour, have been seen to have a strong impact on early language acquisition. Two-thirds of the children in the wide-ranging spectrum of autism disorders experience impairments in the development of language and pragmatic functioning associated with joint attention deficits in attention-following, gaze following, gaze-switching, and interpreting speaker’s referential intention. Joint attention, the ability to maintain two-way communication, is considered to be a prerequisite for language development. It is possibly the most significant and the earliest pragmatic impairment that uniquely affects children with ASD in pre-speech intentional communication, and in their lexical acquisition in comprehension and production. The frequency of vocalisations used to respond, and non-directed vocalisations in pre-speech (other than distress sounds), are predictive of language outcomes in comprehension and production. Also predictive are the rate and variety of intentional communication, consisting of both gestured and vocalised acts of initiating interactions, including showing, commenting, and directing another’s attention. Fewer, less varied, and delayed instances of gestures, particularly pointing, are indicators of ASD in infants and are prognostic of reduced comprehension and production outcomes.

Language delay is an early indicator of ASD and is predictive of word learning and eventual language outcomes. Lexical delay in comprehension is associated with developmental motor milestone delays in general. Joint attention deficits in attention following and processing non-verbal cues of social information are particularly
important, while early comprehension is associated with outcomes of better production and less severe autism. Verbal children with ASD have shown similarities with TD children in comprehension of word matching, semantic categories, and SVO word order. Differences exist in some children with ASD in the delay in the onset of word acquisition in production, in fast-mapping abilities, and in lower rates in lexical acquisition.

Most researchers agree that in verbal children with ASD the lexical system is a relative strength in their language acquisition, comparable in many cases to that of TD children in lexical knowledge, diversity, and density, form class distribution, memory, word learning processes, vocabulary size, and frequently used early words. Similarly, semantic memory, categorisation, and representation in children with ASD can be comparable to TD children in the early stages of word learning. The following exceptions to this have been found: preschool TD children use the shape bias more than ASD children do; there is a tendency for preschoolers with ASD to name parts of an object rather than the whole; and older ASD children have fewer words for mental states. The heterogeneity of the autism spectrum results in variability in different aspects of lexical acquisition; namely, in the age of onset of comprehension and speech production, vocabulary size, and rates of growth. Studies of phonological abilities in verbal children with ASD have also generally not shown impairment, although there may be unusual patterns, particularly of prosody.

Although autistic syndrome disorders are life long, atypical behaviours can diminish, and communicative abilities can improve. With the wider inclusion of less severely affected children, earlier diagnoses, and improved intervention, it can be said that most of these children will improve in fluency and have less profound language deficits. Even children with very delayed language can show significant developmental advances as they grow older.

The predicting variables in prelinguistic skills for good language outcomes are dependent upon the child’s capabilities and environmental supports. In general, the outcome of the language level in children with autism is related to the severity of their cognitive and social impairments. In addition to joint attention, children’s abilities in cognition, imitation, pretend and object play, and their social-affective behaviours all determine
language outcomes, with higher skills and more social response producing earlier and more rapidly developing language acquisition in comprehension and production. The amount and the age at onset of therapeutic intervention positively affect word learning as well as language input. Children with the earliest and largest quantity of intervention, along with the prelinguistic abilities noted earlier, will show the greatest vocabulary growth.

In terms of the application of these studies to my second research question, on the definition of the earliest words in children with ASD, the closest research in this area is the study by Tager-Flusberg et al. (Tager-Flusberg et al., 2009) While this study provides phonological, lexical, and pragmatic criteria for defining the first word stage of children with ASD, the phonological criteria exclude Graeme’s earliest word/signs from the first word stage, as do the criteria for referential words. These criteria are more stringent than those of Menn (1976) and Vihman and McCune (1994) for TD children’s first words. They do not examine lexical acquisition before this stage, referring to it as ‘prelinguistic’.

This concludes the review of research literature for the lexical acquisition of TD children and children with ASD. Chapter 4 presents the data collection method and the data analyses.
Chapter 4: Diary Collection Method and Data Analysis

Part 1: Diary and case study research methods

Introduction to diary and case study methodology

This chapter examines general issues in case study and diary study methods as applied to language acquisition and, specifically, my\(^{13}\) use of this method to collect data on Graeme’s lexical acquisition. The chapter covers three areas. First, it discusses the suitability of case study and diary study methods for research in the field of lexical acquisition, comments on updating diary collection methods, and looks at methods of analysis. Second, it describes my original diary collection method, the other sources of data, and their subsequent augmentation with current technologies. Third, my diary of Graeme’s language acquisition is examined in terms of its design, organisation, function, strengths and limitations, and its suitability for an investigation of his lexical acquisition. In this section, the process for obtaining Graeme’s consent for the research ethics board at the University of British Columbia is described.

Case study methods

Case study method normally falls within the field of qualitative research. Because it has the potential to provide a more a complete and detailed picture of a process in order to discover general patterns, case study method is appropriate for the investigation and evaluation of dynamic and complex processes that continually change over time within a domain, such as an individual, or context bounded, closed system (Dromi, 1987). These attributes of case studies make them particularly suitable for research in language acquisition, which traditionally has relied on longitudinal studies of very small groups of subjects observed in their natural context. Case studies therefore are ideally suited for research in early lexical acquisition, in which the child’s language increases in complexity quickly and continuously, and the researcher’s interpretations of the earliest

\(^{13}\) The reader will note a shift in the authorial voice to the first person, in keeping with stylistic conventions for diary and case studies, when I refer directly to my involvement as Mother and researcher in this study.
word productions are often highly dependent on both their linguistic and non-linguistic contexts.

Case studies can provide naturalistic data. L. Bloom supports research that is “based on naturalistic data; listening to children learning to talk and watching their spontaneous acts of expression and interpretation as opposed to observing their responses to manipulations of word learning events in an experiment.” (2000). Bloom (2000) argues that the social context is inherent in word learning, and that the child’s drive to communicate in his own environment elicits newly acquired linguistic constructs.

**Diary study method**

A diary study is a comprehensive longitudinal case study using observation in naturalistic contexts. The first systematic studies of language acquisition were diary studies, and include the classic works of Preyer (1889), Stern and Stern (1907), and Leopold, (1939; 1947; 1949; 1949). More recent diary studies include Dromi’s diary of her daughter’s lexical acquisition (Dromi, 1987). Dromi’s (1987) diary exemplifies meticulous methods for the collection and analysis of data to facilitate the investigation of the contents and rate of her daughter's one-word lexicon, and her development of reference and word meaning.

Diaries provide a database that can support finer-grained analyses of a child’s lexical, phonological, and semantic acquisition than the snapshots of development that grouped data from cross-sectional studies typically provide. Tager-Flusberg et al. (2009) state that natural language samples, which are not available through standardised direct assessments for children under 02.00, along with parent reportsm supply excellent measures of children’s productive language abilities, including their phonological, lexical, grammatical and pragmatic/communicative skills. Pine, Lieven, and Rowland (1996) also suggest that detailed longitudinal studies can collect more comprehensive vocabulary records for individual children than observational sampling methods or maternal-report checklist measures.
Diary studies also obviate the difficulty found in controlled test situations in gaining the co-operation of children under 03.00, which is particularly relevant to a child with autism. Braunwald and Brislin (1979) define the ideal diary record as one which is a written journal kept on a regular basis, substantial in scope or depth, rich in detail, and notationally accurate.

Daily diary collection is suitable for recording the extraordinary levels of daily and even hourly variation in infant vocalisation and speech (Oller, 2008). It can also reveal the progression to major transitions and milestones in both word learning and related social/cognitive development (Braunwald, 1995; Dromi, 1987; Dromi, 1993; Dromi, 1999; Ingram, 1989). Diary studies have other advantages for obtaining data on word learning; they provide norms for comparison, reveal patterns and emergent behaviours, show when items come in and fade out, provide context, illustrate usage, feedback, and input, and are a source of anecdotal illustrations of development. Dromi (1987) writes, “Only in a study involving systematic daily recordings can one obtain the amount of information needed to develop a precise and complete picture of the shape of the acquisition curve of new words.” (p. 21).

The diary collection method can mitigate two related challenges in analysing children’s semantic acquisition. First, it is almost impossible to differentiate word use from word meaning on the basis of a single speech event. Second, early words have unstable meanings. Recording the repeated contexts of use in diaries can reveal any change in reference, along with the processes involved in the acquisition of extensions of word meaning (Dromi, 1987; Dromi, 1993; Huttenlocher & Smiley, 1987; Ingram, 1989). Diaries also provide repeated data points of a word’s changing usage over time in various situations including related play, input in conversation, and any associations or triggers for the word’s use, along with communicative supplements such as gestures, signs, graphics, and rewards for speech.

Diary studies avoid a methodological issue in determining comprehension acquisition; namely, that word comprehension is difficult to assess in controlled studies even for TD infants and young children under 02.00, and is further limited by the difficulty in
maintaining the interest and attention of young children with ASD. In the case of this dissertation, Graeme was markedly loath to attend to anything that did not interest him, and uncomfortable in new environments and with people he did not know well, such as in hearing and diagnostic assessments.

**Some limitations of diary methods**

While the diary method is a highly effective approach for collecting data for research in lexical acquisition, there are some limitations that should be noted; specifically the time commitment and effects of the intrusion of data collection on the family and possibly on the child. In addition, diary studies fall by nature into the realm of ethnography with a small number of subjects and thus are limited in their generality. Braunwald and Brislin (1979) mention the observational subjectivity and the lack of scientifically measurable detail as unavoidable deficiencies in diary data. They also note that diary records are disproportionately sensitive to children’s most advanced language, as opposed to their ordinary speech, possibly selecting items that are developmentally rare in the child’s language.

Braunwald and Brislin (1979) note that recording the children’s utterances in front of them places a value on their productions, which may prompt children to modify their language behaviour, either encouraging them to speak, or inhibiting them. While Graeme’s father and I would have welcomed any encouraging effect, Graeme appeared largely oblivious to my diary data collection until he was around 05.00. He was, however, entranced by the tape recorder, resulting in less than naturalistic language interactions, as recording sessions were punctuated by me imploring him not to touch the microphone and by his repeated requests for playback.

**The design of the diary for this study**

The diary of Graeme’s language acquisition is an example of a broad-spectrum diary using the criteria sampling method. Because broad-spectrum diaries have a massive and
multifaceted database (1979), this approach suits the generality of my data and the longitudinal nature of language collection.

In the criteria sampling method, data are entered whenever a defined behaviour occurs. The criteria sampling approach is suited to a study of lexical acquisition because it is sensitive to rare events, the context of a naturally occurring pace of acquisition, and to the small increments of change signalling a transition or milestone. In addition, it reveals the sequence and rate of change, creative idiosyncratic forms, and the upper limit of communicative competence. A drawback to this method is that it emphasizes newness, and requires the commitment to enter data continuously on the basis of emergent structure; thus diarists must interrupt their activities or rely on memory. This drawback can be mitigated by observations about continuing and repetitious behaviours, as it was in the current study.

I occasionally augmented daily note taking by compiling vocabulary checklists for Graeme’s preschool teachers or speech therapists. Such parent-completed vocabulary checklists have proven to be valid and effective for assessing vocabulary size and development over time in both typically and atypically developing samples of young children (Dale, Price, Bishop, & Plomin, 2003; Nott, Brown, Cowan, & Wigglesworth, 2005; V. Smith et al., 2007).

Other important supplements to my diary collection were the data from formal evaluations and reports of educators and medical specialists involved with Graeme, including standardised tests relating Graeme’s language to normative measures of development. These supplied validation to my observations, and added professional and medical expertise from paediatricians, speech and language pathologists, speech and language therapists, a language acquisition researcher, psychologists, child psychiatrists, an audiologist, a neurologist, behavioural therapists, infant development therapists, community-based nurses, special education preschool professionals, a social worker, and physiotherapists. Their contributions are noted in the findings Chapters 5 and 6.
Diary updating: modern technologies

In 1977 to 1983, when I collected this corpus of data, the diary method involved less choice and a considerably more primitive technology than is available today. I collected the data in handwritten notebooks and years later had them transcribed in word processing formats. As is recommended by Braunwald and Brislin (1979) I incorporated supplemental periodic tape recordings which remedied some of the limitations of the written diary, such as the emphasis on emergent language. In addition, I documented Graeme’s language acquisition from perspectives other than naturalistic observation centred on a longitudinal written record. In addition to giving context to ordinary speech, the recordings were used in spontaneous informal testing situations in which I elicited lexical items from Graeme. In order to transfer the diary contents to computer format, I scanned my sketches and illustrations.

Audio recordings captured the sounds that were very difficult to transcribe into the diary, such as babbling and the many non-speech vocalisations common to Graeme’s early communication. Audiotaped data can be interpreted by multiple observers, providing a systematic assessment of reliability that data collected and analysed by a single author frequently lacks. However, my audio recordings were made from previously used tapes, on a primitive machine, and sometimes missed fine phonetic distinctions or were inaudible. The transcriber of the early recordings was not present during the recording. The utterances that she found unintelligible or difficult to interpret were used as data only if I could confidently interpret them. I transcribed the later tape recordings myself long after memory could assist me, but these later recordings were more intelligible and consisted of more speech sounds. The audibility of the tapes was improved by digitisation to a digital format, aiding interpretation. Phonetically transcribing these tapes required a minimum of 10 hours of transcription time for each hour of tape.

A handwritten diary is an historical relic in the light of contemporary electronic technologies. In the era of the diaries by Braunwald, Dromi, and myself, handwritten notes were the only immediate and efficient method of recording material, because audio tape, film, and videotape were labour-intensive and specialized data recording media at
the time. Audio recording alone was available to me, though some silent film exists of Graeme’s first birthday.

Contemporary recording platforms, evolving apace in a much more mediated world than that which produced the classic diary studies, have entirely reinvented case-study data collection and analysis. Handheld digital devices, such as tiny powerful portable digital recording devices, cameras, and DVD equipment have made the immediate collection of a finer grained recording of data much easier. These devices are more capable of including context, recording direction of gaze, gestures, and utterances, as well as discourse and social interactions for linguistic and pragmatic studies. They create data media that are permanent, clear, transmittable without degradation, and more exhaustively analysable both in the size of the data set and in objectivity. Perhaps diary, with its historical implication of a paper notepad of handwritten notes, needs redefinition to now mean an inclusive, longitudinal, daily, intensive case study type of data collection, recorded in the current electronic technology.

Contemporary technologies have their drawbacks. While reformatting the handwritten data into digital form can present the data in a form which is easier to read, distribute, and analyse, media platforms evolve so quickly that the next computer model and word processing programme can render one’s data irretrievable. My first digitisation from the yellowing pages of the tattered original notebooks was in Word 2 in the 1980s.\(^\text{14}\)

The history of the diary on Graeme’s language acquisition

With optimal diary design and collection methods, the diary organisation would be pre-planned and designed for a specific purpose. In contrast, the diary of Graeme’s language acquisition was not planned in advance and suffers therefore from some of the pitfalls invisible to a naïve diarist. Graeme’s diary evolved from the initial notes I took before his assessment at 02.02 in which a diagnostic team at the Children’s Hospital investigated the

\(^{14}\) The CHILDES website (Archives of INFO-CHILDES list.) has contributed a great deal of useful advice on the permanence of digital storage material, in particular, the degradation over time of CDs as well as audiotapes. Permanence is subjective; if the latest technology outdates the one used to record, the data become hieroglyphic, permanent but inaccessible.
causes of his language delay. These notes were intended to be an aid in determining his comprehension in order to design a programme of language therapy. The need for current information on his language deficiencies and on ways to overcome them spurred my interest in recording his language acquisition. His language development was so sparse and slow at that time that I made notes on any type of interaction, any sign of cognitive development, all his intentional communications, and all emerging changes. As Graeme's comprehension slowly began to increase, my observational skills sharpened and my note taking became more precise. Though it was not my stated purpose to obtain data that were sufficient and reliable for qualitative analysis of Graeme’s lexical acquisition, the detailed notes of close observation extended the data available for analysis beyond the anecdotal (Braunwald, 1979). Keeping the diary became an end in itself, with a specific research objective of observing how far Graeme would go towards acquiring language, and then, when it had become certain that he would in fact acquire language, to record what steps he took along the way.

**Being a parent observer**

Language diaries are typically produced by a parent who is a professional in the fields of child development or language acquisition. Such a data collector is constantly present, familiar with the child and his experiences, and known to the child, allowing for naturalistic data typical of the child’s regular language (Ingram, 1989). Furthermore, because Graeme’s early idiosyncratic word/signs were either unique to him or highly phonologically modified, the field of people who understood his speech was extremely limited, making the parent-observer role particularly appropriate (Dromi, 1987).

Although I had studied child language acquisition and had an M.A. in Linguistics, I was not a professional in the field; rather, I was a working mother with a very challenging child with autism. However, according to Ingram’s (1989) criteria, I was qualified to be a successful parent data collector because I was linguistically trained, in close proximity to Graeme, and committed to the continuous and intensive effort over two and a half years of active daily data-collection. This ensured the close observation needed to distinguish between accidental, transient, or atypical behaviours, and the characteristic features of
Graeme’s language (Dromi, 1987). I was able to perceive and note in detail any benchmark in language development that was acquired over a period of hours, days, or weeks (Ingram, 1989). Collected data were based both on my own educated scrutiny and on the untrained but highly descriptive observations of his father, Graeme’s primary caretaker, who informed me of Graeme’s daily activities and wrote the diary in my absence.

The drawbacks to the parent as investigator, as noted by Dromi (1987) and Ingram (1989), also unavoidably applied to me. As a parent, I was likely to be subjective, and while I do not think I over credited Graeme’s lexical knowledge, I did observe it with a fair degree of desperation. I noted with hope what little initial evidence there was that he might someday acquire conventional language. I undoubtedly contributed infrequent words, but noted the frequency of all data so that infrequent words were identified. (Yoder, 2006).

Data collection in the diary

Concentration on comprehension data

Diary studies of typical children usually concentrate only on production data (Dromi, 1987); whereas with Graeme, developmentally delayed and autistic, there was an absence of production. Graeme’s comprehension, therefore, was the initial focus of my diary, in which I collected extensive and detailed data on his vocabulary in comprehension. An additional reason to collect data on comprehension is that it is greater than production in most aspects of language; therefore, an emphasis solely on production data will provide a very conservative estimate of the child’s total lexicon.

Though Watson (2001) notes that word comprehension is difficult to accurately observe and document, the development of Graeme’s comprehension was rendered more easily observable by his initial delay and the prolonged slow growth of his comprehension. Graeme’s initial acquisition of gestures and words, both in understanding and in
production, was so attenuated that every aspect of his unfolding early comprehension and production of signs and words was a separate and noticeable event.

Scope of the diary

Although the length and detailed information in the entries varied, they were in general extensive and inclusive. As can be seen in Appendix A and in the diary excerpts in the dissertation, the data entries recorded information on:

1. The date and Graeme’s age
2. The location, activities, and routine of Graeme’s day
3. Graeme’s health
4. Graeme’s emerging behaviours and development
5. Graeme’s continuing and repeating behaviours
6. Any initiation of communication from him
7. Any repetition or imitation from him
8. The pragmatic function of his production
9. The situational context of any intentional communication, including babble, meaningful vocalisation, gesture, and word/sign
10. His response or interaction that indicated comprehension as well as understanding or inquiry about an event or object
11. Paralinguistic information such as Graeme’s direction of gaze and gesture
12. The linguistic context, such as an adult’s prior utterance or response
13. His accompanying behaviour and reactions such as gesture and direction of gaze
14. Any misunderstandings on his part, in response or comprehension
15. Linguistic notes, such as frequency, newness, and developing aspects of his communication and interactions.
I collected as much information as possible on the use and contexts of each of Graeme’s words in both his lexicons in comprehension and production, recording not only all of his new words, but also all repeated comprehension and uses of the same words in different linguistic and non-linguistic contexts, in order to identify the understanding and emergence of a new word and its meaning and use over time. In the first part of the diary, covering the chronological age period from 02.05.27 to 03.01.30, the emphasis was on his comprehension\textsuperscript{15}. The remainder of the diary, in the single word stage from age 03.02.00 to 04.02.00, focused on his production. Unless one is examining only one or two days of a child’s language acquisition, it is impossible to record everything a child understands and says, especially when his comprehension and production increase during the word spurts; therefore, mainly new, comprehensible utterances were recorded in the diary. As much as possible I recorded all Graeme’s new, spontaneous, elicited, and imitated words and gestures, and any change in a word’s meaning in both comprehension and production, and its form in production.

Data entries for production progressed from notes of his silence, early vocalisations, babbling, onomatopoeic words, gestures and signs, leading eventually to more conventional early utterances with speech sounds. My phonetic transcription, while mostly consistent, was a modified form of IPA, stretched beyond its limit (and mine) by the number of non-speech sounds Graeme used. As shown in Tables 4.1, 4.2, 4.3, 4.4, 4.6, and 4.8, the entries for production, in addition to those above, included:

1. Productions that Graeme initiated
2. Productions that Graeme used in response
3. Productions that Graeme imitated
4. The pragmatic function of his productions
5. A gloss of the meaning

\textsuperscript{15} I collected data informally at random intervals prior to the diary in a babybook and photos. Professional observations, assessments, and tests supplemented the pre-diary data.
6. Linguistic and paralinguistic information on his word/signs such as his accompanying behaviour and reactions, including tone of voice, volume, and suprasegmentals.

Braunwald and Brislin (1979) list these as suitable language events to be recorded in a general data entry in addition to the child’s productions.

In order to assess the relationship of his language acquisition to other concurrent changes in behaviour I documented his overall development, including:

1. Any evidence of cognitive development
2. Solitary play activities
3. His social interactions, both initiated and responsive
4. Physical development and state of health
5. His emotional state and development
6. His routines, including toilet training, sleeping and eating patterns
7. Unusual events in the household
8. His emotional state, fears, objects of fascination, and eccentricities of behaviour typical of autism
9. Anecdotal information

Figure 4.1 shows a scan of the original handwritten diary.
Figure 4.1  The original handwritten journal (02.10.22)

The following are excerpts of entries in the diary for three consecutive days.

Journal entries

02.07.06

Graeme's just gone to bed--when he saw me fill his bottle and go into his bedroom he ran in after me and jumped into bed and lay down, to get his bottle. His eyes roam
around the room, looking at me, at the door, at his fingers, then they start to roll up
as his eyes close, and open, and close again.
Now he definitely knows Lennie means Lennie the cat, and Daddy means F\textsuperscript{16}.
*\textsuperscript{17} He understands pointing now. Tonight he looked at the fire, F, and Lennie, as I
pointed to each. He’s pointing more himself -- less vaguely.
    When F and he came home from their shopping outing he stayed out in the yard-
-it's a lovely warm day--he didn't follow F in. He was playing with the hibachi ashes,
sifting them through his fingers when I came home. He usually takes a few minutes
to come to me (unlike to F) and looks down, then shyly up, then comes and climbs
on me and hugs me around my neck.
Points to ask for the pencil drawer.
* When I was picking (14!) four leaf clovers in the backyard grass he started pulling
up the grass, imitating me doing something he hadn’t seen before.
He likes to feed F and I pieces of food off our plates.
He put the square nesting cups back in order. He doesn't enjoy them as much as he
did the round ones--he's bored with those now.
* He banged the drainpipe with a stick, enjoyed the booming noise.

\textbf{02.07.07}

(By F) He has directions for food; leading me to one end of counter means bananas,
to the other, bread (or cookies, if around).
To bank, where he got hugs from his teller friend. He likes her and crows when he
sees her. Think he distinguishes bank door for this reason.
* He likes being placed upright on letterboxes; makes him taller than me.
* When Deb came home he pulled us both down and made us rub noses!
(By D) Walks well beside F for as much as a block and a half before running up
someone's sidewalk and stairs or playing with their gate.

\textbf{02.07.08}

(By F) In the past couple days Graeme has discovered the gas and electric meters
beside the house; they make a slight whirring sound. Today he tried to open them,
using a pencil as a screwdriver.
(By D) * Today F, Gray and I were sitting around the table having brunch. I said
Daddy with exaggerated intonation and Gray turned to look at F and reached out to
F’s nose pointing with one finger.
The red-nose test again--Graeme laughed at our reflection when I was carrying him
into the bathroom to wash his grubby little face so I put a lipstick dot on his nose--he
laughed and shook his head when he saw it, still didn't touch his nose. Then I put a
dot on my nose and he laughed, looking in the mirror, then turned to look at me and
touched my nose. I touched his nose, while he watched in the mirror--he didn't
imitate.
The sun is coming through his low bedroom windows--his table is at this window and
he often flicks his hand at floating dust motes. Just now, as he stands at his table
playing with plastic dominoes (stacking, seriating) I heard him laughing. Peeking in, I
saw he was amused at the light reflections cast by the dominoes.

\textsuperscript{16} Initials replace names throughout, to maintain confidentiality. F is Graeme’s father.
\textsuperscript{17} Asterisks signal new behaviours.
As in the pre-diary collection, I supplemented these data with tape recordings, photographs, the results of standardised tests, the formal evaluations of medical professionals, the reports of therapists and preschool personnel, and the observations of babysitters, relatives, and others involved with Graeme. Photographs served to illustrate behaviours as well as to resolve decisions in analysis. For example, figure 4.2 is a photograph of Graeme using his joint attention skills to prompt naming in his picture book, which demonstrates that Graeme used touching rather than pointing to elicit names.

Figure 4.2   Using joint attention to prompt naming pictures (~03.00)

Using diary data for research in Graeme’s lexical acquisition

One of my research goals in the present study is to relate Graeme’s lexical acquisition in both comprehension and production to social/cognitive developments, and to compare these to data from typical children. These questions were not formulated at the time of the
data collection; nonetheless, the detail provided in the diary data allowed for analysis procedures to explore these questions:

1. What were the interactions among social, cognitive and linguistic systems involved in learning words?
2. What aspects of the word did Graeme understand?
3. How did his semantic knowledge of each word expand?
4. How did his intentional communication develop, prelinguistically and in the pragmatic functions of his early word/signs?
5. How did the meaning and form of each word/sign develop?

The diary provided data on:

1. The rate of word acquisition
2. The contents of the one-word lexicon in comprehension
3. The contents of the one-word lexicon in production, in both meaning and form
4. The development of intentional communication
5. The development of early word/signs
6. The development of referential words
7. Graeme’s cognitive development
8. Graeme’s behaviour and social development
9. Graeme’s autistic characteristics
10. The linguistic and behavioural input Graeme received
11. Aspects of Graeme’s comprehension of word meaning
12. The changes over time in the extension behaviours of words in production.

The reliability of these data will be discussed in the analysis section of this chapter.
Graeme’s consent

The research ethics board at the University of British Columbia (UBC) required Graeme’s consent to my use of data collected from him. The Preface contains the number of the certificate of approval, and the letter of consent given to Graeme is in Appendix C. I considered Graeme to be vulnerable to coercion in two ways: he has autism, and the data on his language were collected by his mother, myself. To avoid the risk of coercion, the subject's consent to use the data was invited by a third party, Dr. Pat Mirenda, Professor, who directs the Centre for Interdisciplinary Research and Collaboration in Autism (CIRCA) at UBC. Dr Mirenda is a member of my doctoral advisory committee, who is familiar to Graeme, thus obviating his fear of talking to a stranger. She met with Graeme in his home, obtaining his consent.

Graeme wishes to be acknowledged for his contribution to this research, requesting that his name be used in this dissertation. He has contributed an afterword to this dissertation following Chapter 7, which he entitled “Afterward!”. Dr. Ingram has also given his consent for his name to be used in this dissertation. G also gave permission for her picture to be included (Figure 5.7), as did R (Figure 6.1).18

Summary

Diary and case study methods are appropriate to describe a rapid, increasingly complex, constantly changing, context dependent process such as first language acquisition. They provide context, revealing patterns and emergent behaviours, and showing change over time. My diary study collected natural and spontaneous language samples in the context of Graeme’s everyday social routines to provide a full record of his lexical acquisition. As a parent observer I was on hand to record and interpret Graeme’s lexical acquisition daily. The diary was augmented with my audio and video recordings, and with medical and educational assessments.

18 R gave her permission orally. G’s and Dr. Ingram’s permission were obtained by email.
The diary contained lexical acquisition information on Graeme’s response to the words and gestures of Graeme’s father (F) and myself, his gestured and vocalised intentional communication, and his utterances and signs. These include but are not limited to his age, the linguistic context, the situation, any related play or behaviour, and, in comprehension, which aspects of the word Graeme understood. In production, I noted a gloss of the meaning of his communication, any paralinguistic information, and its pragmatic function. The diary contained a word’s complete history in both comprehension and production, providing a means by which to observe the development of its meaning through its extensions. Emerging or continuing emotional, cognitive, and social developments were also tracked, along with autistic characteristics.

Part 2: Methods of Data Analysis

Introduction

This section describes the methods and procedures used to organise and analyse the data in order to address my first research question:

What is the relationship between the delayed and unusual early lexical acquisition, in both comprehension and production, of my son Graeme with autism, and the major developmental milestones in his cognitive and social growth?

In order to analyse the data, it was necessary first to design tools to organize the data sets on language-related and behavioural events into searchable taxonomies. This in turn necessitated defining a unit of analysis for the lexical data, and determining the descriptive variables for the data on social/cognitive development. An important function of the lexical taxonomy was to demonstrate which partial aspects of words were acquired over time in Graeme’s lexicon, and the order in which they entered both his production and comprehension.

This section presents my rationale for the design of these taxonomies, and for the procedures used in organising and classifying the data for the analysis of the temporal
correlation of Graeme’s early lexical acquisition and his developmental milestones. In addition, the nature and reliability of both the data and the analyses are discussed.

The chapter also addresses my second research question:

Can the meaning and function of the initial idiosyncratic productions justify the inclusion of these in the early lexicon as word/signs, and how does this inclusion explicate the definition of what comprises a word in the lexical acquisition of children with autism?

My analysis examines the criteria used to determine the status of full acquisition in both lexicons for TD children, in order to reveal the processes of word learning for this child with autism. I suggest a more inclusive definition for Graeme’s earliest productions than the one traditionally used for TD children.

**Assembling the data from primary sources**

The raw data assembled during Graeme’s first three years came from a variety of sources:

1. The baby book I kept from Graeme’s birth to 02.06
2. The daily diary that began 02.05
3. Babysitter’s notes
4. Physiotherapy reports and developmental assessments from the Infant Development Programme (IDP)
5. Dr. (David) Ingram’s Report on Language and Cognition (between 02.02 and 02.05)
6. Team assessments at the B. C. Children’s Hospital Diagnostic Centre (CHDC)
7. Reports from B.C. CHDC preschool
8. Medical tests at B.C. Children’s Hospital
9. Reports from the Berwick Preschool at the University of British Columbia
Over a period of years after the data collection, but before this dissertation was begun, the raw data were digitised from their original formats: the paper diary, reports, tape transcriptions, and assessments were word-processed, audio recordings were digitised and stored as CDs, photographs likewise, as jpegs. The phonetic data were transcribed using SIL (Summer Institute of Linguistics) Doulos phonetic font for IPA transcriptions at http://www.sil.org/.

In order to begin the organisation of the data on lexical acquisition and the social/cognitive milestones, all the data had to be extracted from the sources listed above. To re-acquaint myself with the data, I reviewed the source material in chronological order, with a focus on Graeme’s language development (or its lack), and his social/cognitive development. The language data, both audio and written, included information on his comprehension of words and signs, productions of babble, intentional gestures and utterances, and early words and signs. The data on Graeme’s social/cognitive development included descriptions of emerging and consistent behaviour relating to cognition; social behaviour, play, motor skills, and autistic characteristics; as well as environmental, emotional, and health factors. The process of assembling the relevant data for analysis necessitated the development of organisational tools.

**Defining the categories of analyses for the two developmental streams**

Before the data sets describing Graeme’s linguistic and social/cognitive developmental streams could be entered into organisational schemata it was necessary to define and establish criteria for key concepts in both the lexical and social/cognitive streams. For the lexical stream, this required three steps: first, defining the main unit of analysis; second, determining the criteria for the full acquisition of a word event in comprehension and production; and third, re-defining an early word/sign. For the social/cognitive stream, this
required determining a coherent set of the variables underlying the behavioural clues, in order to detect patterns in development that influenced lexical acquisition. The two developmental streams therefore required different units of analysis.

The lexical data lent itself to one unit of analysis. Our early communications with Graeme, as with any infant, were global and inclusive experiences, as Graeme’s father and I tried to promote his understanding and to interpret his ways of conveying his feelings and needs. Describing these communications as lexemes, words, signs, or pragmatic intentions was not a sufficiently inclusive description; thus, a different unit of analysis was needed. Many of the earliest things Graeme understood included phrases and gestures from interactive games such as hide and seek, as well as single words. His earliest productions were intentional communications that functioned as protests, greetings, and requests for objects or actions; as well as grunted and onomatopoeic utterances. Crying and laughing were the first productions noted. In order to cover the range of vocalisations, words, phrases, gestures, signs, and intentions that made up Graeme’s communicative and understood lexicons, these data were described as word events. The word event unit of analysis permitted inclusion of all these linguistic events in comprehension and production, in order to provide a complete picture of his development. This simplified the decision-making process about which data to enter into the linguistic taxonomies, and how to classify them.

Unlike the single unit of analysis used for the lexical data, the data from the broader sphere in Graeme’s social/cognitive development were clustered thematically into various types of behaviour. The thematic categories included: emerging, repetitive, and decreasing activities; relating or autistic behaviours; cognitive achievements or attempts; and influential factors in his life and environment, such as therapy, health, mood, and daily routines. Each category had its own coding, rather than being part of one unit of analysis as the linguistic data were.
Developing the analytical tools

Developing the tools for analysis required creating searchable taxonomies in the two data sets of linguistic word events and social/cognitive behaviours. The goal was to organise the raw data into meaningful categories in order to examine and reveal relationships between the growth of Graeme’s lexical acquisition and his emerging and continuing social and cognitive development. This would facilitate analysis addressing my first research question. The analytical tools therefore had to provide clear information on the specific instances of development, as well as reveal the larger processes involved.

I designed analytical tools in the form of Excel spreadsheets for entering and organising the data into formats convenient for analysis. The primary taxonomy for linguistic data was the Word Event (WE) list. A separate set of spreadsheets was developed to compile the data on babble. Subsets of the WE list were created to examine specific aspects of acquisition such as semantics. The Social/Cognitive Development (SCD) taxonomy was created to organise the relevant data in that area. These two taxonomies were expanded and refined as I entered data in the order in which it occurred in Graeme’s life. The procedures involved in the organisation and use of these taxonomies will be described in detail in the sections on the WE list and the SCD list below.

The Word Event list

Introduction

The WE list contained the linguistic data for both comprehension and production. The three goals of the WE list were: first, to show the development of Graeme’s lexicon over time; second, to describe the comprehension and production history of each word event; and third, to present the lexical data so that they could be related to his cognitive and social benchmarks. The WE taxonomy demonstrated the order and processes with which Graeme acquired his lexicons in comprehension and production. It showed his first exposures to the word event in comprehension; when word events were first attempted in production; when full acquisition of a word and sign occurred; and when, and how,
different aspects of acquisition, such as meaning and form, developed towards conventional words. A detailed recording of the linguistic and non-linguistic context of each occurrence of Graeme’s word learning illustrated these processes, for each word event and across his lexical acquisition as a whole.

This section will comment on the reliability of observation and recording of the data, the criteria for lexical status in comprehension and production, and the age dates and age of acquisition, before describing the WE list in detail.

**Reliability of observation and recording**

The WE list for the period under study, to age 03.00.28, is a large database of nearly 1200 entries (951 for comprehension and 242 for production) for the acquisition of 230 word events, yet the data are necessarily incomplete. Not every instance of Graeme’s exposure to a word, production of a word or sign, or intentional communication could be recorded over such a lengthy period of collection. Nor was it possible to determine all the words he understood or exactly when they were acquired, especially after the onset of rapid word learning in the comprehension word spurt. It is therefore possible that some word events were completely missed.

Imprecision, in the form of data inaccuracies and possible missing entries in word events, occurred because the data were collected from several sources. The babysitter’s and preschool vocabulary reports could not be expected to be provided according to the detailed standards of academic linguistic data collection that I used, nor were the observations of Graeme’s father (F), who was the primary caretaker at home. Typically I relieved F mid-afternoon on arriving home from work, and wrote up the diary notes nightly, basing them on my time with Graeme, F’s observations, and the preschool or babysitter’s daily reports. Also, data are missing from a 6-day period (03.01.04 to 03.01.10), lost when the data were being entered on the computer. These exceptions aside, most major variations in the words’ histories were noted.
There are a few words in the WE list that were not listed as acquired because there is not enough evidence of Graeme’s full comprehension, although because of the familiarity of the referent it is probable that he did understand them. He did however show an interest in them and had some understanding of them. These words include dance, wind, puzzle, Theresa, wrist, moustache, hold hands, clap hands, sloth, and cupboard. These are listed separately at the end of the WE list. Some words were omitted from the data because they were too difficult to isolate from the rest of the remark addressed to Graeme; for example, got, the determiners there, that, it’s, the, a, and quantifiers such as none. These are also listed separately. Conversely, a few word events with only one or two entries (e.g. hay, Lorna, clippety-clop) are counted as acquired because there is enough evidence of full understanding independent of the context. All of his productions were included in the data.

If there is doubt about the date or accuracy of an entry it is noted in the WE list. If there are no precise data on the age of acquisition (AoA) of a word event, it is assumed to have been acquired in the comprehension lexicon within a week of Graeme’s expression of interest in having it named. This estimate is based on an expectation that, in addition to his interest, the lexical item in question would likely have been learned at that time because of its meaning, function, familiarity, frequency of context occurrence, or Graeme’s phonological perception at that time. His requests for names were closely monitored at preschool and at home.

The criteria for lexical acquisition status in comprehension

Benedict (1979) provided the definitive criteria for word acquisition in comprehension for typically developing children. These were strictly followed for all but Graeme’s first 30 words in comprehension. Benedict’s main criteria were the word’s productivity and continuity. That is, for a word to be considered acquired the child must show a correct and consistent response to the word, verified within the following days. The following
demonstrations of understanding were used to satisfy the requirements for Graeme’s full comprehension of a word event:

1. Correct response to the word or sign alone, not the word accompanied by a gesture.
2. Correct response to the word without the addition of his name (which would get his attention all by itself).
3. Correct response to the word or gesture alone without ostensive indication of the object, such as holding it up or pointing to it.

My proposal for an amendment to Benedict’s criteria is that an extended inclusion of the criteria for the earliest words acquired in comprehension is warranted for language delayed children who have hitherto shown no signs of lexical understanding, rendering the comprehension of any aspect of a word noteworthy. Conditions one and three therefore were relaxed for the first 30 words Graeme understood. The first 30 words in his comprehension were context dependent and his understanding of them was usually aided by the gestures of F and myself. For example, in word event 15, step, Graeme responded to *step* only when his pants were held out for him to step into, but the presence of the held out pants alone was not sufficient to get him to comply. Since the verbal command was necessary to induce him to step into them, I considered *step* to be acquired though it did not fulfill Benedict’s criteria based on the word alone without ostensive indication. Comprehension that was dependent on additional physical and linguistic context was permitted. However, for the first 30 word events to be considered as acquired with full lexical status in his comprehension, some aspect of the word/sign itself had to be understood. That is to say, his understanding of the word event could not depend on the tone of voice or the use of his name by the speaker.

Another reason for including context dependent words in comprehension as candidates for words in the corpus was that many of the earliest words in Graeme’s comprehension

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19 Exceptions, noted below, were made for the first 30 words acquired.
20 It is possible that he might have responded to a different word here in the same way.
21 See Chapters 5 and 6 for further details on determining the acquisition status of Graeme’s early lexicons.
described events as a whole. An example was *bottle*. When Graeme first responded to hearing me say *bottle* when no bottle was visible he ran into his room to lie down on the bed where he always had his bottle. This act demonstrated that his meaning for *bottle* was undifferentiated from his whole bedtime routine. The first 30 word events in Graeme’s comprehension, whether or not they were context dependent, were given acquired status when it could be determined that he had some real-world referent or concept for the word or phrase, and consistently responded to its verbal or signed use. Any indication that Graeme understood a word differently from the adult meaning was noted, as were any changes in his understanding of the word’s meaning over time.

**The criteria for lexical acquisition status in production**

Establishing the criteria for lexical acquisition status in production contributes to answering both parts of my second research question. The first part queries the applicability to children with autism of the criteria for the definition of a word in child language acquisition research in TD children. The second part questions the criteria for the point of entry of a word into the early lexicon in production.

In order to determine a word/sign’s point of entry into Graeme’s production lexicon, I used the spontaneous use criterion (Menn, 1976). Therefore, forms that were imitated only, but not spontaneously used, were not considered to be fully acquired. The criteria of productivity and continuity were also applied: a word/sign had to be repeated, although there could be variations in its form and extensions of meaning (Vihman & McCune, 1994). An isolated exemplar with no repeated use was not included. If a word/sign fulfilled these criteria, it was entered into the Word Event list as having acquisition status at the first instance of its spontaneous use.

The point of origin into the lexicon, while defined at a given age, is nonetheless part of a gradual, continuous process of acquisition. The process includes the earlier imitations, underextensions, less intelligible, and context bound attempts prior to its full lexical status. It also includes the subsequent acquisition of the more conventional aspects of the
word’s phonological form, symbolic reference, over-extensions and more regular semantic extensions.  

Tager-Flusberg et al. (2009) provide stringent phonological, lexical, and pragmatic criteria for defining the first word stage of children with ASD, which is age equivalent to TD children of 01.03. The data are collected in a natural language sample of at least 30 minutes duration, preferably in more than one context, in which the child interacts with several people. These data are augmented by parental reports that use the CDI. The phonological criteria consist of having a minimum of one consonant-vowel (CV) combination or a minimum of four consonants from the early repertoire of /n/, /b/, /y/, /n/, /w/, /d/, /p/, and /h/. TD children can have CV-CVC combinations and up to eight consonants at this stage. The vocabulary criteria require two to 15 referential (not context bound) words, used spontaneously within a 20-minute period, with a minimum of five types and 20 tokens. The pragmatic criteria entail using two to five functions, with a minimum of one comment and one other function.

Given Graeme’s delay and the uncertainty that he would become verbal, he was monitored and scrutinised closely for any sign of lexical acquisition. Almost every phonetic, gestured, semantic, and pragmatic aspect of his earliest unintelligible and ambiguous communications was recorded in the diary, along with the frequency and duration of occurrence. From these data, information on the spontaneity, productivity, consistency, meaning, and function of an utterance informed decisions about acquisition status.

**The definition of a word in this study**

As noted in Chapter 2 in the section “Form, meaning, and function criteria for defining early words”, researchers from different theoretical perspectives in the field of lexical acquisition have provided terminology and descriptions with which to define the earliest words that children produce. The research focus has been more on distinguishing the

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22 See discussion in Chapter 2 in the section on Determining the point of entry into the lexicon.
earliest words from referential words than on distinguishing the earliest words from the meaningful consistent vocalisations and gestures of intentional communication. There is, therefore, a lack of agreement over the distinctions between the earliest words, intentional communication, context bound words, and referential words. Because of this lack of agreement, and in order to fully examine the incremental developmental process of the aspects of lexical acquisition in a language-delayed child with autism, I extended the definition of early words for Graeme’s data to be more inclusive. My extended definition includes all his consistent, meaningful, productive, spontaneous, continuous intentional communicative productions, both gestures and vocalisations. While this definition accords with Menn’s (1976) spontaneous use criterion, Vihman and McCune’s (1994) continuity and productivity criteria, and Tager-Flusberg and colleagues’ (2009) data collection criteria, it does not meet their lexical, phonological, or pragmatic tests for first words, nor Vihman and McCune’s (1994) phonetic semblance criterion.

I entered Graeme’s consistent, meaningful, and intentional communicative productions as lexical acquisitions into the Word Event list of his lexicon in production, and I refer to them as early words, or as word/signs. These early words include all the “ragged beginnings” (Vihman & McCune, 1994) of his invented and learned signs, in addition to idiosyncratic, non-dictionary, context bound, and onomatopoeic words, and also include words that contain non-speech sounds, such as squeaking and growling.

**Age dates and the age of acquisition**

The age of acquisition (AoA) is a term from psycholinguistics which specifies the child’s chronological age when a word is acquired (Reilly et al., 2007). I use this term for the age of acquisition of full lexical status; that is, the point of entry in the lexicons. For data entries other than full acquisition I use the term *age date* to refer to Graeme’s chronological age at the time.
The design and contents of the Word Event list

The WE list was designed to organise the large quantity of data into categories meaningful to word learning. The design evolved during the process of data entry, as the requirements for its analytical function became apparent, with new lexical features emerging in Graeme’s lexicons as I progressed through the diary review. The entire comprehension lexicon in the WE list, ordered chronologically according to his AoA, is attached in Appendix B.

The WE list had 18 columns. In these columns, linguistic and contextual information on each entry could be recorded, depending on the available data, as listed in the section on the scope of the diary and diary data above. Table 4.1 shows the first four columns. The first column, the index, contained the number of the word event based on the order in which Graeme fully acquired that word in either comprehension or production, whichever occurred first. The second column in the WE list was the word event itself. This could be a word or sign Graeme used or understood, or a word or phrase describing his intentional communication.

The third column was meaning. In entries for comprehension, this referred to my interpretation of Graeme’s understanding. In production entries, the meaning explicated his reference if that was not obvious. If an adult utterance was modified for Graeme’s understanding, the full adult form was also put in the meaning column. This column included the pragmatic function of Graeme’s communications as well.

The fourth column, adult word used, provided the linguistic context of the utterance that the adult had used to initiate or continue the exchange. Examples are: eliciting a word; labelling for Graeme’s comprehension and for answering his name questions; correcting a misunderstanding; or confirming his repetition. In Table 4.1, the first example is of Graeme’s production of an intentional communication, pulling F’s arm to request an action (RA). The other examples are of his comprehension of the word event.
Table 4.1  Examples from the first four columns of the WE list

<table>
<thead>
<tr>
<th>Index</th>
<th>WE</th>
<th>Meaning</th>
<th>Adult word used</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>I want it</td>
<td>G’s request for action, I want you to get my top. RA</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Hide n seek game</td>
<td>D. Invitation to play.</td>
<td>Where’s Graeme?</td>
</tr>
<tr>
<td>13</td>
<td>Greeting</td>
<td>D. Interactive, to start conversation.</td>
<td>Hello (exaggerated intonation)</td>
</tr>
<tr>
<td>25</td>
<td>Bottle</td>
<td>A whole sequence - time for bed, lie down with F and have bottle.</td>
<td>Bottle [ba]</td>
</tr>
<tr>
<td>35</td>
<td>Water</td>
<td>D. Labelling drinking, pouring, bath, pool, ocean.</td>
<td>Water [wa wa]</td>
</tr>
<tr>
<td>51</td>
<td>Dog/woof</td>
<td>Dog</td>
<td>Doggie, woof woof (response to G pointing)</td>
</tr>
</tbody>
</table>

The next five columns in the WE list contained information on the order in which aspects of word events entered Graeme’s lexicons and the order in which they achieved full acquisition status. The entries were dated by age:

1. The age date at the time of any instance of comprehension, age comp event, which could have many entries per word event.

2. The age date at the time of Graeme’s full acquisition in comprehension, AoA comp. This column had only one entry per word event.

3. The age date at the time of any production of a word event, age prod event, which could have many entries.

4. The age date of the full acquisition of the first early production, AoA early prod.

5. The age date of the full acquisition of the first signed production, AoA sign.

With this organisation, it was clear at a glance when aspects of partial acquisition as well as full acquisition occurred in each lexicon and modality with few exceptions. There were almost always multiple entries for each word event. The number of entries for each word

---

D is an abbreviation for Deborah. F is Graeme’s father.
event indicated the frequency of this word event in each lexicon, which was a measure of Graeme’s interest in the word, as well as his parents’ and therapists’ desire for him to learn it. In the comprehension lexicon the number of entries revealed the amount of exposure, teaching, and requests for the word event name from Graeme. In production, the number of entries showed Graeme’s efforts at producing forms, and ours at eliciting them.

Entries prior to full acquisition (AoA) showed the first aspects of a word event that Graeme learned. During the time span of this study, the comprehension of a word event usually preceded its production. The exceptions to this are the signed or vocalised intentional communications that made up his few early word/signs. An example is his grunt that meant *I want it*, which was produced prior to his comprehension of that phrase.

Table 4.2 gives examples from the WE list for some of the entries for word event 23, *round about*, which came into Graeme’s lexicon in production with reference to a specific game. This word event was extended in form and meaning. It became *round and round* as it was extended to the more general meaning of spinning and turning actions, and eventually *round* for round and circular shapes. A vocal production of *round/round about* did not occur during this study.

**Table 4.2 Age dates for the word event *round/round about***

<table>
<thead>
<tr>
<th>Age comp event</th>
<th>AoA comp</th>
<th>Age prod event</th>
<th>AoA sign</th>
<th>Notes</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>02.08.15</td>
<td>02.08.15</td>
<td>02.08.15</td>
<td></td>
<td></td>
<td>G holds palm out for D’s <em>round</em> game.</td>
</tr>
<tr>
<td>02.08.23</td>
<td>02.08.23</td>
<td>Palm up, Finger turning</td>
<td></td>
<td>G asks for game before it's offered.</td>
<td></td>
</tr>
<tr>
<td>02.09.00</td>
<td></td>
<td>Extension</td>
<td></td>
<td>Made a circle on etch-a-sketch.</td>
<td></td>
</tr>
<tr>
<td>02.09.20</td>
<td></td>
<td>Extension</td>
<td></td>
<td>Circled his hand on the record to request it. RA</td>
<td></td>
</tr>
<tr>
<td>02.11.08</td>
<td></td>
<td>Extension</td>
<td></td>
<td>Turned skipping rope</td>
<td></td>
</tr>
</tbody>
</table>

---

24 Both the actions of spinning and turning, and spherical and circular shapes were favourites of Graeme.
As shown in Table 4.3, linguistic information on production was presented in the next five columns:

1. The vocal utterance Graeme produced, word G used.
2. Its International Phonetic Alphabet, IPA, transcription.
3. A description of its suprasegmentals.
4. A description of a sign or gesture.
5. The notes column included: observations on the linguistic uniqueness of the entry; any change in form (e.g. articulation) or meaning (e.g. semantic extension; homonyms, any ambiguity or confusion); disambiguation strategies; and any query regarding the entry’s accurate AoA.

Table 4.3 Examples of production columns in the WE list

<table>
<thead>
<tr>
<th>Word G used</th>
<th>IPA</th>
<th>Suprasegmental</th>
<th>Sign</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog/woof</td>
<td>[u?uh?]</td>
<td>Grunted</td>
<td>Blinks and nods</td>
<td>Uses it as phone opener and to greet people.</td>
</tr>
<tr>
<td>I want it/more</td>
<td>[?uh ?uh ?uh]</td>
<td>Rising grunts</td>
<td>Leads F by the hand to item, waves one hand up.</td>
<td>Request for object</td>
</tr>
<tr>
<td>Down</td>
<td>[a:جاب]</td>
<td>Falling intonation</td>
<td>Palm down, downward motion of arm.</td>
<td>Request for object</td>
</tr>
<tr>
<td>Name question</td>
<td>[؟uh؟uh؟uh؟uh؟uh؟]</td>
<td>Grunt, sharp questioning intonation</td>
<td>Touches pic, looks at D, asks.</td>
<td>Request for lexical information</td>
</tr>
</tbody>
</table>

25 Space does not permit inclusion of the age dates.
As shown in Table 4.4, the context column contained data on the non-linguistic context in which the word event was understood or uttered. This included the referent or activity, Graeme’s solitary play, home or preschool routine or game, or during therapeutic intervention. It also notes whether the entry was taped. The type column was for production only, and identified whether Graeme’s utterance was elicited, a spontaneous imitation, or volunteered spontaneously, which indicated acquisition. The last column was for other instances of word event entries, which contained the age dates of identical entries. This prevented redundant repetition of data entry, while confirming that Graeme had exhibited comprehension or production of this word event on other occasions, to satisfy the productivity criterion. Table 4.4 shows the context comments for a few word event entries, as well as the age date of the comprehension (comp) and production (prod) for that entry, and whether it was spontaneously volunteered (spon) or imitated (im).

**Table 4.4** Examples of context, age dates, and type from the WE list

<table>
<thead>
<tr>
<th>WE</th>
<th>Age comp event</th>
<th>Age prod event</th>
<th>Context</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name question</td>
<td></td>
<td>02.11.19</td>
<td>D didn't answer until his Q, so he asked for each word about 20X.</td>
<td>spon</td>
</tr>
<tr>
<td>Hide and seek</td>
<td>02.06.06</td>
<td>02.06.06</td>
<td>Initiates by pulling D to his eye level.</td>
<td>spon</td>
</tr>
<tr>
<td>Hot</td>
<td></td>
<td>02.07.30</td>
<td>Imitated [a]. Made eye contact.</td>
<td>im</td>
</tr>
<tr>
<td>Bottle</td>
<td>02.08.21</td>
<td></td>
<td>Ran to F, pulled him into the bedroom and lay down.</td>
<td></td>
</tr>
<tr>
<td>Foot</td>
<td>02.09.24</td>
<td></td>
<td>Brought his foot out from sitting on it for D to put his shorts on.</td>
<td></td>
</tr>
</tbody>
</table>

**Word Event list organisation**

There were two procedures for sorting data entry in the WE list. Data could be entered chronologically on a daily basis, so that all entries for 02.07.01 were followed by all entries for 02.07.02. It was also possible to sort the data in word event groups; in this latter case all entries for the word event *Daddy* were grouped together and ordered chronologically within that word event. Each option had its advantage for analysis. The chronological order showed the pace of acquisition with the spurts and lags in development that co-occurred with cognitive milestones. This organisation revealed the
larger patterns of lexical development as they occurred over time, which was especially valuable for noting phonological changes in the latter part of the single word stage. The grouped word event data showed the incremental developmental history of each word event, entry by entry. This organisation made it possible to determine the order of acquisition for each word event in Graeme’s earliest word learning, according to when the word event entered his lexicon. Because grouped word events suited the earliest data in Graeme’s lexicon, this was the organisation I used to analyse the data. Owing to the sorting capacity of Excel, however, both of these methods of organisation were available and both were employed at different points in the data analysis.

**Daily chronological organisation**

Organising the data in the WE list in daily chronological order presented the data as they were recorded in the diaries. Depending on Graeme’s rate of acquisition in a given period, one day might have several word events, while another day might have none. At the start of the diary there were usually only a few word event entries per week, and only five or six vocabulary acquisitions in comprehension per month for the first four months, whereas during the word spurt in comprehension, one single day (02.11.02) had 42 word event entries (see Table 4.7).

Table 4.5 shows an example of daily chronological sorting in comprehension. The data include all of the consecutive entries over an eight-day period during the period of slower comprehension acquisition. Except for **Daddy** and **juice**, these were pre-acquisition entries in the word’s history. In these examples, the word event was initiated by the labelling of F and me, in accordance with our intervention strategy to identify and name whatever Graeme was engaged in. Graeme’s interest in the referent, or his response to our naming, was the reason this word event was noted in the diary as an example of his comprehension, as these examples pre-dated his ability to ask for a name. Appendix B contains samples of chronologically sorted data from the WE list in the major linguistic periods of Graeme’s lexical acquisition in comprehension.

---

26 These data, from 03.02.00 on, are outside the scope of this study.
Table 4.5 Daily chronological word event entries in comprehension

<table>
<thead>
<tr>
<th>WE</th>
<th>Age date</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>02.07.08</td>
<td>Laughing aloud at light reflections.</td>
</tr>
<tr>
<td>Pen/pencil</td>
<td>02.07.12</td>
<td>Got pen and paper and scribbled by himself.</td>
</tr>
<tr>
<td>Grandma</td>
<td>02.07.13</td>
<td>Recognised Grandma through window, got excited and ran to her but got shy and stopped.</td>
</tr>
<tr>
<td>Dog</td>
<td>02.07.13</td>
<td>Loves the dog Slick at his babysitters.</td>
</tr>
<tr>
<td>Daddy</td>
<td>02.07.14</td>
<td>Pointed to F when asked Where’s Daddy –AoA.</td>
</tr>
<tr>
<td>Juice</td>
<td>02.07.14</td>
<td>Responded to word alone–AoA.</td>
</tr>
<tr>
<td>Watch (item)</td>
<td>02.07.15</td>
<td>Object of interest, asking for name.</td>
</tr>
<tr>
<td>Nose</td>
<td>02.07.15</td>
<td>Touched his own nose.</td>
</tr>
<tr>
<td>Mouth</td>
<td>02.07.15</td>
<td>Started looking in people's mouths.</td>
</tr>
<tr>
<td>Bike</td>
<td>02.07.16</td>
<td>Loves to spin the pedals on the bikes.</td>
</tr>
</tbody>
</table>

Table 4.6 shows daily entries for both production and comprehension during a later period of slow word learning in comprehension. These are either instances in which Graeme had partially acquired words in comprehension with the benefit of our ostensive naming, or were word utterances or intentional communication in his production lexicon. In this table only down, and hide and seek had been fully acquired in both comprehension and production at this age, while I want it was acquired in production only.

Table 4.6 Daily chronological word event entries in comprehension and production

<table>
<thead>
<tr>
<th>Index</th>
<th>WE</th>
<th>Age comp event</th>
<th>Age prod event</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Down</td>
<td>02.08.07</td>
<td></td>
<td>[aː]When he throws an object.</td>
</tr>
<tr>
<td>204</td>
<td>Box</td>
<td>02.08.07</td>
<td>02.08.07</td>
<td>Loves putting things in boxes, carrying, dumping.</td>
</tr>
<tr>
<td>22</td>
<td>Look</td>
<td></td>
<td>02.08.08</td>
<td>[u] G pointed at something, D didn’t know what.</td>
</tr>
<tr>
<td>115</td>
<td>Window</td>
<td>02.08.08</td>
<td></td>
<td>Loves to play with windows, banging on them, playing with latches.</td>
</tr>
<tr>
<td>27</td>
<td>Aeroplane</td>
<td>02.08.09</td>
<td>02.08.09</td>
<td>Looked up when D said aeroplane, hadn't noticed sound.</td>
</tr>
<tr>
<td>10</td>
<td>I want it</td>
<td>02.08.09</td>
<td>02.08.09</td>
<td>[uh] Took his yoghourt to and Touched the arm of the person he wanted to feed him.</td>
</tr>
<tr>
<td>11</td>
<td>Hide and seek</td>
<td>02.08.11</td>
<td></td>
<td>Pulls D to floor, pushes her head to floor, runs away, laughs when she</td>
</tr>
</tbody>
</table>
To compare rates of word learning, Table 4.7 shows the same chronological sorting, but during the word spurt in comprehension. These entries were all acquired in the comprehension lexicon on the same day; a day on which a total of 18 new words were acquired. Daily chronological sorting clearly shows the pace of acquisition.

### Table 4.7 Chronological sorting during rapid acquisition in comprehension

<table>
<thead>
<tr>
<th>Index</th>
<th>WE</th>
<th>AoA</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>Brush</td>
<td>02.11.02</td>
<td>Pointed to pic(^27), imitated me stroking his hair.</td>
</tr>
<tr>
<td>63</td>
<td>Bus</td>
<td>02.11.02</td>
<td>Recognised pic even though the colour was different from his schoolbus, pointed, asked, brought book right up to his eyes.</td>
</tr>
<tr>
<td>64</td>
<td>Orange (fruit)</td>
<td>02.11.02</td>
<td>Touched pics in books when asked <em>where’s orange?</em></td>
</tr>
<tr>
<td>65</td>
<td>Spoon</td>
<td>02.11.02</td>
<td>Identified pic, then real thing. Many months of training on eating with a spoon.</td>
</tr>
<tr>
<td>66</td>
<td>Candy</td>
<td>02.11.02</td>
<td>Identified pics, great interest in real thing.</td>
</tr>
<tr>
<td>67</td>
<td>Bath</td>
<td>02.11.02</td>
<td>Identified in pic, associated with water, tap.</td>
</tr>
<tr>
<td>68</td>
<td>Leg</td>
<td>02.11.02</td>
<td>Game of burying his leg in sand, touched his leg.</td>
</tr>
<tr>
<td>69</td>
<td>Cat</td>
<td>02.11.02</td>
<td>Pic and real.</td>
</tr>
<tr>
<td>70</td>
<td>Bad</td>
<td>02.11.02</td>
<td>Ripping more plaster off the wall, cried and ran. away when scolded with bad.</td>
</tr>
</tbody>
</table>

**Grouped data organisation**

Grouped data organisation in the WE list shows the entire history of Graeme’s learning of a word event, as exemplified in Table 4.8. It is a type/token analysis, with the word event

\(^{27}\) *pic* is an abbreviation for *picture* in his picture books.
being the type, and all occurrences of it tokens. The procedure for entering the data with this organisation under this schema was as follows: when the first instance of any word event was found in the diary it was entered in the WE list. At that point the entire diary was searched for every occurrence of that word in both comprehension and production, and these instances were entered individually in chronological order by age date. The index number for that word event was determined by Graeme’s age at the time a word event met the criteria for full acquisition in either comprehension or production, whichever came first. The index numbers of the WE list therefore reflect the order in which Graeme acquired both his comprehension and production vocabulary. Index #1, _crying_, was his first communicative word event, while #230, _tattoo_, was the last word event acquisition during the time span of the study. _Crying_, with 48 entries, was produced as an intentional communication, and _tattoo_, with 2 entries, was acquired in comprehension. Separate tabulations were also made for the word event count in each lexicon.

Table 4.8 illustrates grouped entries for the word events _banana, Mummy_, and _string_. Graeme’s AoA of a word event is listed in the column named ‘AoA Comp’. It is from this column that the order of his lexical comprehension was compiled and the index number assigned.

**Table 4.8 Examples of grouped word events in comprehension**

<table>
<thead>
<tr>
<th>Index no.</th>
<th>WE</th>
<th>Age of entry for word event</th>
<th>AoA comp</th>
<th>Adult word used</th>
<th>Context at acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Banana</td>
<td>02.07.03</td>
<td></td>
<td>Banana?</td>
<td>I hold it out, G comes for it.</td>
</tr>
<tr>
<td>16</td>
<td>Banana</td>
<td>02.07.19</td>
<td>02.07.19</td>
<td>Banana?</td>
<td>Comes for it, word only.</td>
</tr>
<tr>
<td>16</td>
<td>Banana</td>
<td>02.07.30</td>
<td></td>
<td>Banana?</td>
<td>Running for it, vocalising <em>I want it</em>.</td>
</tr>
<tr>
<td>34</td>
<td>Mummy</td>
<td>02.10.12</td>
<td></td>
<td>Mummy's nose</td>
<td>Touched my eyes, comp MLU of 1.</td>
</tr>
<tr>
<td>Index no.</td>
<td>WE</td>
<td>Age of entry for word event</td>
<td>AoA comp</td>
<td>Adult word used</td>
<td>Context at acquisition</td>
</tr>
<tr>
<td>----------</td>
<td>------</td>
<td>----------------------------</td>
<td>----------</td>
<td>----------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>34</td>
<td>Mummy</td>
<td>02.10.24</td>
<td>02.10.24</td>
<td>Where’s Mummy?</td>
<td>Looked at me, touched my nose.</td>
</tr>
<tr>
<td>94</td>
<td>String</td>
<td>02.08.20</td>
<td></td>
<td>String</td>
<td>Asked for name, loves thread, string, cord, tassels, twine for knotting, threading.</td>
</tr>
<tr>
<td>94</td>
<td>String</td>
<td>02.11.08</td>
<td>02.11.08</td>
<td>String</td>
<td>Identified it after only 10 repetitions.</td>
</tr>
<tr>
<td>94</td>
<td>String</td>
<td>02.11.20</td>
<td></td>
<td>String</td>
<td>Semantic extension, pointed to hair, saying String.</td>
</tr>
</tbody>
</table>

Table 4.8 also illustrates the criteria for my decisions about when a word event was fully acquired with examples of word event entries before, at, and after acquisition in comprehension. For example, the first entry for the word event banana occurred at 02.07.03, when I said banana and held one out for him. He responded by approaching, but because he saw the banana, his response could not be determined to be to the word alone. Banana was not considered to meet the criteria for full acquisition until 02.07.19 when he came for a banana after hearing the word alone with no banana in sight. This AoA determined the index number of the word event banana, the 20th word event in Graeme’s lexicon. Entries after acquisition confirm comprehension and show semantic distinctions.

Within a single grouped word event there were as many as 80 separate data entries, particularly for the earliest word events, many of which had histories of continuing development that continued to span the whole one-word period. As Graeme’s word learning progressed and he became more proficient in language acquisition, the amount of time between the initial recognition of a word and its full comprehension decreased. Fewer exposures to the word were needed until, in the last month of the word spurt in
comprehension, acquisition could usually be confirmed after the first exposure to a nominal, particularly if he had asked for the name.

Grouping all the data on each word event together revealed the process of acquisition in Graeme’s comprehension and production lexicons, in addition to illustrating the history of that word’s development. Prior to Graeme’s complete understanding of an early word he had many exposures to it in his daily routine while it was being actively taught. Examining the details of the linguistic and non-linguistic contexts of a grouped word event revealed the progress of comprehension. Earlier entries demonstrated instances of incomprehension and of confusion with similar sounding words. Later entries showed partial recognition within a narrow context, progressing to the point of acquisition. Entries beyond AoA revealed further modifications in Graeme’s understanding of aspects of meaning. In production, the grouped data for a word event showed the progression of learning a word/sign. First entries showed Graeme’s initial attempts at sign and sound, both elicited and imitated. Later entries showed his under and overextensions, and the development from idiosyncratic, invented and onomatopoeic forms of the word event to more conventional signs and words.

Table 4.9 displays grouped data examples of Graeme’s growth in understanding in the word event *knock knock*, which was a peek-a-boo type game involving knocking on doors. As its low index number of 4 and AoA of 02.00.00 indicate, *knock knock* was one of Graeme’s first lexical acquisitions. It was acquired first in comprehension. The age date is approximate since it was in Graeme’s lexicon before detailed data were available. These entries showed further lexical development after acquisition; for example, how Graeme elicited the word event, responded to it, extended its meaning. Graeme’s production of the knocking sign, and his variations on knocking such as stamping, occurred early in his productive lexicon.

**Table 4.9  The word event *knock knock***

<table>
<thead>
<tr>
<th>Index no.</th>
<th>WE</th>
<th>Age</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Knock knock</td>
<td>02.00.00</td>
<td>Acquired in context. Looks at my hand for knocking, then at my mouth for <em>come in</em>.</td>
</tr>
</tbody>
</table>
**Index no.** | **WE** | **Age** | **Context**
---|---|---|---
4 | Knock knock | 02.06.04 | G knocked to initiate the game and to elicit *knock knock* from me.
4 | Knock knock | 02.09.01 | Looks at or goes to the door for *knock knock*. Opens the door for come in.
4 | Knock knock | 02.09.02 | Knocked when I said it, then opened door for my *knock knock*.
4 | Knock knock | 02.09.07 | G was pushing the door, hands busy, so he stamped his foot when I said *knock knock*.
4 | Knock knock | 03.08.07 | Got excited at me saying *knock knock*, started knocking everywhere.

**Additional organisations of the WE data**

Because the WE List was large, several different organisations in Excel workbooks were used to display subsets of data. These organisations were instrumental in organising aspects of the data in order to search and retrieve information or to run analyses for comparison. They are described briefly in the following section.

**Short versions of the WE list**

Short versions of the WE list for comprehension and production provided only the AoA of the word events. Like the WE list, the default sorting of these entries was by chronological order. The short versions were also useful sorted into alphabetical order, enabling fast word event searches. In the comprehension short version, data from the Communicative Developmental Inventory (CDI) (Fenson, 1989) was included to provide a comparison of Graeme’s vocabulary. The CDI data gave the percentages of TD children who had acquired comprehension for the word events at ages 00.08, 01.00, and 01.06. Table 4.10 shows a section of the short version organisation from the period of slow acquisition in comprehension.
Table 4.10  Short version with CDI comprehension percentages

<table>
<thead>
<tr>
<th>WE order</th>
<th>WE</th>
<th>AoA comp</th>
<th>AoA first prod</th>
<th>CDI comp%</th>
<th>CDI comp%</th>
<th>CDI comp%</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Top (toy)</td>
<td>02.06.25</td>
<td>04.02.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Daddy</td>
<td>02.07.06</td>
<td>03.01.25</td>
<td>86</td>
<td>93</td>
<td>96</td>
</tr>
<tr>
<td>17</td>
<td>Juice</td>
<td>02.07.14</td>
<td>03.08.07</td>
<td>31</td>
<td>67</td>
<td>89</td>
</tr>
<tr>
<td>18</td>
<td>Jump</td>
<td>02.07.18</td>
<td>04.01.15</td>
<td>9</td>
<td>23</td>
<td>43</td>
</tr>
<tr>
<td>19</td>
<td>Step</td>
<td>02.07.19</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Round/about</td>
<td>02.08.15</td>
<td>02.08.23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>More</td>
<td>02.08.19</td>
<td>03.02.13</td>
<td>14</td>
<td>34</td>
<td>67</td>
</tr>
</tbody>
</table>

Organisation of the WE production data

Two other subsets of the WE list presented the production data separately. The full production list was the WE list for production data, containing every entry for each word event in production. It was sorted into two separate schemata. The first were grouped data; for example, all the utterances for the word event bear. The second was in chronological order, and contained all the production entries of the various word events for each consecutive day.

Another sorting, the Short Production data list illustrated in Table 4.11, presented the production acquisitions on one line per word event, in the order they were acquired. It illustrates the age and time of the stages in the acquisition for each utterance and/or sign, from first try to early form to full acquisition. The time it took for Graeme to acquire a production was variable, as noted above in the section on Grouped data. The first try could co-occur with acquisition, as in look. Alternatively, there could be a few days of practise before acquisition, as in this little pig, or there could be six months before the word event is used voluntarily, as in bye bye. Either the signed or vocalised form could be acquired first.
Table 4.11  The short production data list

<table>
<thead>
<tr>
<th>Order of prod/acq</th>
<th>Words/signs</th>
<th>First try</th>
<th>Sign</th>
<th>Early vocal form</th>
<th>Age of convent'l form</th>
<th>Word event order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Down.</td>
<td>No data</td>
<td>02.06.24</td>
<td>02.05.27</td>
<td>04.02.24</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Up</td>
<td>No data</td>
<td>02.07.16</td>
<td>02.05.27</td>
<td>04.00.30</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>I want it</td>
<td>02.05.27</td>
<td>03.04.18</td>
<td>02.06.00</td>
<td>04.03.21</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Knock knock</td>
<td>No data</td>
<td>02.06.04</td>
<td>n/a</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Look (comment on object)</td>
<td>02.06.08</td>
<td>02.08.08</td>
<td>02.08.08</td>
<td>05.01.22?</td>
<td>22</td>
</tr>
<tr>
<td>6</td>
<td>Greeting</td>
<td>02.07.02</td>
<td>02.07.20</td>
<td>03.02.29</td>
<td>04.02.00</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>Round</td>
<td>02.08.15</td>
<td>02.08.23</td>
<td>03.04.16</td>
<td>04.00.30</td>
<td>23</td>
</tr>
<tr>
<td>8</td>
<td>Hide n seek</td>
<td>02.06.00</td>
<td>02.06.06</td>
<td>02.09.04</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>This little pig</td>
<td>02.09.15</td>
<td>02.09.18</td>
<td>n/a</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>10</td>
<td>Name question</td>
<td>02.10.10</td>
<td>02.10.13</td>
<td>02.11.15</td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>11</td>
<td>Bye bye</td>
<td>02.06.12</td>
<td>03.00.05</td>
<td>03.05.21</td>
<td>03.11.19</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>Dog/bark</td>
<td>03.00.05</td>
<td>03.00.17</td>
<td>03.00.08</td>
<td>04.00.16</td>
<td>51</td>
</tr>
<tr>
<td>13</td>
<td>Pig/oink</td>
<td>02.11.16</td>
<td>n/a</td>
<td>03.00.08</td>
<td>03.08.12</td>
<td>82</td>
</tr>
<tr>
<td>14</td>
<td>Cow/moo.</td>
<td>02.11.19</td>
<td>n/a</td>
<td>03.00.11</td>
<td>04.00.14</td>
<td>80</td>
</tr>
<tr>
<td>15</td>
<td>Horse/neigh</td>
<td>02.11.16</td>
<td>n/a</td>
<td>03.00.12</td>
<td>&lt;04.01.26</td>
<td>112</td>
</tr>
<tr>
<td>16</td>
<td>Bear/growl</td>
<td>03.00.12</td>
<td>n/a</td>
<td>03.00.14</td>
<td>03.05.03</td>
<td>46</td>
</tr>
<tr>
<td>17</td>
<td>Cat/miaow.</td>
<td>03.00.17</td>
<td>03.02.15</td>
<td>03.00.17</td>
<td>03.08.07</td>
<td>69</td>
</tr>
<tr>
<td>18</td>
<td>no</td>
<td>03.00.24</td>
<td>02.05.27</td>
<td>03.00.24</td>
<td>04.04.04</td>
<td>5</td>
</tr>
</tbody>
</table>

Only *bye bye* and *no* of Graeme’s early word/signs in the *sign* and *early vocal form* columns were conventional words or signs; the others were idiosyncratic, invented and/or onomatopoeic. Though beyond the scope of this study, Graeme’s age at the time he acquired the conventional forms, (in some cases this was in the form of an initial whispered consonant), is given for the sake of interest.

**The semantic categories organisation**

The organisation of the semantic categories sorted the acquired words in the comprehension and production lexicons from the short versions on the WE list into their

---

28 The headings are abbreviated: *prod* is production, *acq* is acquisition, and *convent'l* is conventional.
semantic categories, in order to compare Graeme’s semantic acquisition with that of typical children. These categories were proper names, food, toys/objects of fascination, everyday and household objects, parts of the body, clothing, social action games and routines, relational/locative, and colour/attribute/state terms Benedict (Benedict, 1979; Dromi, 1987; Fenson, 1989; Nelson, 1973; Rescorla et al., 2001). The CDI comprehension percentages were also included in this table for purposes of comparison.

Words were sometimes placed in more than one category. Words denoting social action games and routines overlapped with relational/locative words; e.g. *step* and *jump*. Toys/objects of fascination included many everyday items and household objects such as *fire*, *hole*, *string*, *button*, and *words/writing*, although in fact Graeme predominately, if not exclusively, learned words only for things that interested him. The distinction therefore is one of degree; objects of fascination were those for which Graeme had an extreme enthusiasm.

**The babble data organisation**

The linguistic data on Graeme’s babbling was not included on WE list because it was neither meaningful nor intentionally communicative. Babbling, however, was of interest in Graeme’s unusual language ontogenesis because he had ceased his early babbling at around 01.00 and did not resume until 02.06, and then only sporadically. The data on Graeme’s babbling showed his phonological development over time, as he overcame his resistance to uttering speech sounds and to vocalising in social situations. Table 4.12 contains selections from the babble data.

**Table 4.12 Babble data**

<table>
<thead>
<tr>
<th>Age date</th>
<th>IPA</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>00.04.30</td>
<td>[a]</td>
<td>Tape--imitated me [a], giggle</td>
</tr>
<tr>
<td>00.06.14</td>
<td></td>
<td>Tape--affected laugh and cough for interaction</td>
</tr>
<tr>
<td>00.06.19</td>
<td>[dad a dad a ge ge ge] u</td>
<td>Tape cranky babbling, peek a boo laughing</td>
</tr>
<tr>
<td>02.06.10</td>
<td>[wha wha wha]</td>
<td>I said it to G, G imitated</td>
</tr>
<tr>
<td>Age date</td>
<td>IPA</td>
<td>Notes</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>02.07.17</td>
<td>[wa wa] [di dyi], [dae dae dae]</td>
<td>A few times, with parents and solitary</td>
</tr>
<tr>
<td>02.08.26</td>
<td>[ay ay ay] [u:wa], [wuh wuh wuh]</td>
<td>Loved that G imitated his sounds, likes an exchange of babble</td>
</tr>
</tbody>
</table>

**Summary**

The word event (WE) was the primary unit of analysis. The WE list, coded in an Excel table, was the primary tool of lexical analysis. Developing the analytical tool of the WE list necessitated defining the lexical status of a word event, and determining its entry point of acquisition into Graeme’s lexicons. The WE list revealed the nature of the lexicon as a whole, the complexities of its development, and the trajectory of Graeme’s word learning. There were two organisations of the data: grouped data and daily chronological order. The grouped data ordering explicated Graeme’s lexical development over time, showing the order in which the word events were learned. It also revealed how long it took to acquire a word in the modalities of both comprehension and production. This organisation detailed the linguistic and non-linguistic contexts in the history of the learning of each word event and its semantic, phonetic, phonological, and pragmatic variations. Grouping data in the WE list facilitated the analysis of the difference between the early and later word forms. The daily chronological order showed the pace of lexical acquisition and related it to his cognitive and social developmental signposts. The WE list was also sorted into various organisations in order to display particular segments of the linguistic data, such as semantic categories, production, and babble, and to enable efficient data searches.

Benedict’s (1979) criteria to determine lexical acquisition status in comprehension for typically developing children (a correct and consistent response to the word or sign alone, verified within the following days) were used for Graeme’s comprehension. These criteria were amended for some of the first 30 words in comprehension, to include words that Graeme understood in context, and with the assistance of gestures by others. The first 30 word events in Graeme’s lexicon in comprehension were given acquired status when it
could be determined that he had some real-world referent or concept for the word or phrase, and consistently responded to its verbal or signed use. In order to determine a word/sign’s point of entry into Graeme’s production lexicon, the criteria of productivity, continuity, and spontaneous use were applied: a word/sign had to be repeated, and used with more than one person, although there could be variations in its form and extensions of meaning (Menn, 1976; Vihman & McCune, 1994).

The definition of early words/signs for Graeme’s production data was extended to include all his consistent, meaningful, intentional communicative productions: invented and taught gestures; and idiosyncratic, non-dictionary, context bound, and onomatopoeic words containing non-speech sounds. This extension was done on the basis of a lack of agreement among researchers over the distinctions between the earliest words, intentional communication, context bound words, and referential words, and on the basis that Graeme’s meaningful earliest word/signs, as a language-delayed child with autism, were significant in his production lexicon.

The Social/Cognitive Development list

Introduction

The Social/Cognitive Development (SCD) list was the analytical tool that specified details on Graeme’s emerging and continuing behaviours. It was drawn from data from the daily diary observations, as well as from assessments, that noted his developmental achievements and major benchmark events. This Excel workbook organised the data on the daily changes in Graeme’s behaviours, play, and conceptual and physical developments that explicated the transitions in his growth. It was the social/cognitive counterpart to the linguistic data in the WE list. However, rather than having one taxonomy like the WE list, the SCD list was coded into categories to track change and growth in the areas of cognition, social behaviour, and characteristics of autism, as they emerged, continued, and faded out. The SCD events logistically corresponded to the WE
list by time, through the age date on which they occurred, to facilitate the correlation of lexical and social/cognitive growth.

The organisation of the SCD list

The data in the SCD workbook was organised into six informational columns, as follows.

1. Age: entries were ordered chronologically by Graeme’s age in order to correlate these data with the concurrent lexical acquisition data in the WE list.

2. Codes and subcodes for behavioural categories: coded abbreviations for the observations on social/cognitive abilities and characteristic behaviours, in order to simplify retrieval of data for analysis from the 1335 entries for this time period.

3. First instance of emerging behaviours: each new advance in Graeme’s development on the day that it occurred.

4. On-going activities: continuing behaviours and activities, including persistent autistic behaviours.

5. SCD milestones: observations of significant developmental events that could trigger change in lexical acquisition.


A sample from the SCD list is in Appendix B.

Emerging and continuing behaviours

Observations on Graeme’s behaviour for each day, entered chronologically by age date, were divided into two columns for emerging and on-going behaviour. Graeme’s emerging behaviours were distinguished from his on-going activities in separate columns in the SCD list. The first instance of emerging behaviours column revealed new developments while the on-going activities column charted the duration of behaviours and the pace of development by tracking his typical behaviours and activities, including those that were characteristic of ASD. New and typical behaviours were more perceptible than those that were fading. The milestones column commented on a new behaviour or a
cluster of behaviours that indicated a change in developmental stage. Table 4.13 displays columns three, four, and five in the SCD list at 02.07.08, illustrating the distinction between emerging and continuing behaviours, and the aspects of social/cognitive developmental milestones that the new behaviours revealed.

**Table 4.13  Entries for emerging behaviours and on-going activities at 02.07.08**

<table>
<thead>
<tr>
<th>First instance of emerging behaviours</th>
<th>On-going activities</th>
<th>SCD Milestones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doorknobs and tops all day.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spins top on wall, on different surfaces.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put his ear to speaker to hear symphony.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tried to open gas meter using pencil as screwdriver.</td>
<td>New (and unwelcome) advance in tool use.</td>
<td></td>
</tr>
<tr>
<td>Didn't notice bird in cage, just played with cage knob.</td>
<td>Used a picture to request an object.</td>
<td></td>
</tr>
<tr>
<td>Pulled me to the pic of his top on the box when he wanted it.</td>
<td>Still won't imitate me. Won’t touch his nose when I put a red dot on it and hold him to the mirror.</td>
<td></td>
</tr>
<tr>
<td>Laughed at light reflections.</td>
<td>Stacking and seriating dominos.</td>
<td></td>
</tr>
<tr>
<td>Now looks up and around in his bike seat, not just down.</td>
<td>More observant of his environment, not entirely focused on spinning wheels.</td>
<td></td>
</tr>
<tr>
<td>Figured out his escape route loop of front and back doors and basement stairs.</td>
<td>Still hugely interested in new swinging gate and hinges.</td>
<td></td>
</tr>
</tbody>
</table>
The variables in the SCD taxonomy

The SCD data were not grouped as the entries for each word event were. Instead, the entries in the emerging and on-going behaviour columns describe a range of social/cognitive abilities, characteristic behaviours, and activities that were categorised, subcategorised, and coded to form the SCD taxonomy. Each item in these categories and sub-categories can be regarded as its own unit of analysis with a coherent set of determinants, and thus as an independent variable in the SCD taxonomy. The taxonomy provided information on the steps in Graeme’s learning, tracked the evolution of specific behaviours, such as types of play, and revealed patterns of development when several emerging behaviours co-occurred and a milestone was reached. Table 4.14 shows the SCD taxonomy, with examples from various age dates.

Table 4.14  The SCD list taxonomy

<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Examples</th>
<th>Age dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social/pragmatic ability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint attention</td>
<td>Ja</td>
<td>Played <em>ta</em>, giving and taking an object.</td>
<td>02.07.02</td>
</tr>
<tr>
<td>Relating behaviours (also coded as social)</td>
<td>Rb</td>
<td>Notices and stares at other children; no vocalisation, smiles, or approaches.</td>
<td>02.06.05</td>
</tr>
<tr>
<td>Imitating</td>
<td>Im</td>
<td>Imitated D picking clovers, something he hadn't seen before.</td>
<td>02.07.06</td>
</tr>
<tr>
<td>Pointing</td>
<td>Point</td>
<td>Pointed to objects.</td>
<td>02.06.11</td>
</tr>
<tr>
<td>Cognitive ability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorting</td>
<td>Sort</td>
<td>Sorts beads by colour and type.</td>
<td>02.07.24</td>
</tr>
<tr>
<td>Conceptual advances</td>
<td>Concept</td>
<td>Couldn’t figure out how to turn jar over to get marbles out, frustrated.</td>
<td>02.05.29</td>
</tr>
<tr>
<td>Symbolic growth</td>
<td>Sg</td>
<td>Looks at drawings or photos of things he owns for a long time.</td>
<td>02.08.02</td>
</tr>
<tr>
<td>Language</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of utterance</td>
<td>Mlu</td>
<td>Likes me to use longer MLU's, asks for more repetitions when I’ve used a sentence with 3 nouns, especially a preposition phrase.</td>
<td>03.00.10</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Com</td>
<td>Now responds to his name as well as to noise at preschool.</td>
<td>02.05.16</td>
</tr>
<tr>
<td>Babble</td>
<td>Babble</td>
<td>Answers praise, e.g. <em>good boy</em>, with babbling.</td>
<td>02.08.02</td>
</tr>
<tr>
<td>Semantic distinctions</td>
<td>Sem</td>
<td>Interested in distinctions within semantic fields, eg <em>leg, ankle, foot</em>.</td>
<td>03.00.10</td>
</tr>
<tr>
<td>Category</td>
<td>Code</td>
<td>Examples</td>
<td>Age dates</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Animal names and sounds</td>
<td>An</td>
<td>Intense and serious when parents make animal sound after the word. No imitation.</td>
<td>02.11.18</td>
</tr>
<tr>
<td>Colour</td>
<td>Col</td>
<td>Very curious when D labelled <em>orange</em>. He knows the word only as food, plus it was a new colour distinction from <em>red</em>.</td>
<td>03.00.07</td>
</tr>
<tr>
<td>Speech sound</td>
<td>Ss</td>
<td>The use of a speech sound in babble or in meaningful vocalisation.</td>
<td>00.06.19</td>
</tr>
<tr>
<td>Non-speech sound</td>
<td>Non ss</td>
<td>Likes slowing down and speeding up his animal sounds talking toy to distort the sound.</td>
<td>03.00.06</td>
</tr>
<tr>
<td>Requesting</td>
<td>Ask</td>
<td>Reaches and points at objects with his asking noise, asking for object not its name.</td>
<td>02.09.26</td>
</tr>
<tr>
<td>Physical gesture, facial expression</td>
<td>Sign</td>
<td>New silent greeting gesture.</td>
<td>02.10.25</td>
</tr>
<tr>
<td>Intentional communication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Request for action</td>
<td>Ra</td>
<td>Asked me for <em>round about</em> game for comfort by pulling my hand over.</td>
<td>02.08.14</td>
</tr>
<tr>
<td>Protest</td>
<td>Protest</td>
<td>Flaps his arm laterally, crossly, when a child takes his items from his line up.</td>
<td>02.08.15</td>
</tr>
<tr>
<td>Avoiding behaviour</td>
<td>Avoid</td>
<td>Pulled F away to avoid me when I came home.</td>
<td>02.10.13</td>
</tr>
<tr>
<td>Request for object</td>
<td>Ro</td>
<td>Held out his hands as F was running water to give him a drink after he drank hot sauce.</td>
<td>02.09.04</td>
</tr>
<tr>
<td>Play</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensorimotor play</td>
<td>Smpl</td>
<td>Mastered stacking rings, graduated blocks, does not expand play.</td>
<td>02.05.16</td>
</tr>
<tr>
<td>Pretend play</td>
<td>Prpl</td>
<td>Puts toy animals in and out of train, links carriages.</td>
<td>02.09.26</td>
</tr>
<tr>
<td>Music</td>
<td>Music</td>
<td>Closes my mouth when I sing. I’m out of tune.</td>
<td>03.00.24</td>
</tr>
<tr>
<td>Autistic characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autistic characteristics</td>
<td>Aut</td>
<td>Responded better to environmental sounds than speech in testing.</td>
<td>02.02.02</td>
</tr>
<tr>
<td>Lining up</td>
<td>Lu</td>
<td>Lining up spice bottles.</td>
<td>02.05.26</td>
</tr>
<tr>
<td>Physical skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross motor</td>
<td>Gm</td>
<td>Crawled across the length of the flat</td>
<td>01.00.17</td>
</tr>
<tr>
<td>Fine motor</td>
<td>Fm</td>
<td>Stacked three blocks</td>
<td>01.06.00</td>
</tr>
</tbody>
</table>

The coded categories described broad overlapping areas or highly specific behaviours.

For example, symbolic growth was a large category that consisted of increases in
perceptual and conceptual knowledge. Symbolic growth included identifying recurrences of prior sensual experiences, association of events, representational ability including object permanence, and the ability to form concepts including semantic extension and intension. If a variable pertained directly to lexical acquisition, such as semantic distinctions and sorting into similarity relationships, or to aspects of language acquisition that related to ASD, such as joint attention, pointing, line-ups and pretend play, it was coded separately. Autistic characteristics included emotional displays, special enthusiasms and fears, and Graeme’s highly developed skills at avoiding greetings, which reflected his discomfort with transitions. Many entries had more than one coding. For example, asking for names and pointing could be coded specifically or included in the category of comprehension, to facilitate a broad or narrow focus in analysis. The data on the SCD list correlated with the age dates on the chronological WE lists. Appendix B contains a sample of the SCD list.

Language-related activities could appear as emerging behaviours entries on the SCD list as well as the WE list, because when all the new behaviours were on the same list it was easier to track the relationship of both developmental streams. SCD language entries were more general than those detailed on the WE list and signalled a change in emerging patterns of lexical development. Examples of language related activities on the SCD list included instances in which Graeme first asked for a name, made new semantic distinctions, communicated intentionally in a novel way, was first receptive to the purely social use of language, began production of animal sounds, and showed a change in understanding a longer MLU.

**Summary**

The research methods used to analyse the data were: first, designing tools to organise the data in an accessible and retrievable manner; second, determining the criteria for acquisition of the comprehension lexicon and early word/signs in the productive lexicon; and third, defining the units of analysis and the descriptive categories for the lexical and behavioural acts and social/cognitive benchmarks. The organisational tools designed
were two taxonomies: the WE list for the lexical data, and the SCD list for the social/cognitive data. The WE list demonstrated the order and processes with which Graeme acquired his lexicons. It was a large workbook of 951 entries, with 18 columns of information for each entry. Data were provided for these categories: age dates of the entry, its order in Graeme’s lexicons, the age of full acquisition (AoA), the variations in meaning, descriptions of the form in production, the linguistic and environmental context, the pragmatic function, and linguistic notes. This taxonomy was sorted into two presentations: (a) daily chronological order, which showed the pace of acquisition and the development of Graeme’s lexicons over time, and (b), grouped data, which detailed the processes of acquisition within each word’s history. The point of origin into the lexicon is part of a gradual, continuous process of acquisition, as the entries in the WE list demonstrate. These processes included partial acquisition in both modalities in meaning and form prior to its full lexical status at AoA, such as: aspects of incomplete understanding in comprehension, initial less intelligible, and context bound attempts at sign and utterance in production, earlier imitations, and underextensions. It also includes the subsequent acquisition of the word’s semantic extensions.

Other methods of presenting subsets of data from the WE list included workbooks to analyse specific aspects of Graeme’s word learning such as semantic categories and production, as well as shorter and alphabetised workbooks for efficient retrieval. There was also a workbook with data on Graeme’s babbling.

The SCD list was the taxonomy in which data on Graeme’s daily emerging and continuing behaviour were organised in categories to show developmental variables in his conceptual and perceptual growth. These included representational ability, social and autistic behaviour, solitary play, and physical prowess. These categories were coded to facilitate the analysis of Graeme’s growth and delays in his emerging and continuing social/cognitive developments, as well as fading behaviours and activities. The taxonomy tracked the rate and pace of his development and the signposts that signalled a transition to a new stage. This list was coded by age dates to correlate the data with those in the WE list. These data organisations facilitated the identification of related linguistic and
behavioural events from naturalistic data, in order to determine, empirically, the transitions that signalled new phases of lexical and social/cognitive development, as Graeme overcame the language impairments and delay of ASD.

Benedict’s (1979) criteria to determine lexical acquisition status in comprehension for typically developing children were used for Graeme’s comprehension. Lexical status depended on the word’s productivity and continuity. Graeme must have shown a correct and consistent response to the word or sign alone, verified within the following days. These criteria were amended for some of the first 30 words in Graeme’s lexicon in comprehension, to include words that Graeme understood in context and with the assistance of gestures. The justification for this extension of Benedict’s criteria was that Graeme had up until 02.00 had not indicated any lexical comprehension, giving greater significance to his first steps toward understanding words. Another justification was that many of the earliest words in Graeme’s receptive vocabulary described events as a whole, therefore they could not be divorced from their context. The first 30 word events in Graeme’s comprehension lexicon, whether or not they were context dependent, were given acquired status when it could be determined that he had some real-world referent or concept for the word or phrase, and consistently responded to its verbal or signed use.

In order to determine a word/sign’s point of entry into Graeme’s production lexicon, the criteria of productivity and continuity were applied: a word/sign had to be repeated, and used with more than one person, although there could be variations in its form and extensions of meaning (Vihman & McCune, 1994). If a word/sign fulfilled these criteria, it was entered into the Word Event list as having acquisition status at the first instance of its spontaneous use (Menn, 1976).

Because there is a lack of agreement over the distinctions between the earliest words, intentional communication, context bound words, and referential words, and in order to fully examine the incremental developmental process of the aspects of lexical acquisition in a language-delayed child with autism, I extended the definition of early words/signs for Graeme’s data. My extended definition includes all his consistent, meaningful, intentional communicative productions: invented and taught gestures; and idiosyncratic,
non-dictionary, context bound, and onomatopoeic words containing non-speech sounds. While this definition accords with Menn’s (1976) spontaneous use criterion, Vihman and McCune’s (1994) continuity and productivity criteria, and Tager-Flusberg and colleagues’ (2009) data collection criteria, it does not meet these authors’ lexical, phonological, or pragmatic tests for first words.
Chapter 5: Graeme’s Lexical Acquisition from Birth to 02.09.28 during the Period of Slow Word Learning

Introduction to the findings presented in Chapters 5 and 6

These two chapters, which present the findings from the data analysis, focus on Graeme’s lexical acquisition over a 3-year time period, beginning at his birth. The chapters address my two research questions. The first question is:

What is the relationship between Graeme’s delayed and unusual early lexical acquisition, in both comprehension and production and the major developmental milestones in his cognitive and social growth?

The findings chapters examine the relationship between his lexical acquisition and his social/cognitive development. Graeme’s atypical social behaviour, variations in cognitive development, and aspects of his language delay and ASD affecting his lexical acquisition are described. The majority of Graeme’s word learning during this time was in comprehension. His production consisted of babble, intentional communication, and early word/signs. The Findings chapter examines Graeme’s productions to address the second research question:

Can the meaning and function of the initial idiosyncratic productions justify the inclusion of these in the early lexicon as word/signs and how does this inclusion explicate the definition of what comprises a word in the lexical acquisition of autistic children?

Graeme’s word learning is discussed in the following order. The sections of Chapter 5 and Chapter 6 are named for the dominant linguistic development of that period.

Chapter 5, Part 1: The prelinguistic period

Chapter 5, Part 2: The onset of Graeme’s lexical acquisition

Chapter 5, Part 3: The period of slow word learning
Chapter 5, Part 1, the prelinguistic period, summarises Graeme’s first two and a half years of life, describing his delay in language acquisition, the various assessments of his development, and his social/cognitive behaviours during this period. Part 2 examines the social/cognitive growth spurt that immediately preceded the onset of Graeme’s comprehension at the onset of his word learning around 02.06.00. His continued linguistic and social/cognitive development during the slow period of word learning in comprehension from 02.06 until 02.09.28 comprises Part 3. The onset of acquisition of early words/signs in his productive lexicon, his rates of lexical acquisition in comparison with those of TD children, context bound words in his comprehension, and his language input are also discussed in this section.

Chapter 6 examines the social/cognitive development that appeared to lead to his word spurt in comprehension. It also covers his production and his semantic development during that period. Journal entries and photographs supplement the text.

In these chapters, I present the data, interpret it, and relate it to the literature. The data in the findings chapters correlate Graeme’s major developmental milestones with his most important achievements in lexical acquisition in both comprehension and production: the onset of word learning, the systemic reorganisations during the word spurt, and the development of word meaning.

**Part 1: The prelinguistic period from birth to 02.06**

**Introduction**

This section will give an overview of Graeme’s linguistic and cognitive development in his prelinguistic period, from infancy to around 02.06, prior to the onset of word learning.
During the period from Graeme’s birth until 02.02, the data for the WE list and the SCD list\textsuperscript{29} are drawn from sporadic tape recordings, notes I made in his baby book from his birth, assessments by Graeme’s paediatrician, and observations made by the Infant Development Programme (IDP)\textsuperscript{30}, a programme in Vancouver that provided rehabilitative therapies for infants identified as developmentally delayed. Graeme’s development in infancy was closely monitored by medical professionals because he had had difficulties at birth and a seizure at 00.00.21. At 00.04.00, his delay in physical milestones resulted in his enrolment in the IDP. Graeme continued to receive support and therapy through this programme until he was referred for assessment at CHDC at 02.02. Between 02.02 and 02.05, more formal assessments were made by Dr. Ingram of the University of British Colombia and the B.C. Children’s Hospital Diagnostic Centre (CHDC).

**Social/cognitive growth in the prelinguistic period**

The data illustrate Graeme’s social skills in infant/adult interaction in his prelinguistic period. His lack of joint attention skills, his solitary play, and his autistic-like behaviours demonstrate his delayed social development. The data show a similar delay in cognitive abilities of imitating, general symbolic capacity, and to a lesser degree, in early object categorisation. At 01.01 Graeme was assessed by the IDP using the Gesell Developmental Test (Gesell & Doll, 1953), on which he performed all personal/social items at a level of 00.11, in contrast to his language level of 00.09. On this test, he was delayed in his physical milestones; he was assessed in all gross motor items at a level of 00.08, and in the adaptive and fine motor items at a level of 00.09 to 00.11. He was described as “personable and pleasant, and demanding attention from adults”.

Developmental motor milestone delays are associated with early language delay and lower comprehension abilities in children with autism (Eisenmajer et al., 1998; Lord et al., 2004).

\textsuperscript{29} Samples from the WE list and the SCD list are in Appendix B.
\textsuperscript{30} The observations of Graeme’s development below are drawn from these sources, prior to the beginning of the diary in 02.05, when a summary of Graeme’s development at that point prefaced the daily entries from 02.05.
During his first two and a half years, as his assessments between 02.02 and 02.05 show, Graeme did not imitate adult actions, the sole exception being that he made a good imitation of a pincer grip at 01.00.03. However, this gesture of bringing his index finger and thumb together happened to be one that he often enjoyed for long periods in solitary play.\(^{31}\) One sign of general symbolic growth was his response to his mirror image, which he patted at 01.01.\(^ {32}\) His attention to musical sounds was apparent early (Figure 5.1).

![Playing his piano (01.04)](image)

**Figure 5.1**  Playing his piano (01.04)

He also showed a keen interest in tool use (Figures 5.2).

\(^{31}\) Noted in IDP assessment at 00.08.15.

\(^{32}\) Baby book entry.
By 02.02, Graeme still indicated little evidence of joint attention and intersubjectivity, which are considered to be the social/cognitive foundation of word learning (Akhtar et al., 1991; Carpenter et al., 2002). It is the ability that is reported to be the most impaired in young children with ASD (Adamson et al., 2005; Adamson et al., 2010; Carpenter & Tomasello, 2000; Charman, 2003; Dawson et al., 2004; Loveland & Landry, 1986; Mundy et al., 1994). Like other children on the spectrum, Graeme had difficulty responding to verbal and non-verbal communications to direct his attention (Baird et al., 2000; Baron-Cohen et al., 1996; Carpenter et al., 2002; Landry & Loveland, 1988).

Judging from the data in Graeme’s baby book and the IDP reports, Graeme’s social abilities appear to have plateaued in the year before he was two. He would spontaneously

\[ \text{Data drawn from the CHDC assessments, and Dr. Ingram’s assessments, in Appendix A.} \]
initiate interactions through intentional behaviours, usually to protest, or to request an object or action, rather than to comment or invite participation. Graeme responded positively to adult-initiated affection or interaction if it did not interrupt his solitary perseverative activities. He participated a little in a few interactive games, responding with giggles to a round of this little pig at 02.02, and by 02.03 to a game of knock knock come in that centred on doors, objects of continuing fascination to him. However, he did not respond to an adult’s attention-getters by making eye contact, by gaze following, or by following pointing by others, nor did he establish attentional engagement by using his own direction of gaze. He usually looked down, and rarely made eye contact, especially with anyone outside his small circle of intimates. Not until 02.05.28 did he begin to look at us, his parents, when he wanted us to participate in interaction with him. Cantwell, Baker, Rutter, and Mawhood (1989) found that 2-year-olds with ASD produced fewer vocalisations in social situations than TD children, and that these were less often accompanied by shifts of gaze, gestures, or changes in facial expression. Attentional impairments, such as a lack of eye contact, lack of orienting to name, lack of imitation, and low social interest are indicators of ASD (Mitchell et al., 2006; Zwaigenbaum et al., 2005). Graeme’s development in object categorisation was more advanced than other areas of his cognition, as noted in Dr. Ingram's assessment. He perceived similarities in blocks, first attempting to build a tower at 01.01, and was able to stack six blocks by 01.04 (Figure 5.3).

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34 The journal began with notes on earlier behaviours.
By 02.04 he had begun to line up items, an activity that preoccupied him for the next two years and, along with spinning objects, was his favourite solitary play activity (Figure 5.4).
By the end of his prelinguistic period there was a qualitative change in Graeme’s classification ability. He could seriate and sort objects on the basis of similarity to fine levels of difference, as the journal selection for 02.05.28 illustrates.

**Journal entry**

**02.05.28**

Cried at preschool when F came to pick him up--realised F’s arrival meant leaving his new delight--crayons. F bought him some today. He grasps one in his fist and bangs it on the paper to create dots. When shown hand-on-hand he moved the crayons back and forth to make lines and circles. He puts all the crayons at the same level, same end up, in one hand, as he’s been doing with all pen-like objects since 02.04. Lines up crayons side by side and gets the tops even. Hunkers down beside coffee table to gaze at the crayon line-up at eye-level, whispering his pleasure sounds [uwau] or "creaking". Occasionally says [wa:u wa:]. [aeng] is a sound he makes when he discovers something, e.g. some tidying up to be done in the crayon line-up. All these sounds are non-communicative expressions, in solitary play. Runs a few steps back and stamps his feet happily, then runs back to the line-up. He put crayons against different surfaces e.g. the wall, the fireplace.

He took the crayons into his place behind the bedroom door to peel the paper off them. Brought them back and lined them up end to end along the coffee table. Protested shrilly when I took 2 crayons from line-up, laughed when I held one in each hand and drew parallel lines. He changed the line-up to a more complex pattern: point to point, end to end, point to point, end to end. Put 2 crayons on the rug and ran in circles around them

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35 Journal entries are excerpted. Complete entries for these selections can be found in Appendix B. They are verbatim, with a few exceptions of light editing for clarity.
for several minutes, calling [aaayee*] at a very high pitch, which seemed to express delight and possession.

Figure 5.5   Stacking blocks at CHDC (02.05)

Intentional communication in the prelinguistic period

During his two and a half year prelinguistic period, Graeme’s earliest gestures and vocalisations, in keeping with those of TD pre-linguistic infants, expressed wishing, protesting, and noticing objects and events in his environment (Clark, 2003). Graeme’s productions, however, were not usually intentionally communicative, but, rather, non-directed expressions of his emotional states of mind, while his father and I supplied the attributions of meaning and interpretations (Calandrella & Wilcox, 2000). Like many other children with autistic traits, Graeme did not point to objects and events to direct the adult’s attention towards the object (Carpenter et al., 2002; Parisse, 1999), nor did he use objects to gain attention from an adult (Curcio, 1978). Instead, he tantrumed and employed idiosyncratic gestures, such as banging an object in frustration, or guiding his parents’ hands to get or do what he wanted (Donnellan & Mirenda, 1983; Loveland & Landry, 1986; Stone, Ousley, Yoder et al., 1997; Tomasello & Camaioni, 1997). He
usually expressed the pragmatic functions of requesting through vocal inflections, such as a high-pitched whine, or scream, when he wanted an item, or by silently attempting to get adults to act by pulling their arms or hands. Graeme protested by shrieking, crying, shaking his head, and pushing our hands away. An idiosyncratic gestural example from 02.00 occurred when he protested against the possibility that F might disturb his line up of milk cartons, by lightly clasping and flapping his hands together as if shaking a ketchup bottle.

Crying was Graeme’s main form of communication. By 02.00 (in the following journal entry of 02.06.09) Graeme produced six types of crying that signalled different emotional states.

**Table 5.1 Types of crying (journal entry 02.06.09)**

<table>
<thead>
<tr>
<th>Type and context</th>
<th>Vocal and physical characteristics</th>
<th>Gestures and actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angry cry, when thwarted or frustrated.</td>
<td>Immediate onset. Big, loud, furious sounding. Few tears. Plethoric face. Usually short duration.</td>
<td>Hands up to eyes, looks at us out of the corner of one angry eye. Sinks to floor, bum first, rolls over to lie on his face, still looking. Arches away if picked up, hitting at our hands.</td>
</tr>
<tr>
<td>Red Queen. Full temper tantrum.</td>
<td>As above but more intense and purple faced.</td>
<td>Collapses or hurls himself onto the floor. Bangs head.</td>
</tr>
<tr>
<td>Sad cry. When put to bed, or F leaves.</td>
<td>Starts with agitation, indrawn breath. Lots of tears, runny nose.</td>
<td>Runs to us and asks to be picked up, then stops crying but sobs catch his breath for a long time.</td>
</tr>
<tr>
<td>Scared cry.</td>
<td>Sudden screaming onset. Sounds afraid.</td>
<td>As above, but not such big long sobs or aftermath.</td>
</tr>
<tr>
<td>Cranky cry, when tired or sick.</td>
<td>More whiny than sobbing. Can have a long duration.</td>
<td>Not comforted by cuddles.</td>
</tr>
</tbody>
</table>

Demonstrating an early act of joint attention and communication, Graeme made the most eye contact in the angry cry, which had the most manipulative intent.

36 References are to F and me, Graeme’s parents.
Journal entry

02.06.09

Phony cry --frustration, temper, rage, manipulative intent, but not very successful in results. Immediate onset, choleric ("plethoric") face, hands up to eyes, big loud furious [wa→] looks at us around hands out of the corner of one angry eye. looks at us around hands out of the corner of one angry eye. Sinks to floor--bum first, then rolls over to put his face down on the floor, still looking out of his eye, then gets very sorry for himself and sobs. Usually of short duration with no tears. Depending on how much he wants what he is being denied, stops after first [wa]. If picked up, he arches away, struggling to get down, hitting at our hands.

At this time, Graeme had not yet developed the ability in intentional communication to point at objects he was interested in, use eye-gaze to attract attention to what interested him, or reach persistently towards objects he wanted (Namy & Waxman, 1998).

Language development before 02.02.00

The IDP worker administered the Gesell Developmental test to Graeme at 01.01. He passed all language items at the 00.09 level, the time of the onset of comprehension usually cited for TD children. Graeme did not continue developments that had begun in his first year. The supraglottal babbling that had begun at 00.05.08, and continued frequently until around 01.01.00 had gradually died out by 01.06.00, as did imitations of [a] noted at 00.04 and 00.05, and coughing affectedly for attention, at 00.06. At 01.00 children with autism are generally less responsive than TD children to their names, to someone speaking (Lord, 1995), and also to the voices of their mothers (Klin, 1991). During Graeme’s second year, the data from all sources show no development in his language acquisition. Aside from his sole linguistic development, responding to his name, he did not demonstrate any awareness of adult vocalisations as having meaning, or that they pertained to him, until he was around 02.00. At 02.00, Graeme’s comprehension consisted of having some meaning for four context dependent\(^\text{37}\) word events: *Graeme, no, good boy*, and the verbal component of the *knock knock come in* game.\(^\text{38}\).

\(^{37}\) The section on context bound words is in Part 3.
\(^{38}\) Graeme’s comprehension of these word events is further discussed in the section on his receptive lexicon in the period of slow learning, in Part 2.
By 02.02, Graeme had become predominantly, uncommonly, silent. He produced very few sounds other than crying and whining. The exceptions were occasional squealing, growling, and laughing, usually in solitary play. Occasionally, as noted in the journal entry of 02.05.28, he would make soft vocalic sounds expressing his pleasure in an aspect of his solitary play, roughly transcribed as [uwau], [waː u waː], and [æŋː:]. These vocal sounds seemed to be a self-directed monologue of self-instruction, curiosity, observation, and analytical comment on his activities, as described by Piaget (1962). He voiced them when, for example, he discovered a spot to investigate, or some tidying up to be done in the configuration of the crayon line-up. If he was especially delighted, he would also stamp his feet and run away to have a distant look, then run close up and crouch down for an eye-level look, cooing as he did so. These vocalisations did not seem to be either communicative or social since they were not directed at F or myself (journal entry 02.05.28). On occasion, he pulled objects through his teeth in order to make sounds, a demonstration of his atypical preference for environmental, non-speech sounds. In general, Graeme showed disinterest in language during his second year of life. He had a noticeable aversion to being addressed, and often turned or moved away from the speaker³⁹.

Delays in lexical comprehension and in the production of first words are a strong early indicator of ASD (Lord, 1995; Lord & Pickles, 1996; Mitchell et al., 2006; Rice et al., 2005; Rutter & Schopler, 1992). Professional and medical assessments, discussed in detail in the following sections, support these observations.

**Play behaviours in the prelinguistic period**

Although Graeme had not been assessed or diagnosed with ASD at this time, the baby book entries, IDP observations, and early diary entries noted that he exhibited behaviours typical of autism such as: his preference for solitary activities over social interactions; paying more attention to objects than people; an attraction to spinning motions; perseverating on activities; and focusing on irrelevant features of an object. One early

³⁹ These observations are from the CHDC assessment, in Appendix A.
example of this was his great absorption in tiny, barely distinguishable marks on various surfaces, prevalent between 00.08 and 01.02, though the fascination continued for several years. He would squeal, crow, and delicately and precisely touch these for hours, while conventional toys held no interest. One favourite toy was a wooden rattle with a monkey face that he shook for long periods to create its *pock pock* noise, a further example of environmental sounds capturing his interest more than speech. Another early autistic-like activity that captivated him for long periods, enduring beyond his prelinguistic period, was lying on his back looking at his fingers and cooing as he brought his pincer hand close to his eyes and took it away again. When Graeme was happy he twirled his fingers; when upset he flapped his hands. He also flapped his hands near his face in self-stimulation. Graeme’s toy play in his first year consisted of mouthing and flinging toys, progressing in his second year to sensori-motor play with some tactile, movement, sound, and visual sense experiences. The IDP physiotherapist noted that Graeme experimented with bodily sensation and motor movements, using action schemes such as pushing and grasping.

Graeme had many unusual fears, among them bubbles and corrugated tubing. Frightened of the brightly coloured toys the IDP physiotherapist brought him at 01.03.07, he preferred to play with a heavy brass question mark, the top of the wicker laundry basket, and the hinged mechanism of his high chair tray. At 01.00, he discovered electric plugs and sockets as items of great interest, one age-typical behaviour that was not welcome. At 01.01 he discovered the shadow of his hand on the floor, the first instance noted of his enduring enthusiasm for reflections and shadows. Any object that turned, twirled, or spun was a favourite, including bike wheels and spinning tops. These occupied him for hours and provoked tantrums when he was frustrated with them or when they were removed. He engaged in self-stimulating perseverative behaviour with doorknobs and doorstops, especially when he was in a new place. My speculation was that these door-related objects had enough slight variation to maintain his interest but were consistent enough to be comforting in a new environment. During this period, as noted in Dr. Ingram’s assessment, Graeme had the delay in social/cognitive abilities that affected language
onset, including joint attention, imitating, general symbolic capacity, and early object categorisation.

Assessments

Graeme’s developmental delay prompted a medical assessment when he was 02.02. Testing by the CHDC using the Structured Clinical Interview for Disorders, ascertained that Graeme had a 01.04 level of sound discrimination, no evidence of comprehension of spoken language, no display of evidence of representation sound development, and a clear preference for environmental sounds over human speech. He produced no imitation of vocal or motor behaviour, a lack that placed him at a level of under 01.00. Though he showed a symbolic understanding for the use of a key, this reflected more on his great interest in keys, locks, hinges, gates, doors, and doorknobs than on any more general symbolic capacity. Graeme attended mostly to visual stimuli, made no eye contact, and displayed no consistent relating behaviour with the examiners. A month later, at 02.03, he was enrolled in the CHDC preschool for four and a half hours a week, to determine and initiate a suitable course of developmental intervention.

Dr. David Ingram of the University of British Columbia’s Linguistics Department offered to assist in establishing a base level for language therapy. He observed Graeme’s language, cognition, and play over three visits at the end of 02.05, noting that Graeme mostly engaged in non-relational play, playing with one object at a time. His functional relational play was not well developed, and there was no symbolic play. His other observations were that Graeme had no object permanence, and could not find an object in single displacement.\(^{40}\) Representational ability was not present, and there was only a slight reflective ability to solve problems; for example, Graeme could not figure out how to turn a jar over to get marbles out, and became frustrated. He used objects and people to achieve goals. The testing showed delays in cognition congruent with delays in language. Dr. Ingram’s assessment placed Graeme’s language as a nonverbal communication

\(^{40}\) When Graeme had seen the object, and had seen it being hidden.
system at an 00.08 level, and his cognition at sensori-motor stage IV, an 01.00 to 01.04 level.

Dr. Ingram made several recommendations. Because F and I had become rather silent in our parental communication with Graeme, as a result of his distaste for speech, Dr. Ingram suggested that we address Graeme frequently. Further suggestions were to start him in a professional speech therapy programme that Dr. Ingram would design. I began to write a daily diary when Graeme was 02.05.27, starting with a summary of his development and behaviours over the preceding 6 months, with the intention of providing a record of his emerging behaviours to be used as a tool in designing the language therapy programme. G, a speech pathology student working on a programme designed by Dr. Ingram (Figure 5.6), began to work with Graeme at home around 02.07.

![Figure 5.6 Working with G](image)

**Diagnosis**

By the diagnostic standards of today Graeme displayed many indications of ASD, behaviourally and with his delays in language comprehension and production and in joint attention (le Couteur et al., 1989; Lord & Pickles, 1996; Rice et al., 2005). Delays in language and lexical comprehension are strong early indicators of ASD, and differentiate autism from other language disorders (Dahlgren & Gillberg, 1989; Lord, 1995; Rutter &
Schopler, 1992). In the more narrow definition of autism accepted in 1979, Graeme did not meet the criterion of social impairment, since he liked to give and receive affection with his family members. He was therefore diagnosed with “expressive and receptive aphasia” at that time by the CHDC\textsuperscript{41}.

**Summary**

Graeme’s prelinguistic period lasted from his birth to around 02.06. This was a period of slow development in social/cognitive abilities, and stalled development in language. Autistic behaviours predominated in his play and social interactions. His areas of cognitive strength lay in observing fine levels of differences, and categorising similar objects by stacking and seriating. Until Graeme was 02.06, he did not appear to have the social/cognitive abilities for word comprehension, nor did he give evidence of communicating other than through the pragmatic functions of gestured and vocalised expressions of wanting and protest. These delays are early indicators of ASD (Lord, 1995; Lord & Pickles, 1996; Mitchell et al., 2006; Rice et al., 2005; Rutter & Schopler, 1992). At this age, he had started to develop the skill of joint attention by making eye contact, which in the research literature constitutes the most significant social/cognitive milestone in the onset of lexical acquisition (Bono et al., 2004; Carpenter & Tomasello, 2000; Dawson et al., 2004; Delinicolas & Young, 2007; Leekam et al., 1998; Leekam et al., 2000; Mitchell et al., 2006; Mundy et al., 1994; Rogers et al., 2003; Sigman & Kim, 1999; Stone & Yoder, 2001; Zwaigenbaum et al., 2005). This achievement signalled the end of his prelinguistic period, the beginning of his intentional communication, and the onset of his lexical comprehension.

\textsuperscript{41} Later at 06.10, Graeme received a diagnosis of Pervasive Developmental Delay, NOS from CHDC. As the definition of autism became more inclusive over time, medical professionals began to refer to him as having autism. When Graeme was 10.00 his medical assessment had become autism.
Part 2: The onset of Graeme’s lexical acquisition

Introduction

This section discusses the developments at the milestone of the commencement of Graeme’s language acquisition, around 02.06. The onset of Graeme’s lexical acquisition in both comprehension of first words and initial early words/signs occurred within three weeks of a social/cognitive developmental spurt. The milestones of Graeme’s developmental spurt that appeared to facilitate the onset of his word learning, along with his play and autistic behaviours, will be examined in order to investigate my first research question. The inclusion of meaningful, functional productions as word/signs in his lexicon is investigated in terms of my second research question regarding the definition of word/signs in Graeme’s productive lexicon.

The social/cognitive developmental spurt at the onset of word learning

The onset of Graeme’s language acquisition coincided with the beginning of the diary collection. At 02.06.08, I noted Graeme had had a developmental spurt during the previous two to three weeks, with increases in joint attention, social ease, intentional communications, attention to language, and an interest in objects and interactions. He reached a cognitive milestone at 02.06.01, when he understood pointing, for the first time looking at what was indicated, rather than the finger used to point. At 02.06.08, Graeme pointed, himself, for the first time. He vaguely gestured towards an object, in a loose indication of it, lifting his hand with the palm down, and whole hand outstretched in an immature hand shape. Because he did not combine pointing with looking at another person initially, this gesture did not seem communicative in the sense of involving others, but, rather, a self-directed private comment on something that interested him, such as the fire, a tower he had built, or the spice jars. He used it only when people were present, however, and was able to co-ordinate it with gaze following at 02.06.11, when it became apparent that he was using pointing to comment communicatively.  

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42 Pointing will be further discussed in the section of the acquisition of word/signs, in Part 3.
Graeme’s achievements in joint attention ability and relating behaviour immediately contributed to his heightened interest in interactive games with a language component. He also began voluntarily listening to someone address him, and following a few directives, although he was more willing to come when called if he could see a parent. He became responsive to salutations, though his early comprehension of *hi* (02.06.10) and *bye bye* (02.06.05) were usually dependent on the context, the use of his name, enthusiastic intonation, and waving.

Graeme demonstrated increased symbolic capacity in the graphic modality with his enthusiastic recognition of the packaging of a milkshake treat, and of pictures of a cat, a cup, pens (at 02.06.10), and the box for his top (at 02.06.25). He looked intently at images, laughing and holding them at arm’s length before bringing them close to his face. In other cognitive advances, Graeme was able to solve the problem of getting objects from a box by removing the lid and spontaneously pouring them out at 02.06.08, and two days later he poured water from cup to cup. Practise play occurred in his turning, balancing, and examining his tinker toy constructions from all angles (02.06.12).

Graeme began stringing beads at 02.06.14, and combining toys, putting a bangle on the tinker toy, rather than twirling the bangle as before at 02.06.12. Line-ups became more complex and inclusive, and his sorting abilities improved: he distinguished hammer and nails from wrenches and nuts, and screwdrivers and screws at 02.06.07. As his body awareness evolved, he started holding or touching the part of himself he had hurt (02.06.08). His musical keenness manifested in his ear-to-speaker listening to records (Figure 5.7), and in his own playing with a guitar and xylophone. He was especially attentive to violins (02.07.02).

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43 The age dates of the first instance of a behaviour are given from the SCD list.
Journal entry

02.06.12

* A big exciting first today: he waved *bye bye* (no sound) to F! When we leave by the front door, he scrambles onto the window seat to look out of the window to watch us go down the porch stairs. F, L, Grandma, me, and others have been waving to him and calling *bye bye* for a while. I've been waving his hand with mine—today he did it on his own. F jumped up and down on the stairs and I rushed over and hugged the sweet boy and we praised him. He didn't repeat it but he knew something was good and he didn't cry when F left. Then 6 hours later when I left for ballet he waved to me, after F waved Graeme's hand first. * When we say *bye-bye* he turns to look now with an apprehensive expression. * Another new word receptively, Lenny! Our sweet 12 yr old white cat was on the couch, being tormented by Gray for about 20 minutes. Graeme was biting and sucking his tail tip, pulling his tail, pounding him, touching his nose, and laying his head on Lenny's stomach, finally sticking his tinker toys in Lenny's bum, whereupon Lenny, easy-going to the point of sloth, chose his moment and sneaked out without Gray's noticing. Graeme had returned to his minute examination from all directions, angles and distances, of the elaborate tinker-toy construction he and F put together--a major play activity in the past 2-3 weeks. Then I said, *Lenny! Where's Lenny?* (special *cat talk* intonation) and Gray turned and looked at where Lenny had been on the couch. He looked surprised and looked around for Lenny! So he understands *Lenny* now and maybe *Daddy*. I can't tell if he hears F coming or if he's responding to *Daddy*.

Graeme picked up the cup again today to ask for milk and mimed drinking--the onset of symbolic representation. When we get the carton from the fridge he flaps one or both hands rapidly--a kind of nod of the hand, definitely an affirmative gesture.
He seemed rather vaguely to look at where I was pointing--to Lenny, to a banana--looks more at me, as I'm naming, paying attention to speech. Doesn't imitate hand clapping.

He took me to the door by pulling my hand to ask to go out. We went for a long walk in the chilly rain today, Graeme a B.C.\textsuperscript{44} boy in his Cowichan sweater, rubbers, and a woolly tam. His hair curls up, his nose and cheeks get red, and he is so beautiful. We went to our favourite Tatlow Park, stopping at many car door locks on the way, and with lots of naughty playful running in the opposite direction. At the park, he always runs straight to the horrible musty, wet, old concrete ladies toilet, having for my boy a door knobs and house-type security appeal. He looked with interest at the jungle gym and watched briefly as I climbed up, ran for the Ladies as soon as I was on top. Afraid of swinging again--played a while with the swing, pushing it.

At the beach without me modelling he picked up stones, carried them to the edge of the mud flat and pitched them about 2-3 feet forward at the puddles*. I had modelled throwing stones at the beach for him a week ago. Stares, turns and looks after people who greet him on the street as they pass, rather than ignoring them.

The behaviours that occurred in this developmental spurt were typical of the late sensori-motor period: increases in symbolic capacity; tool use; functional practise play; initiating games; responding to cue; and the joint attention skills of eye contact, pointing, and recognising pointing. These social/cognitive achievements were the foundation for the genesis of Graeme’s lexical comprehension, his initial meaningful vocalisations, and his intentional communication.

**Graeme’s comprehension lexicon at the onset of word learning**

Graeme had the delay in the onset of lexical comprehension common to children with ASD (Mitchell et al., 2006). At the onset of his word learning, I noted in the journal that Graeme had some context dependent comprehension of his name *Graeme, no, good boy*, and *knock knock*. It was impossible to know what Graeme comprehended by the use of his name, or what his notion of self was. He did seem to know *Graeme* applied to him, though he only responded to its use by a few intimates. He may have simply understood the intonations that were used as being some form of address rather than having an understanding based on the phonetic shape of the word. F and I also referred to and addressed him with many nicknames including *Greebo* and *Poggy* but there was no indication that he understood any reference to himself in these. The use of his name with

\textsuperscript{44} B.C. is British Columbia, Canada.
instructions (e.g. Look, Graeme) aided his comprehension by attracting his attention. A milestone in comprehension occurred at 02.05.16, when Graeme first responded to his name at preschool. Characteristically, prior to that he had never responded to any speech directed to him at preschool, responding only to environmental sounds there. F and I used no to reprimand and forbid, and good boy or good to convey our general approval, most often to encourage Graeme’s eating in our constant struggle against his rigid food preferences. While he appeared to respond to the negative and positive affects of these words and/or the exaggerated intonation associated with them, they were probably more emotionally than linguistically relevant to his early understanding.

Graeme reacted most to games in which I would say something while performing an associated action. For example, in the knock knock game I would knock while saying knock knock, and then open the door saying come in. The environmental sound and act of knocking was Graeme’s most meaningful, most initiated, and most imitated social interaction, associated as it was with his deep and lasting attraction to doors and doorknobs. Graeme understood the lexical items up and down from repeatedly hearing the words while simultaneously seeing my actions in a game-related situation. I taught him up and down games at 02.05, conveying meaning with my gestures, intonation, and words. In the down game I brought my arm slowly down to place it on his face while saying down with exaggerated cadence, and for up I chanted up with a rising intonation as I raised my arm. Around this time his Grandmother taught him to understand clippety-clop, a name for a tickling hand game.

Journal entry

02.06.05

*Graeme looks up anxiously when he hears bye bye, a new word he understands. He doesn't wave or vocalise except with tears. He’s more saddened by F leaving than by me. Today he tried to pull me to follow F, then escaped through a crack in the old garage

45 A report from the CHDC preschool is in Appendix A.
46 The acquisition of knock knock is shown in Table 4.9 in Chapter 4.
47 Knock knock, up, and down will be discussed in the section below on Graeme’s earliest word/signs in the productive lexicon.
to follow him down the lane. He's very happy to see F return with a paper bag, recognises that it's a food treat.

Played with me on the monkey bars, but was very fearful when held on my lap on the swing, clung on and buried his head in my jacket--no sounds. Also stood under a 60 foot tall evergreen and looked up through the branches and smiled. He doesn't usually look up, except at aeroplanes. I'm reiterating these words: up especially for picking him up, sock and shoe when putting them on, aeroplane, Daddy (when F is heard), run when he's running, come on and come here, and bye bye.

On the beach he sat down and immediately trickled the sand through one hand. He found a stick and put sand on the point and tasted it a few times speculatively--didn't gorge on it like 6 months ago. He's Mr. Picky with his food but will eat sand, ink, double-salted liquorice, and any medicine! He likes to sit down any place with small stones or gravel, pick up a handful and throw it down. After 10 minutes of sand play, he got up and ran to within a yard of the water, to stand and look at the incoming waves, then ran and clung to me when I joined him, scared of the larger waves. He watched me throw stones in the water but didn't imitate. I ate a bit of seaweed but when I offered it to him he buried his head in my lap, then pushed my hand away. I accidentally dropped the seaweed on his boot and with an expression of distaste and a sound of protest he knocked it off with the stick in his hand. *The first time he's used a stick in that way, as a tool.

When he was tired walking home he whined and clung to my legs, stepping on my feet to be picked up. He gives a little bounce of pleasure when he's picked up and hugs very tightly around my neck, but if he doesn't want to be carried he struggles and arches, kicking. He doesn't climb, but *today he put his foot up on the gate cross bar to try and follow F. He's very interested in gate hinges now. He sits on the sidewalk to investigate odd patches, still loves tiny imperfections but not as constant an activity.

More lining up and playing with spice bottles on the counter--I don't like this: it's wasteful and messy, though he shakes the spices out rather than pours. It's dangerous--he's gotten knives out of the sink. He loves it though. *After a demonstration, he poured a raisin from a box. First tried to pick it out, then tilted the box.

He watches other children now--stands near and stares--no smiles, vocalisation or approaches.

The earliest word/signs in Graeme’s productive lexicon

At the onset of Graeme’s production acquisition, he began to use four meaningful vocalisations and gestures (knock knock, hide and seek, up, and down) spontaneously, consistently, and productively, fulfilling the criteria I set for his earliest lexical acquisition in production. Graeme’s first early words/signs had the pragmatic functions of requesting actions (mainly games), and objects (food or toys). Table 5.2 presents Graeme’s productive vocabulary acquired at the onset of word learning.
Table 5.2  Meaningful utterances and gestures acquired at the onset of word learning

<table>
<thead>
<tr>
<th>Word no.</th>
<th>AoA</th>
<th>Meaning</th>
<th>Word</th>
<th>Sign/gesture</th>
<th>Pragmatic interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;02.05.27</td>
<td>Bring the food down, imitating when throwing</td>
<td>Down [a:]\</td>
<td>Down</td>
<td>Request for action (RA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Comment on action (CA)</td>
</tr>
<tr>
<td>2</td>
<td>&lt;02.05.27</td>
<td>Pick me up</td>
<td>Up [a:⇈]</td>
<td>Up</td>
<td>RA</td>
</tr>
<tr>
<td>3</td>
<td>02.06.00</td>
<td>I want it</td>
<td>I want it [?uh ?uh  ?uh]</td>
<td>Pulling adult, showing cup, nod.</td>
<td>Request for object (RO)</td>
</tr>
<tr>
<td>4</td>
<td>02.06.04</td>
<td>Knock knock game</td>
<td>Knocked</td>
<td></td>
<td>Comment on object (CO)</td>
</tr>
</tbody>
</table>

The first two words/signs in Graeme’s productive lexicon were *up* and *down*. The initial, context dependent, uses of these first word/signs began around 02.05, when with much painstaking repetition I taught Graeme the onomatopoeic sounds and gestures for *down* ([a:\]\, arm lowered), and *up* ([a:⇈], arm raised), as perceivable events. He eventually imitated me with prosodic matches, to enthusiastic encouragement. Graeme began to volunteer these sounds and gestures consistently to communicate various intentions, thereby extending their meanings. He used *down* with the new pragmatic function of initiating a game, by pushing my foot up so that I would bring it down while saying *down*. By 02.05.27, he had extended *down* beyond the original game in three ways: first, to spontaneously request that a parent bring a food item down from the counter; second, as imitation of our comment, *down*, on a downward action; for example, when he threw something down, or it dropped; and third, an imitation of our directive, *down*, meaning *sit down*. The imitated uses shortly became spontaneous. At the same age, he imitated my *up* [a:⇈] when he wanted to be picked up, and, shortly afterward, used it spontaneously himself.

At the onset of his language acquisition, Graeme continued to express protest and requests for actions and objects with his pre-linguistic manifestation of intentional communication to mean *I want it, give it to me*; behaviours such as crying, whining, or
silently directing F’s and my hands as he pulled us to act. At 02.06.00, he became more specific in his request for some milk. In place of his usual high-pitched whine, he produced a new utterance: three forceful grunts with a level intonation that conveyed urgency, [uh ?uh ?uh] with the accompaniment of a little bounce. Instead of just pulling on F’s arm, he shook his bottle, before leading F to the fridge. This instance of use was the point of entry of the word event *I want it, give it to me* into Graeme’s productive lexicon as his third word/sign acquisition. The lexical status of the word event was changed from being an intentional communication with an undifferentiated form for the expression of his wishes, to being an early word/sign. Considering Graeme’s communicative delay, this instance of a specific and creative vocalised lexical acquisition, volunteered spontaneously and not imitated, was a significant milestone.

At 02.06.10, he confirmed the productivity and consistency for *I want it, give it to me* in two separate occurrences. In the first, he combined gesture, imitation, and attentional engagement, as he took an empty cup from the counter and lifted it to his lips to mime drinking, while making eye contact with me and uttering the same grunts. On the second occasion, he grunted as a request, then nodded his approval (for the first time) as I got the peanut butter out of the cupboard. Because *I want it, give it to me* initially entered Graeme’s lexicon in production as an intentional communication, it developed and was acquired in production prior to comprehension.

At 02.06.04, *knock knock* became the fourth word/sign acquired in production when, for the first time, Graeme voluntarily initiated a game of *knock knock*, by knocking to signal that wanted to play it with me. Although the word/sign *knock knock* was limited to the game situation, restricted to the gesture of knocking, and did not become a spoken utterance in the single word stage, I regarded it as an early word/sign because he used it productively and consistently, and extended it semantically into a broader meaning that included all doors, gates, and doorknobs, and the actions of opening and closing them. This association was connected with Graeme’s preoccupation with doors and doorknobs. The sign had a duration of over a year.
At the onset of Graeme’s production acquisition, he also began to indicate through gesture the word/signs for *hide and seek* and *look*, though these did not attain full acquisition status at this time.

The criteria I used to ascribe lexical status to the items *up, down, I want it, give it to me, and knock knock* were:

1. Graeme used these signs and vocalisations spontaneously.
2. He used them consistently in both meaning and form.
3. He used them productively in different situations.
4. He used them productively for different pragmatic functions.
5. Their forms were specific to a particular game, or requested item, differing creatively from the general intentional communications he had used previously.
6. He extended their meanings from their initial limited situational uses to multiple examplars (still context bound) of meanings and functions.
7. There were no inappropriate uses.
8. *Up, down, and knock knock* related to earlier imitated forms.
9. They had an invariant phonetic stability, and, for *up* and *down*, a prosodic match to the forms I used.

My criteria for ascription were drawn from those found in Vihman and McCune (1994) and in Hirsh-Pasek and Golinkoff (1999; 1999).

**Summary**

Overcoming joint attention impairments during a social/cognitive developmental spurt co-occurred with the onset of Graeme’s attentional engagement, his lexical comprehension, and his production of meaningful vocalisations and gestures. He understood his parents’ pointing at 02.06.01, began his own pointing at 02.06.08, and increased his eye contact, at the same time as he began to comprehend words used for
social routines, and interactive games with a verbal component. These joint attention skills are correlated with word learning in TD infants (Carpenter et al., 2002; Luyster et al., 2008; Mundy et al., 1990; Parisse, 1999). At this time, Graeme began to overcome deficits in social/cognition and in comprehension acquisition common in young children with ASD (Mitchell et al., 2006). His relating behaviour developed as he began to initiate games (Sigman & Kim, 1999; Sigman & McGovern, 2005; Stone & Caro-Martinez, 1990). Notably, his comprehension increased as he began to attend to being addressed, to salutations, and to a few directives (Baird et al., 2000; Baron-Cohen et al., 1996; Lord, 1989; Lord, 1995). The abilities associated with language development in categorisation and in recognising pictures improved, as Graeme demonstrated functional relational practise play, (Lifter & Bloom, 1989; Mundy et al., 1987; Piaget, 1962). Graeme added four word/signs to his lexicon in production. These acquisitions qualified for inclusion in his earliest word/signs because of their productivity, consistency, spontaneity, extended meanings, and specificity (McCune, 2008; McCune, 2009; Menn, 1976; Menn & Bernstein Ratner, 2000; Vihman & McCune, 1994). Graeme had commenced his period of slow acquisition in comprehension.

**Part 3: The period of slow lexical acquisition from 02.06.00 to 02.09.28**

**Introduction**

Following the social/cognition developmental spurt that occurred at the onset of Graeme’s lexical acquisition, there was a four-month period of slow word learning, from around 02.06 to 02.09.28, which will be described in the present section. An account of Graeme’s acquisition of his comprehension will be followed by an account of the onset of his production during this period. In keeping with my first research question, the social/cognitive developments that emerged during this period, along with Graeme’s play and autistic behaviours, will be examined in relation to the slow lexical growth. Graeme’s additional early word/sign acquisitions are investigated in terms of my second research question, regarding the definition of word/signs in Graeme’s productive lexicon.
Graeme’s comprehension in the period of slow word learning

Introduction

This section presents the data on Graeme’s slow, case-by-case acquisition of comprehension, from the onset of his word learning, around 02.06, to just before his word spurt at 02.09.28. A discussion of Graeme’s context bound lexical acquisition in comprehension precedes a detailed account of his comprehension of relational and nominal words, directives, and proper names. This section also describes the rate of his word learning, his language input and therapy, his comprehension of phrases, his early semantic categories, and the apparent semantic extensions in comprehension.

Context bound early lexical comprehension acquisition

Though Graeme was still inattentive to language in general, and disinclined to respond with eye contact or attention, he began to display an increased receptivity to language addressed to him at the onset of the four-month period of slow word learning. Data in the WE and SCD lists, based on the contextual information for word events in the diary, show new behaviours included initiating and participating enthusiastically in interactive games, responding to salutations, attending more to his name, and even following a few directives. All of his understanding of the verbal component of these social routines was embedded in his experiences within their linguistic and situational contexts. His comprehension of most of the first 30 words in his lexicon in comprehension acquired during this period was aided by several factors: his close relationship with the speaker; a dramatised delivery; the presence of the person or object referred to; the familiar context of verbal interaction and routine; and the presence of referents. During this period Graeme acquired his earliest words and signs, in both comprehension and production, in a qualitatively different fashion from his later words. He understood and used his early word/signs only for highly restricted ranges of meaning within everyday social routines and perceptually salient settings (Dromi, 1993).
Graeme’s understanding of his early words/signs in both comprehension and production differed from their conventional adult meanings. His comprehension of a word had a broader definition than the adult meaning in that it included a whole sequence in a routine. Paradoxically, it also had a more narrow meaning, in that the words were restricted to and dependent on the particular context in which they were embedded. This dependency applied particularly to the verbal component of interactive routines that made up most of his comprehension throughout this period. An example of this was his comprehension of *bottle*\(^{48}\), which included his whole bedtime routine, but was limited to only that particular bottle in that specific context. He first showed lexical comprehension at 02.08.20 when he ran to get his bottle upon hearing the word without seeing the object. When F said *bottle* the next day, Graeme ran to him, pulled him into his bedroom, and lay down with his bottle. More examples and details of Graeme’s context bound acquisition process follow in the sections on the comprehension of relational and nominal words, directives, and proper names.

### Rates of word learning per month

Graeme gradually began to understand words, one word at a time, over the four-month period after the onset. Table 5.3 shows monthly summaries for the new entries to Graeme’s cumulative lexical comprehension. By the end of 02.09, just before his receptive word spurt, Graeme comprehended 30 words.

| Total: 6 | 5 | 5 | 7 | 7 |

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\(^{48}\) The acquisition of *bottle* is described in Chapter 4, in the Criteria for lexical status in comprehension.
The estimate of Graeme’s comprehension is conservative. It is difficult to give a precise determination of comprehension acquisition for these early word events because of their dependence on context, and on my interpretation of Graeme’s understanding. Daily data collection revealed the acquisition of semantic and pragmatic aspects of words in addition to their point of entry into the lexicon.

Comprehension of relational and nominal words

Like TD children, Graeme acquired more relational words/signs than nominals in his early comprehension lexicon (McCune & Zanes, 2001). Atypically, he was markedly uninterested in having objects named. Although he added top, the object of his obsessive focus, to his lexicon at 02.06.25, he could well have understood top to mean its spinning action. Food items were the nominal exceptions. Graeme pointed to identify juice in response to my juice at 02.07.14. This counted as an acquisition in comprehension because, although the juice was present, I did not have my attention on it, so gaze following did not assist him. I added banana to his acquired lexicon at 02.07.19, when, on hearing the word, with no banana in sight to assist in comprehension, he ran into the kitchen to get it. In each of these instances, Graeme demonstrated his comprehension of the word without the presence of ostensive cues to the referent. His understanding of the words was likely limited to a specific referent; i.e. only his own top or his kind of juice, rather than to any full understanding of those words as generic categories that included all items of that name.

Graeme directly associated the word aeroplane with its meaning when he pointed out of the window after I had said aeroplane, although there was no sight or sound of one. Aeroplane was exceptional in that it was not associated with a routine of daily life, a favourite food, toy, animal, or person, and possibly not even with an object. Instead it seemed to be associated primarily with environmental sound, and was probably restricted in meaning to its sound, location, and possibly movement. Therefore it may have been a

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49 The acquisition of banana is shown in Table 4.8, Chapter 4.
relational rather than a nominal word. The directive words in the section below are also relational.

**Comprehension of directives**

A deficit in following adult attentional directives is among the primary indicators for the early diagnosis of ASD (Baird et al., 2000; Baron-Cohen et al., 1996). This inability to process social meanings affects the understanding of linguistic input in children with ASD (Lord, 1989). In addition to this deficit, Graeme was often resistant to obeying those directives he did understand. While he responded to the instructions *come, here*, and *come here*, there was no evidence he understood them without the accompanying gestures and tone of voice, so I did not consider them acquired. However, his obedience (or the lack of it) was a consideration in my deciding whether he understood commands and instruction. *Here* was added to the comprehension list at 02.09.23, when obedience was not an obstacle to demonstrating understanding, as Graeme, expecting food he liked, turned around quickly when I said *here*, responding to *here* in its meaning of *here you go* rather than *come here*.

By the beginning of 02.07, he engaged in the give and take of the interactive game of *ta*, in which I would give him an object, say *ta*, and hold out my hand to get it back, and he would run away with it, either with delight or with apprehension that he would not be allowed to keep it. By the end of 02.08, he understood both *ta* and *give it to me* to mean that an adult wanted him to relinquish something, but as I accompanied this command with the additional aids to understanding of intonation, pitch, loudness, use of his name, and gesture, I still did not consider it fully acquired. On the benchmark occasion Graeme’s novel obedience to G’s 50 *Give it to me Graeme*, at 02.09.13, she had held out her hand and spoken with exaggerated volume and pitch, so his acquisition of the verbal component alone was still in doubt. Two weeks later, however, Graeme gave me, on request, without undue fussing on his part or supplemental gestures and suprasegmentals on mine, separately, both a record and the end of the skipping rope. This exchange

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50 G was his speech therapist.
signalled his full comprehension. Initially, although *give it to me* and *more* overlapped semantically, I listed them as separate word events because of his eventual understanding of *more* as a repetition of action. At 02.08.00, he realised the use of *more* by Graeme’s father and I meant that we would repeat a desired action, such as rewinding his music box. As noted in the section on production in this period, the word event *I want it, give it to me* came into Graeme’s lexicon initially as an intentional communication with the pragmatic function of requesting an object, and thus developed in his productive lexicon prior to comprehension.

Graeme’s newly acquired instructional relational words, such as *step, jump, foot, run* and *look*, were embedded within routines. For example, at 02.07.19, he showed his understanding of *step*\(^51\), in dressing, by waiting until my verbal command before lifting his leg to put his pants on. At 02.08.00, *look* was added when he looked up, right away, from having had his head in my lap upon hearing the word, without having seen me point or emphasise the command. Graeme indicated that he understood *hot*, delivered vehemently, to be a warning of danger (of a hot oven), through his action of running away. He would not have done so for *no, or don’t*.

**Comprehension of proper names**

Graeme began to acquire some proper names independently of the demonstrated presentation of their referent; therefore, context free. The first, at 02.06.12, was *Lenny*, the name of the family cat\(^52\). While *Mummy*\(^53\) did not come into Graeme’s comprehension vocabulary until the period of word spurt, at 02.10.04, Graeme understood *Daddy*, his primary caretaker, at 02.07.06. On this occasion, Graeme turned to look for his father, who was present but not in Graeme’s line of sight, when I said *Daddy!*, albeit with the exaggerated intonation necessary to get Graeme’s attention. *G* (Graeme’s language therapist) entered Graeme’s comprehension lexicon at the end of 02.09, also only when she was present. Graeme responded more slowly and occasionally to *Where’s Mummy?*,

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\(^51\) The acquisition of *step* is described in the Criteria for lexical status in comprehension, Chapter 4.

\(^52\) The acquisition of *Lenny* is described in the journal entry of 02.06.12 in the prelinguistic section.

\(^53\) The acquisition of *Mummy* is shown in Table 4.8 in Chapter 4.
again only in my presence. His initial understanding of *Where’s Mummy?* was in the context of hide and seek, at 02.07.19. In contrast, at 02.09.30, he pointed to the room where F was out of sight, when asked *Where’s Daddy?* This was one of the first instances of his understanding a referent that was not present and not in the context of a routine, signalling a qualitative change in lexical acquisition at the commencement of his word spurt in comprehension.

**Language input to Graeme**

In addition to its delayed onset, Graeme’s word learning in comprehension differed from typically developing acquisition in comprehension, in that he received language and behavioural intervention. This happened through his preschool at CHDC, his speech therapist G (Figure 5.6), and through being actively taught to understand language in the form of single words by us, his parents. Much of his therapy involved stimulating his cognitive ability with challenging play activities, and engaging him in social interaction to increase his level of joint attention. There was also an emphasis in his professional therapy on increasing Graeme’s imitation skills. This additional intervention in all likelihood contributed to the beginning of Graeme’s lexical acquisition. In children with ASD, improvements in lexical acquisition can be measured by the therapeutic intervention the children receive. The younger the child, and the more words the child has when intervention commences, the greater the increase in vocabulary (Bibby et al., 2001; V. Smith et al., 2007).

After his assessments with the CHDC and Dr. Ingram, F and I had a new consciousness of Graeme’s language delay, and of his need for intensified language experiences at home. We began to increase our input to Graeme, addressing him more frequently. To provide further exposure to words, we added a verbal component of consistent repetition in various pragmatic contexts to his daily routines and activities. Whenever his attention was on an object we intervened in his solitary activity to label it. Later studies in word learning of children with ASD corroborated our efforts in commenting and labelling (Akhtar et al., 1991; Cohen & Brunt, 2009; McDuffie et al., 2006). We employed every available aid to promote Graeme’s understanding and to encourage his early word/sign...
use: directly addressing him, frequently modelling actions, and actively teaching word/signs to Graeme while ostensively demonstrating their referents. Our communications with him were clearly articulated and usually delivered with an intensification of all suprasegmentals: facial expression, gestures, the positive or negative affect of exaggerated intonation contours, pitch and volume, in addition to an emphatic, cajoling, or vehement tone. Gestures were an integral part of the games and routines that comprised many of his earliest vocabulary items in both lexicons. Facial expression was probably the least effective aid, because he usually did not look in the direction of the speaker or make eye contact. We modified our speech directed to Graeme to abbreviated one-word utterances or short phrases.

Vihman and McCune (1994) note that although the elicitation techniques in speech intervention that use consistent environments and interactions such as games and picture books do not result in a more rapid occurrence of representational words, they can train a child to produce context bound words. F and I responded enthusiastically to Graeme’s early spoken and signed productions, eager to assign communicative intention to them.

**Comprehension of phrases**

During the month that Graeme was 02.07, he began to respond to a few short phrases that consisted of an acquired word and one that was familiar but not yet acquired. Three examples are *Where’s your top?* (he began to look for it), *Daddy bye bye* (he immediately ran after F), and *Daddy’s nose* (he touched F’s nose). Although those responses indicate an understanding of *where’s*, and *nose*, I did not accept those words as fully acquired until further evidence of comprehension that was independent of context, which came a few weeks later. By the start of the month in which Graeme was 02.08, he was attending more to language, and getting the gist of directional phrases like *wait a minute*, though there was no evidence out of context that these were fully understood. Near the end of this slow acquisition period, in 02.09, F and I started to address Graeme more frequently with precisely articulated and stressed two-word utterances (or three, with the inclusion of his name), as the mean length of utterance (MLU) of his understanding expanded.
**Partially acquired words in comprehension**

In addition to the acquired words listed in Table 5.3, Graeme had exposure to many other words that were reinforced at every opportunity during this four-month period. Although they were not yet fully acquired there were many instances in the WE list of their partial recognition in context. Table 5.4 lists the most common of these by semantic category.

**Table 5.4   Words partially acquired**

<table>
<thead>
<tr>
<th>Semantic category</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objects of interest</td>
<td>Water, light, fire, pen/pencil, hammer, nail, (and other tool names), door, button, phone, string, bike, piano, organ, gate, fence, lock, bucket, stick, sock.</td>
</tr>
<tr>
<td>Games and social routines</td>
<td>Shoe, painting, music, string.</td>
</tr>
<tr>
<td>Food</td>
<td>Juice, ice cream, cookie, yoghout, milk, other foods.</td>
</tr>
<tr>
<td>Proper names</td>
<td>Mummy, Grandma, Papa.</td>
</tr>
<tr>
<td>Directives and relational words</td>
<td>Come, hold on, put, take, go, and open, sit down, lie down, this way, eat it up, shut, close.</td>
</tr>
<tr>
<td>Animals</td>
<td>(Real, stuffed, plastic, or pictured- an interest during 02.09.)</td>
</tr>
<tr>
<td>Parts of the body</td>
<td>Eye, ear.</td>
</tr>
</tbody>
</table>

**Comprehension of early semantic categories**

The initial meanings of Graeme’s early words in comprehension throughout the period of slow word learning, from 02.00.00 to 02.09.28, were learned in limited semantic categories. Like other verbal children with ASD, the order of Graeme’s acquisition of these categories, and the categories themselves, are the same as those reported for TD children (Charman et al., 2005). Notably, all of these lexical items were on the CDI of early comprehension vocabulary for TD children at 01.04 (Fenson et al., 1994).

Table 5.5 shows the semantic categories and their lexical items for Graeme’s first 30 words in comprehension:

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54 These categories are compiled from those of Nelson (1973), Benedict (1979), Dromi (1987), Resocrla (2001) and the CDI (1994).
Table 5.5  Contents of semantic categories in early comprehension

<table>
<thead>
<tr>
<th>Semantic category</th>
<th>Lexical items in comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Games and social routines</td>
<td>No, knock knock, down, up, give it to me, hide and seek, bye bye, hi, round about, more, this little pig, where’s X? jump, step, look, foot, run.</td>
</tr>
<tr>
<td>Objects of interest</td>
<td>Top, aeroplane.</td>
</tr>
<tr>
<td>Proper names</td>
<td>Graeme, Lennie, Daddy, G.</td>
</tr>
<tr>
<td>Directives and relational words</td>
<td>Good boy, hot.</td>
</tr>
<tr>
<td>Parts of the body</td>
<td>Foot, nose.</td>
</tr>
<tr>
<td>Food</td>
<td>Juice, banana, bottle.</td>
</tr>
</tbody>
</table>

Semantic extension in comprehension

Graeme’s understanding of the words in his small lexicon in comprehension during the period of slow acquisition gradually became independent of the limitations of the immediate context of his own actions, and the usual routines, as the words accrued more meaning through the expansion of the semantic ground they covered. The semantic extension of his early lexicon consisted of gradually adding broader linguistic and physical contexts to the original meanings, with the result that the early words joined different semantic categories that had more inclusive meanings and situations. For example, before *jump* was fully acquired, it described only a game in which Graeme bounced on the bed, holding my hands as I said *Jump*. Initially, Graeme would only respond to the command if he had already been bouncing in this location. By the time of its acquisition at 02.07.18, he responded to the command for the first time without already having been bouncing, indicating that he was responding to the verbal component in the situation. However, his definition of the word at this point was still event bound and restricted, because it did not include jumping in other places, jumping by himself, jumping with both feet off the ground, or any other agent jumping. By the end of this period, the meaning of *jump* expanded to include the action of Graeme making his doll jump on my command. Its semantic category had shifted from social games and routines to action. A similar semantic progression occurred in Graeme’s comprehension of *kick*. His first response to *kick* (at 02.07.03) was restricted to him resuming kicking while lying on his tummy in the bathtub, but only when he had already been kicking. Later, at 02.08.13, this was extended to him kicking on command, without prior kicking, but was
still limited to the same circumstances. The location context expanded; he responded to kick when he was on the table and in the sand at 02.09.24, but still only when he was lying on his tummy\textsuperscript{55}.

Other semantic extensions in comprehension occurred with nose, foot, run, and up. Graeme had a routine of touching noses in greeting, pulling his parents to rub noses with him and with each other. When he first responded to nose, at 02.08.23, he touched his own nose to his toy's nose, imitating this family nose rubbing. Two days later, he extended his meaning for nose beyond that particular routine when he touched the cat’s nose, F’s and my noses, and all the noses in pictures, as I identified the owner of each nose, e.g. Daddy’s nose and Lenny’s nose. The meaning of foot was limited initially to my direction to Graeme to raise his foot while having his diaper changed. This was extended in 02.09 to mean Graeme putting his foot in my lap for the foot game, and to bringing his foot out from sitting on it so that I could put his shorts on. Graeme understood foot only within the defining limits of these actions, not as a part of the body. That expansion occurred in the comprehension word spurt at 02.11.06.

During 02.09, Graeme twice started to run on command when he was holding hands with me. By the end of the month he was very attentive to me labelling run in his toy play, extending the meaning of run to the actions of others. Over the month of 02.08, the up game evolved into Graeme being flung over parental shoulders, then extended to mean someone pulling his pants up, and to pick me up.

Graeme’s delight and participation in interactive games intensified during the slow learning period. At 02.09.13, he learned this little pig when he recognised it verbally and held out his hand. Where’s __? was acquired at 02.09.09, the context limited to an invitation to hide and seek. One of Graeme’s favourites was a rhyming tickle game with a circling feature that F and I called round about\textsuperscript{56}. When Graeme first understood the phrase it narrowly pertained to the signs and words of this game alone. Later in the word

\textsuperscript{55} During the receptive word spurt beyond the scope of this study Graeme extended the agent; he made the doll kick at 03.04.06, and at 03.09.06 he extended the action and understood it to include kicking a ball. All this occurred before his first imitated utterance of kick at 03.10.05.

\textsuperscript{56} The acquisition of round is shown in Table 4.2 in Chapter 4.
history round expanded into the more general meanings of roundness in shape, as well as
twirling, spinning, and circling in motion, actions commonly interesting to children with
ASD.

Summary

In brief, Graeme’s comprehension increased at a slow pace over the four months
preceding his word spurt in comprehension, as he acquired 24 word events, in addition to
the six already in his lexicon. The rate of his word learning averaged six words a month
during this period. These new words, like the early lexicons in comprehension of TD
children, were learned in the restricted context of social and daily routines and interactive
games in highly salient settings (Dore et al., 1976; Dromi, 1993; Ferguson & Farwell,
1975; Halliday, 1975; Nelson, 1988; Rescorla, 1980). They could refer to both a whole
routine and a highly specific reference (Barrett, 1989). Like TD children, Graeme first
acquired relational words, including directives, and proper names (McCune & Zanes,
2001; McDuffie et al., 2005). During this period Graeme had language therapy at
preschool, and intensified input at home.

Graeme’s words in comprehension were acquired on a case-by-case basis, in limited
semantic categories. His new words, their semantic categories, and the order in which the
categories were learned were the same as those of other verbal children with ASD, and
TD children (Benedict, 1979; Dromi, 1987; Fenson, 1989; Nelson, 1973; Rescorla et al.,
2001; Tager-Flusberg, 1985). Graeme gradually increased the semantic range of his
understanding of these words by adding broader linguistic and environmental contexts, as
do TD children (Clark, 2003). These words then joined other semantic categories with
extended meanings (Dromi, 1993; Dromi, 1999).

The following section will examine Graeme’s acquisition of production.
The onset of production

Introduction

While the growth in Graeme’s lexical acquisition occurred mainly in his comprehension during this four-month period, he became a more communicative child. His babbling reappeared, he had important gains in his intentional communication of vocalisations and gestures, and he increased his use of meaningful grunts in his word/signs in production. Graeme added five meaningful words/signs to the first four in his productive lexicon in this period.

Babbling during the period of slow word learning

Graeme was unusual in his development of babbling. Early babbled sounds in his first year had ceased sometime after 01.01. During 02.06, his babbled sounds were very infrequent. All three instances occurred at 02.06.10 and 02.06.11, when Graeme imitated two sequences of sounds I made [uh oh] and [wha wha wha] and twice volunteered the only instance of consonantal stops [dae dae dae dae]. A week later, co-occurring with Graeme’s social/cognitive developmental spurt and the onset of his comprehension and production, Graeme’s babbling increased from these three events to one or two events a day. During 02.07, canonical babbling began, consisting of reduplicated strings of repetitions of the same three or four syllables; mainly of labial sounds, glides, and /d/ and the vowels [a] and [ae]; for example, [wa], [wae], and [dae]. Over the next two months, Graeme gradually included supraglottal, palatal, velar, and glottal sounds, lengthened the strings, and began variegated babbling; for example [waem wa dye dae dyuh yaw dai] at 02.07.30 and [wi wi wi wou wou wa wa wa] at 02.08.22. Graeme’s babble during 02.09 entered the jargon stage, becoming loud in volume and beginning to resemble adult speech patterns of intonation and stress (Stoel-Gammon, 1998).

For the most part Graeme babbled in solitary play and at bedtime, when he also practiced sound-making activity with various non-speech sound play productions such as panting in forced exhalations, humming, cooing, grunting, squealing, and laughing with deep [ho ho
ho] sounds, as described in TD children by Stark, Bernstein, and Demorest (1993). On several occasions, however, he babbled interactively, with [dae dae dae] in response to the praise *good boy*. According to McCune and Vihman (2001), increased consonant production in babble, indicating vocal control, is the most useful predictor of the onset of referential words in production in TD children. By 02.08, Graeme was babbling frequently throughout the day and at bedtime, and by 02.08.26 he began communicative sound-making, enjoying the exchange of babble, particularly when F and I imitated his sounds (Stark et al., 1993). When I babbled to him, he acknowledged it with an unusual facial expression, unfocusing his eyes and blinking\(^57\). Graeme’s development of babbling throughout the slow period of word learning in comprehension, although delayed, was contemporaneous with his acquisition in comprehension. It increased in quantity and in variety of form and function as he approached the word spurt in comprehension. It was remarkable that the sounds Graeme produced in his babbling were closer to speech sounds than those in his meaningful productions. Silence, however, still predominated.

**Intentional communication in the period of slow word learning**

Graeme’s pragmatic skills in intentional communication increased in frequency and became more specific and easier to interpret. Most of his pragmatic acts in the four months of slow word learning were requests for objects and actions, such as pulling one or other of his parents to the fridge, the door, or the pencil drawer, as well as pushing at our legs to hurry us to fetch whatever it was he wanted. Graeme gradually became more gesturally specific in his requests. Using his increased skill in joint attention, he showed us objects to make his requests clear, such as bringing the yoghurt container to F (02.07.11), and brandishing or banging his empty cup. Employing the graphic modality as a communication device for the first time, he pulled me to the picture on the box of his spinning top to ask me to find it for him (02.07.08). By 02.07, instead of whining, he commonly flapped his hand near his face to ask for food and actions, though whining would commence if his requests were not granted swiftly.

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\(^57\) This facial expression later became his sign for *dog* and for greeting.
At 02.06.11, Graeme pointed to an object while directing eye gaze to his Grandmother, with the clear communicative intent of commenting. Other pragmatic functions that Graeme expressed with pointing were requesting (02.07.20), commenting on or greeting a person by pointing at that person’s nose, acknowledging my comment *aeroplane* by pointing at an aeroplane overhead (02.07.24), and indicating a wasp to F when F entered the room (02.09.11). Graeme’s father and I noted each of these rare acts with delight, as the joint attention Graeme displayed was a marked development in communication. Our reactions were not unjustified, as later research showed that the frequency of acts of commenting and requesting, using gestural indicating behaviours co-ordinated with visual attention to an adult, are predictors of both comprehension and later symbolic word production, in TD children and those with ASD (Calandrella & Wilcox, 2000; McDuffie et al., 2005; Sigman & Kim, 1999).

The functions of protest, expressing delight, greeting, and showing off made up the remainder of Graeme’s newly acquired repertoire of intentional communication in this period. Graeme expressed protest with a long high-pitched scream for his uncommon fears, such as bubbles or corrugated tubing. He uttered little vocalisations of distress as he pushed F’s and my legs away to protest our interference in his pleasurable activities, such as stripping wallpaper (02.07.29). During 02.08, Graeme acquired another sign for irritation: a mid-level lateral flapping of both hands when, for example, a child took an item from his line up. Full-on tantrums continued and still featured the broken puppet face-plant collapse and Red Queen rage.
Although Graeme most often laughed loudly in solitary play, clapping and dancing with merry squeals of delight as he looked at his own constructions, played with the cat, or removed wallpaper, he also responded with laughter to being praised. He expressed delight by assuming his happy pose, in which he bent at the waist and clutched his hands between his thighs. Graeme sometimes took this position, crowing happily, when greeting an intimate (Figure 5.8).

Journal entry

02.07.12

* Today he did something amazing and new--instead of using his touch to lead us to what he wants, he used it to push me away. When he has a 1/2 cup of juice or milk he drinks most of it nicely, then starts to slobber and muck with it, waving the cup to make it slop over, smearing the spills with his hand, then emptying the last bit on the floor and puddling in it--happy laughs the while. Naturally, we discourage this. Today when I gave
Gray his juice he ran in the living room with it. I followed him, which he heard, and he knew why--it was to stop him from pouring it on the rug. He put the cup down on the floor, ran back to me, and pushed me vigorously on the legs, to stop me and send me back. He was protesting--little sounds. I stayed where I was and he went back to the cup and drank it, not all, then ignored it. He was watching me and he knew the consequences of pouring it on the rug: No! F said he did this (pushing F away) a couple of times just before he got sick (2 weeks ago).

Later, he was standing on a box to look out the window and play with a tinker toy on the windowsill. He got off to get something and I went over to the box and put my foot on it (in order to do something, not to deliberately irritate Gray). He came right back and pushed my leg off the box. More gestural communication.

Greetings necessarily result from a change in a social situation; either one’s own entry into a new context or the arrival of another. Graeme’s unique forms of greeting were in keeping with the resistance to change, and discomfort in transitions, common to those with ASD (Tager-Flusberg et al., 2005; Walenski et al., 2006). Although at 02.06.09 Graeme waved on his own, after having had his hand waved for bye bye for some months, I did not count this as an acquired word/sign at this age, because Graeme did not continue to wave consistently or voluntarily for either greeting or goodbye. From age 02.06 until 02.10, Graeme acknowledged visitors he recognized in unorthodox ways. Either he did not acknowledge them at all, but concentrated on vigorously spinning his top, hoping for attention and eventually looking at them to elicit it, or he would show off, by running about with his toys, laughing loudly. If strangers greeted him he would only stare. For his parents and other intimates, he touched our noses affectionately, often pushing us all together so our noses would touch. My arrival from work, however, was a transition that Graeme had difficulty with every day during this period and beyond. He would run to meet me, then veer abruptly aside to concentrate on a toy, then shyly, self-consciously, come with much coaxing to lay his head on my lap. Transitions of leaving were sometimes easier for Graeme during this period, when he recognized a routine departure, and he would occasionally wave. When interrupted in an activity Graeme would tantrum.

**Journal entry**

**02.08.09**

Gray was interested when S and K came over. They came in and started paying attention and talking to him and although I don’t think he remembered them (he saw
him once or twice before Christmas), he began to show off, running in a silly getting-
nowhere-fast dancing jiggling manner, crowing and laughing at how amusing he thinks
he is and rushing around, circling the room and S and K and looking around at them.
After a while he wanted to clamber on them.

I gave him his yogurt and a spoon and he tried to make me feed him, pulling on my hand
silently. I said “No, you eat” and he trotted over with the spoon and yogurt to S, put it
down on her chair arm and politely (tentatively) touched her hand and said [?uh] for her
to feed him.

The extension of word/signs in production

After the onset of his lexical production, Graeme extended the meanings of his first four
words: up, down, I want it, give it to me, and knock knock. His use of down began to be
more specific. He signed down with his vocalisation, to request that I get the biscuits
down for him, at 02.06.24. At 02.07.00, upon seeing F get the cough syrup from the shelf,
he knelt in excitement to tap his finger on the floor, a variant of down which in this case
was born of his deep attraction to toxic substances in lieu of regular food. When he
wanted to be lifted down from standing on the freezer (a favourite position), he used
down at 02.09.04 as a request for action. Up was mainly gestured, but occasionally with
vocalisation as well. At 02.07.16, he held both hands up in order to be picked up and
handed over the fence to visit the neighbours. Graeme started regularly using this variant
of the up gesture as a request for being picked up during 02.09. Vihman and McCune
(1994) and Bloom (1993) note that relational words such as up and down imply an
understanding of reversible temporal and spatial events, which are perceptual concepts
and thus depend on representational development. In Graeme’s case, however, these
word/signs were situationally restricted, even when extended in meaning.

Graeme continued to knock as a sign that he wanted to initiate the knock knock game or
general door play. In a creative adaptation of the form of knock knock at 02.09.04, he
stamped his foot to knock when he had both hands engaged in pushing the door58.

Graeme continued to utter the grunts for I want it, give it to me in varying tones of
urgency, usually accompanied by hand flaps, throughout the entire single word stage. The

58 See Table 4.9
pragmatic function was most often a request for an object, or for an action that would lead to an object. An example was his grunt vocalisation as he tugged impatiently at F’s hand to hasten the opening of the box containing his new top. Graeme also later used this sound, less emphatically, as a comment on an object; for example, when watching and pointing at fish in an aquarium, at 02.09.25. This occurrence did not have the question intonation of its later use as a question for names. This type of communicative grunt, combined with joint attention to mother and object, is a precursor to, or co-occurs with, referential word comprehension in slow talkers with limited phonological skill, and also with referential word production in early talkers (McCune et al., 1996). In Graeme’s case, this communicative grunt preceded his referential word comprehension, since his comprehension at this point was context bound.

The acquisition of new word/signs in production

During the four months of the slow period of acquisition in comprehension, Graeme added five word/signs to his productive lexicon: round about, hide and seek, and this little pig. These new acquisitions were acquired slowly, word event-by-word event. All were context bound, all had a gestural component, and only one had a vocalisation.

Table 5.6  Word/signs in the period of slow word learning in comprehension

<table>
<thead>
<tr>
<th>Word no.</th>
<th>AoA</th>
<th>Word event</th>
<th>Vocalisation</th>
<th>Sign/gesture</th>
<th>Pragmatic interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>02.06.11</td>
<td>Look</td>
<td>Pointed, with eye contact.</td>
<td>Comment on object (CO)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>02.07.20</td>
<td>Hi</td>
<td>Touched noses.</td>
<td>Greeting</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>02.08.23</td>
<td>Round about</td>
<td>Circling his finger on his or our palms.</td>
<td>Request for action (RA)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>02.09.04</td>
<td>Hide and seek</td>
<td>[oi yoi yoi yoi yoi yoi yoi yoi yoi]</td>
<td>Pushing my head onto the floor.</td>
<td>RA</td>
</tr>
<tr>
<td>9</td>
<td>02.09.18</td>
<td>This little pig</td>
<td>Doing it on his own fingers and toes.</td>
<td>RA</td>
<td></td>
</tr>
</tbody>
</table>
The word/sign *look* was acquired at 02.06.11, when Graeme used pointing with joint attention, as a pragmatic function of commenting to share a positive affect about an object. At 02.06.11, Graeme pointed to an object while directing eye gaze to his Grandmother, with the clear communicative intent of commenting. As this sign was used consistently to direct attention and to comment, and used productively in multiple situations with different conversational partners, the word event *look*, signed by pointing, became the fifth word/sign Graeme acquired in production. Pointing regularly included joint attention with eye contact by 02.07.11. By 02.07.24, Graeme had refined this sign, from the immature hand shape with his whole hand outstretched, to the conventional hand shape using the index finger to point. Graeme used the gesture of touching F’s and my noses spontaneously, consistently, from 02.07.20 and for several months afterwards, exclusively for greeting us, his parents. It fulfilled the criteria for lexical status, making the word event *hi* his sixth word/sign. By 02.09, he had extended its form and meaning to greeting other people. He would touch the noses of children or people he knew outside of home, and then touch his own, to sign *hi*.

From 02.08 on, Graeme began to use gestures specific to a game to initiate interactive play, such as circling his finger on his palm for *round about*, pushing my head down to the floor for *hide and seek*, and making *this little pig* gestures on his own fingers and toes (02.09.18). These words/signs were his next three acquisitions in production, and were situationally restricted.

**Journal entry**

**02.08.13**

Further developments in the *round about, round about, went a wee mouse; up a bit, up a bit into wee house* tickle game. When I say the first line he looks at my lips and he doubles over laughing on the second line. His hand is held in mine, palm up, and I circle his palm for the first line, run my fingers up his arm for the second line into wee armpit for a tickle. *When he wanted more this afternoon, he stuck his hand in mine, palm down and pulled my other finger. Tonight as we played he was trying to co-ordinate his palm up. I wouldn’t start until he tried, and he circled my palm with his finger and also his own palm but knew it wasn’t what he wanted, he just couldn’t figure out how to turn his palm over and put my finger on it.*
Graeme’s seventh consistent word/sign, *round about*, was first used spontaneously at 02.08.23, to request the rhyming tickle game, *round about, round about went the wee mouse, up a bit, up a bit, into wee house*. By this time he had mastered its conventional form, with his palm up and the other fingering circling it, as a sign to request the game. Graeme extended the meaning of the *round about* sign from its situational restriction of the tickle game to a meaning of circular shapes and the activity of spinning. At 02.09.00 he drew a circle on his Etch-a-Sketch after G said *round*, and at 02.09.20 he circled his hand on his record, imitating its spinning action to sign a request for a parent to play it. Further extensions included gestures of twirling and spinning objects, and his spinning self (Figure 5.9). These actions were dominant in his interests, as they are for many children with ASD. Therefore the word event *round* was acquired early, and was used both as a request and as a comment on his favourite activities, shapes, and objects. Record albums were particular favourites, possessing the three desirable features of roundness, spinning, and music.

Figure 5.9  An attraction to all that spins (02.09)

Graeme understood *hide and seek* as a whole event. His production with the meaning of *hide and seek* was a combination of game-related gestures and an idiosyncratic vocalisation. It was his first interactive routine based on eye contact. The language component of the game did not actually include the words *hide and seek*. Graeme first
acquired my utterance of Where’s ___? in his lexicon in comprehension[^59], context bound to the game of hide and seek. At 02.06.00, Graeme ran and hid his face in a blanket when I called Where’s Graeme? At 02.06.06, he pulled me down to his eye level to initiate the game when I said Where’s Graeme?, indicating that he understood that eye contact was a component of the game. This was the point of entry into his lexicon in comprehension for hide and seek (more precisely for Where’s ___?, but as it had a global meaning for the game, I used hide and seek in the WE list). The next day, 02.06.07, he rolled his eyes back to hide at hearing Where’s Graeme? This was an imperfect strategy for concealment, but one that I interpreted as showing he had some understanding of eye contact as both attentional engagement and significant to being found. By 02.07.00, Graeme showed evidence of perspective-taking and theory of mind through his ability to find places to hide where he would be hidden from sight (Flavell, 1992). Hide and seek was not acquired in production until 02.09.04, when Graeme produced the first instance of his idiosyncratic, musically gargled [oi yoi yoi➘ yoi yoi yoi➘] which meant I’m hiding. This vocalisation was neither a grunt nor a speech sound. Phonetically it fell somewhere between the transcription used above and a series of nasalized vowels. Like his other early words, it did not appear to originate in conventional adult language[^60].

Graeme’s ninth word/sign acquisition in his production vocabulary was also representative of an interactive game. Graeme spontaneously used the gesture of extending his foot, as well as fingering a parent’s toes, to request the game of this little pig. This word event had a specific meaning and consistent use; however, it did not extend in meaning, and had limited use during 02.09. It therefore only minimally qualifies as an early word/sign.

[^59]: In time, Graeme’s understanding of Where’s ___? broadened in meaning from the game of hide and seek to become generally locative.

[^60]: This word had a duration of two years in Graeme’s productive lexicon, and extended in meaning beyond the game of hide and seek.
Graeme also occasionally produced a sound with a specific intent but did not continue its use. For example, on 02.07.17, he made a vocalic call sound [uhoh] to invite me to play, but only produced it once. During 02.09, he addressed F and I several times with his sound formerly used for solitary pleasure. He had a serious demeanor, made eye contact, and used a precise and controlled gesture, flapping his hand up and down twice. It appeared to have meaning for him but it was not clear to us what he was communicating. Graeme used all his early words, except *this little pig*, past the period of slow learning. He produced *I want it* most frequently.

**Summary**

The onset of Graeme’s production occurred during the period of slow word learning in comprehension, from 02.06 to 02.09.28, when his babble, intentional communication, and earliest words and signs emerged together, along with his gains in joint attention and comprehension. This is consistent with TD children, though delayed (Bates et al., 1975; Nelson, 1991). Graeme’s babbling, in both solitary and interactive situations, increased in frequency and volume. His syllabic babbled syllables (vowels and glides) became more canonical, the precursor of a speech sound inventory for a language (Stark et al., 1993; Stoel-Gammon & Cooper, 1984; Vihman et al., 1986).

Graeme acquired an additional five word/signs, bringing his total to nine. The new acquisitions, all social/action words, were consistent in meaning and function. Four were signs, *look, hi, round about, and this little pig*, while *hide and seek* was vocalised. Although they all remained context bound, *look, hi, and round about* extended semantically from their initial meanings which were specific to one situation or function. Graeme volunteered them spontaneously and used them frequently. During these four months Graeme became a less silent, more communicative child.
Social/cognitive growth and play behaviour 02.06 to 02.09.28

Introduction

During the period between the onset of comprehension at 02.06, and the beginning of the comprehension word spurt at 02.10, Graeme’s cognitive growth, like his lexical acquisition, was slow and steady, although he retained many of his autistic prelinguistic behaviours. His growth in general symbolic capacity developed, along with his observation of and curiosity towards his environment. As Graeme became more interested in the manipulation and construction of objects, he became more aware of the relationships between objects and events, and between cause and effect. Socially, Graeme participated in and initiated interactive games, with gains in self-recognition and imitation. His solitary play demonstrated his growth in symbolic capacity and representation, categorisation, manipulation of objects and music, as he showed complex and creative tool use and solutions towards his goals. The sections below will examine these developments in detail.

Activities in solitary play

Between 02.06 and 02.10, Graeme’s solitary play consisted predominantly of earlier repetitive behaviours such as his fixations on doorknobs, doors, gates, locks, keys, phones, string, straps, the water hose, patches of reflected light, the compost box, and hammering pegs. Figure 5.10 shows him on the compost box, distracted from playing with a favourite piece of rusted metal.
His preference for tiny objects and surface anomalies continued unabated: he touched and fixated perserverively on latches, nails, hinges, and spots. He continued to pull his parents to view every lock, doorknob, and doorstop when he visited a new or unfrequented environment. Some undesirable behaviours became less frequent during 02.08, such as putting items into his mouth, ripping plants out of pots, and running into the lane. Graeme still engaged in making objects meet in mid air at his eye level, flinging things off the table, banging on the window, throwing stones and filtering them through his fingers, twirling bike wheels, and putting pegs into water and fishing them out again. A frequent variation on the latter was putting the pegs into a glass of water and drinking the water (02.08.14). Any return to a former haunt brought on earlier behaviours. On returning to the beach after the winter at 02.07.03, he went back to filtering sand through his fingers, putting it on logs, flinging rocks, spinning bike wheels, and lining up sticks in sand. When he revisited his grandparents’ home at 02.09.20, he repeated the activities of his previous visits: putting a pencil in the keyhole, listening to the dial tone on their
phone, and opening and closing their doors for hours on end. He continued to stack and line up objects in a precise order (Sowden et al., 2008).

**Journal entry**

**02.07.11**

It's quite relentless how Gray goes through trying periods of interest (passionate obsession) with our things, behaviour which causes us a lot of time and work in putting things out of reach, tidying, and repairing. Yesterday he stripped another huge amount of the old and painted-over wallpaper in his bedroom. He'd closed the door, whether to get at it better or to hide what he was up to, I don't know. F had to strip the rest of the wall today before repainting and Gray was with him every step of the way, pulling it off, stepping on F's feet, breaking up and mashing the torn-off paper, imitating with the scrapers. He (Gray, not F) was in gales of laughter the whole time.

**Journal entry**

**02.07.16**

It was the first really warm day of the year. J (next door) took Graeme, who was standing (on my fern) by the fence with his arms up asking to be picked up, over to play in the yard with the neighbours. Gray led them to all their doorknobs, wanting the doors opened. They were fixing their bikes and he spun the pedals industriously and climbed (crawling) up and down their stairs for about an hour. Earlier N and W from upstairs were sitting out in the backyard, where he's never seen them before. He was delighted and ran over to them, stopped a few feet away and crowed with laughter, bending over to put his closed hands between his thighs. He crawled all over them, then found their sweatshirts and dragged them around by their drawstrings. He loves a drawstring or tassel or dangling strap end. N rescued his sweatshirt and found an old piece of cord and had a tug 'o war with Gray, then tied the cord around Gray's middle. When I undressed Gray later after the cord was untied, Gray draped it around his neck, and ran around, torn between its appeal and the patch of sun on the wall, where he was playing with his shadow. I did pincer hands in shadow and he loved it and got his tummy next to the shadow hand so the shadow could pinch at his tum. Gray went in his room for 20 minutes then came out dragging the cord with the tinker toy rounds threaded on it. He'd recognized it as his threading cord we lost in the garden a week or 2 ago. He showed us, then went back to thread more and came out and twirled around so the cord would whirl. He takes all the rounds off to have the pleasure (and occasional frustration) of re-threading them.

He’s getting naughtier—quite wilful about doing things he knows will elicit a loud No! or even when it will cause us to take away what he's playing with. Today he broke branches and pulled leaves off my plants as I was potting them on and watering. He’s getting very persistent about the plants, often digs up the dirt and throws it on the floor. He knew today that even approaching a plant would bring a No and that actually touching them would mean being taken into his bedroom and locked in for three minutes, which he hates, especially when he’s outside. (We haven't shut him in his room

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61 See Figure 5.8 for an illustration of stripped wallpaper.  
62 See Figure 5.7 for an illustration of his posture.
for ages—not since the fireplace episode last fall and the stamp drawer incident at Christmas.) But still he persists, looking at me; sometimes speculatively and sometimes mischievously, and sometimes even laughing aloud--little brat. He’s testing me to find out the limits. (Figure 5.11)

Figure 5.11   Temptation of garden string fence (02.07.16)

Imitation

Graeme’s imitation ability, which had been delayed as it often is in toddlers with ASD who have lexical delay, became spontaneous, reflecting his increased attention to others (Charman & Baron-Cohen, 1994; Charman et al., 2005; Receveur et al., 2005; Rogers et al., 2003; I. M. Smith & Bryson, 1998; Stone, Ousley, & Littleford, 1997). Though still infrequent, he imitated F’s tool use, and when F was vacuuming, Graeme followed, using a side-to-side motion with a stick.

The benchmark imitation at 02.07.14 was his first imitation of sounds, a /brrr/ raspberry. Three days later, for the first time since he was eight months old, he imitated me making a gasping sound of surprise, as well as sticking my tongue out. Much of his therapy at preschool and with G had trained him to imitate. By 02.09, Graeme was slightly more willing to imitate actions, both when encouraged and spontaneously. Spontaneous examples included him pretending to brush his teeth when he saw me brushing mine at 02.07.05; imitating a friend patting him on the bum by patting his own leg at 02.09.28;
and imitating a slapping sound I made with my hand by dancing on a table in his bare feet at 02.09.24. More responsive to imitating environmental sounds than people’s handclaps or sounds, he immediately imitated G when she hammered at 02.09.21. On the same day, G made pincer hands and tweeted; Graeme copied the hand motion but not the sound. With encouragement, he imitated making animals walk on the floor, but not matching blocks with pictures (02.09.23). The preschool noted, in the report at 02.09.16, that he was now able to learn how to use objects through imitating others, and no longer needed hand-over-hand instruction.

**Manipulating objects**

Graeme’s ability to manipulate and explore the properties of objects improved during this period. At 02.07.08, Graeme tried to open the gas meter using a pencil as a screwdriver, and screwed the top on and off his new bottle. Spinning maintained its strong appeal. During 02.07, he struggled with figuring out how to remove objects from a box by tilting it to pour them out, rather than trying to pluck them out (02.07.24).

Like many children on the autism spectrum, Graeme’s actions on objects were advanced in comparison to his imitation skills (Charman et al., 2003). His excellent fine motor skills and spatial orientation facilitated such projects as threading, and elaborated tinker toy construction, during 02.07. At 02.07.10, he modified his top’s spin to accommodate the tinker toys he stuck into it, and at 02.07.20 he made a base for his tinker toy construction to enable it to stand, spacing its arms so it could balance. These feats of engineering were proudly carried around to show everyone; also an advance in relating behaviour. During 02.08, he learned to turn flashlights on and off (02.08.27), put the dominos away correctly in their box (02.08.26), and work zippers, snap fasteners, buttons and buckles (02.08.02). In this month, his interest in string and cord brought about new complexities in play: he wound cord around drawer handles to make a pull cord (02.08.13); threaded giant cat's cradles between chairs and tables; and worked out the mechanical possibilities for using a long cord to open doors from a distance (02.08.16). In solitary play during 02.09, a fascination with the grips on bungee cords overtook threading as a preoccupation. This resulted in much frustration as Graeme was unable to
master unhooking them, although he was able to solve the problem of them catching on objects as he dragged them around, by holding them high as he walked at 02.08.10. A favourite activity was twirling them, achieved by circling himself (02.08.09). With his lock-picking skills, Graeme earned the distinction of being the first child to ever escape from the childproofed preschool gym at 02.08.15. Light reflections continued to fascinate him, keeping him silently absorbed for long periods of time with intricate manoeuvres, such as putting his finger on the shimmering light reflection under a glass and lifting it up slowly to keep the reflection on his finger at 02.08.25. Graeme’s object permanence development, according to Dr. Ingram, was practised in his daily upending of all the living room furniture within his means during 02.09. At 02.09.30, he found four of the five toys G hid under shells.

**Categorisation**

Graeme’s sorting abilities during 02.07, while repetitive, were in advance of other areas in his cognition, in contrast with imitation. Line-ups and stacking continued, with frequent upsets over trying to balance the objects. He put pencils in parallel lines, stuck his diaper pins in a row on the wall, lined up and stacked drinking glasses and dominos, and included the graphic representation in the category of tops, by lining up a picture of a top alongside his tops at 02.07.05. The new record player at 02.09 offered hours of amusement, but not initially for playing records. Instead, Graeme lined up the records and put them all in their carrying case (02.09.19). Other object exploration included holding objects against various surfaces (02.07.08), and bringing new objects up to and away from his eyes to examine them (02.07.10). Graeme combined sorting with threading in object categorisation: beads, Lego, and tinker toys were threaded and unstrung; sorted by component type, colour, and shape; and then restrung (02.07.10).

Collecting objects in a container that he carried around was an activity that lasted for several years, began at 02.07. He repetitively filled bags or his top box daily with all his collected treasures to carry, dump it, refill one by one, carry it to a different place, and repeat the whole procedure. In the months to come these portable treasures included pegs, carrot pieces, tinker toys, safety pins, bagels, bits of plaster he had removed from the
wall, rocks, bolts, screws, buttons, pin-on buttons, beads, and dominos, while the container changed from bag to bucket, basket, box, bike helmet and F’s sock. Variations on collecting and carrying his small treasures during 02.09 featured both progress and unwelcome creativity. Graeme filled a bag with dirt, sand and stones and brought it inside to dump on the rug at 02.09.13. He learned to get into F’s and my drawers to get at our socks, put them on, take them off, put his treasures in them, and display them on chairs, while he crowed and assumed his happy pose (02.09.20, Figure 5.8).

Graeme began to do his first puzzles by referencing their shape rather than matching the image, initially doing them upside down. He found the right puzzle piece out of 14 pieces 90% of the time by 02.09.09, an achievement in motor control and categorisation. Sorting objects on the basis of an identification of similarity in shape, size, and colour were new exhaustive categorisation activities during 02.09. Graeme sorted his coloured sticks into yellow and green groups, then lined them up end to end. Clark (2003) and Gopnik (1987; 1992) view the formation of non-linguistic class relationships to be related to the child’s ability to develop strategies for determining meaning for unfamiliar words by identifying similarities.

Music

While Graeme enjoyed noise-making activity during 02.07, such as banging a drainpipe with a stick, in the next month he became very responsive to music and sounds, noticeably more so than to speech. He pressed his ear up to the speaker to listen for the duration of a record (02.07.08, and Figure 5.7), and put his ear down on the table to feel the vibration of the top at 02.08.24. He played one note on his toy organ, holding down either the highest or the lowest key as he turned the volume up and down at 02.08.09. Other favourites were his toy piano, music box, and record player.

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63 As he had been with his toy piano at 01.04.
Symbolic play and representational ability

Graeme had the delays in pretend interactive play skills (B. Morgan et al., 2003), and in the functioning and development of symbolic activity (Blanc et al., 2002), associated in children with ASD. Symbolic capacities include the ability to represent objects (Lifter & Bloom, 1989). In one of Graeme’s earliest examples of representation ability in functional play, at 02.07.15, he made precise screwing motions, in imitation of the locking motion, over a key ring he had hung on a peg. Graeme’s capacity for perceiving pictures and dolls as symbolic representations emerged at the start of 02.08, when he looked for a long time at drawings and photos of things he owned. This was in contrast to his short attention span for pictures of unfamiliar items, when his focus would switch instead to the texture, shape, and noise-making potential of the paper.

Comprehension delays in children with ASD are associated with their pretend play skills (Reijonen, 1997; Sigman & Ungerer, 1981). The SCD list entries show that Graeme’s perception of dolls as symbolic representations emerged at the start of 02.08, when at 02.08.03 he smiled at a doll and touched her nose in greeting, something he had previously done only for animate beings. He began to play more with his stuffed and plastic animals, recognising that they symbolised animate objects. After having been directed in therapy at 02.09.09 to put socks on a doll, his sock play expanded to include putting socks on chair legs (at 02.09.12) and on the stick he dragged around (at 02.09.14). In other symbolic activities of functional play, he held G’s earrings to his ears at 02.09.18, rememberer seeing her wear them, made a little hammer from tinker toys to hammer with (at 02.09.21), and put a stick through his record to make a top (at 02.09.25).

Towards the end of this period of slow learning Graeme commenced functional-relational play; for example, articulating one part of an old piano to make the other parts move (02.09.25), and attempting to add on to the garden fence with sticks and twine (Figure 5.11). He explored all the properties of objects: with crayons, he lined them up in several configurations; tapped them with both hands, then with alternating hands; rolled them; and drew lines, circles, and dots (CHDC preschool report 02.09.16; SCD list 02.09.26).
His CHDC preschool report of 02.05.16 noted that his doorknob play was decreasing, though there was more if he was tired, unwell, or insecure, which continued for another year. The CHDC preschool report of 02.09.26 notes that though still easily distracted, Graeme was at that point able to sustain 10 to 15 minutes of appropriate and constructive play. Graeme began to choose his own toys from the shelf at school, rather than selecting those nearest to hand. He experimented with toys that had new properties of motion and texture, such as the rocking horse, and play dough, a material whose consistency had not appealed earlier.

Graeme’s self-recognition advanced at 02.09.09. He touched his navel in a photo in recognition, and when I responded, *That's Graeme*, he lifted up his shirt to touch his navel in the flesh. He circled his face with his finger in another photo when I labelled it *Graeme*. For a few months, F and I had been putting a red dot on his nose and holding him up to a mirror, to test his ability to recognise the dot as an addition to his face. At 02.09.28, he touched his red dotted nose in the mirror, after first touching his cheeks and lip, trying for his nose.

Interactive pretend play skills indicate the establishment of symbolic representation which are considered a prerequisite for referential lexical acquisition in production in TD children (Sigman & Ungerer, 1984; Ungerer et al., 1981). Although Graeme was just producing his earliest word/signs, his pretend play skills began to slowly appear in 02.08, and were more evident in 02.09 in his play with dolls. This was an important milestone related to language development that marked the end of his period of slow word learning and the start of his word spurt in comprehension (McCune & Zanes, 2001). By the end of the period of slow word learning, Graeme has made gains in symbolic capacity, functional-relational and pretend play, object permanence, imitation, problem solving, categorisation, and self-recognition. Those are the advances in social cognition considered to be necessary for more rapid lexical acquisition.
Social abilities in the period of slow word learning

Graeme’s joint attention skills, which emerged at the onset of the period of slow word learning, developed throughout the four months. The most noticeable attentional growth was in his gestural intentional communication: in the eye contact he made with others, and in pointing at things he wanted or had his attention on. Graeme also liked a parent to point to and label his family members: Mummy, Daddy, Graeme, and Lenny (02.07.16, and Figure 5.12).

Figure 5.12 Joint attention and pointing with Grandma (03.03)

His pointing, and his understanding of F’s and my pointing, were lexical acquisition milestones that laid the groundwork for the concept that people and objects had names. The therapeutic intervention of his preschool, language therapist, and family resulted in his initiated and sustained eye contact (Figures 5.10 and 6.7). He often looked at people out of the corner of his eye, but by 02.09.25 would make direct eye contact for approval and to share a joke. With his intimates, Graeme initiated his favourite interactive rhyming tickle games. His interest in these diminished during 02.09, while his preference for the contact rough and tumble games that started in 02.08 continued, a development common
to TD children (Pellegrini, 2002). Near the end of the period, he involved me more in what he was doing, and enjoyed pointing and touching games, precursors to requesting names. Graeme became more attuned to his environment; for example, at 02.07.00 he cried upon recognising F’s suitcases as signalling his impending departure, while at 02.09.00 he began looking out the window when he was on the bus, rather than his habitual looking down. He also became more aware of cause and effect, trying to put a forbidden object back to hide his activities at 02.07.24.

Graeme’s mood was noticeably upbeat in this period. During 02.07, he was less frustrated and very merry in mood, throwing his head back in uproarious laughter at things he had made, performing a gleeful little hopping dance with his knees bent, and taking his happy pose (Figure 5.8). His cheerfulness made it easier to introduce him to new activities. He was delighted with everything except enforced transitions, such as being removed from a favourite toy or activity, which inevitably provoked a tantrum.

Graeme’s relating behaviours improved greatly over this four-month period. While he was still contented with long periods of solitary play, he became less withdrawn and friendlier, more alert, curious, and aware of his surroundings. At 02.07, he developed a new sensitivity to those who were interested in him and would not approach those who were not. He began to be much more social with people he knew, climbing on them, initiating nose rubbing, and sticking things in everyone’s ears (02.07.11). Graeme sometimes showed affection by gently stroking the face of the one cuddling him (CHDC report 02.09.16). He became much more aware of an audience and honed his show-off techniques during this period; riding into the room on two garden poles in ride a cock horse fashion (02.08.04), spinning his top as a demonstration sport (first noted at 02.07.02), and circling the room running and jiggling for visitors before approaching them (02.07.10). His social relating manners were unusual in some aspects, particularly his greeting behaviour. However, his new social skills and his affection for his parents

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64 Described in the section on intentional communication in this period.
caused the consulting psychiatrist and psychologist at B. C. Children’s Hospital to rule out autism\(^6\), as Graeme related too well to people (02.07.26).

Graeme made some advances in socialisation with children at his preschool during 02.08, most likely attributable to having gone to a babysitter with two other children for that month, in addition to a familiarity with preschool attendance. He engaged only in parallel play with the children at preschool, rarely interacting directly with them. By the end of 02.09, he began to watch the other children intently, sometimes approaching them to touch and show a toy, an improvement over his former indifference (CHDC report 02.09.26). Though Graeme would bring objects to show, he refused to hand them over or let anyone touch them. From 02.09.14 on, he made a game of *give it to me*. When I said *give it to me* (or *ta*), Graeme would touch my outstretched hand with his free hand (not the one holding his precious bag of treasures), and rush in and out of the room, shrieking with laughter. At this time, the CHDC preschool completed their observation of Graeme and recommended that F and I enrol him in the Berwick Preschool, a daily programme that integrated children with special needs with TD children, at the University of British Columbia.

**Physical Abilities**

At 02.09 he laughed, danced, and circled when he was happy, moving his feet more actively although he was physically delayed, with poor balance and less ability in climbing and running than TD children his age (Figure 5.13).

\(^6\) In 1980, autism was defined in part by a failure to relate socially.
Early language delay is associated with developmental motor milestone delays and lower comprehension abilities in ASD children (Eisenmajer et al., 1998; Lord et al., 2004). Near the end of this period, he became noticeably less fearful physically and socially. His balance improved, his walk matured, and he was able to walk on uneven ground, and to run (an improvement from his CHDC report of 02.05.16). He became more adventurous; for example, whereas he had previously wanted to be carried in a new place, he now enjoyed holding F's hand to walk around (02.09.25).

**Journal entry**

**02.07.15**

Long game of hide and seek--he really runs and hides in good places now and laughs his head off when he's "found" (with eye contact).

He recognized my sister and brother-in-law when they came this evening--ran to M especially delighted, laughed, touched her nose, looked in her mouth, hugged her, sat on her lap, crawled all over her (investigating buttons, bracelets, etc.) and wanted her to pick him up all evening. He initiated lots of socialising with her--hide and seek, showing off by running in and out of the room we're in and crowing, holding things between his legs and laughing, hugs and cuddles. She gave him her wristwatch--he dangled it and * held it close to his face, over his closed eyes (while walking!) and against different surfaces (her sweater, the wall).

He knows that L has desirable keys and today she gave him two bunches--he danced around and jingled them, one in each hand, then twirled around a bit till he got dizzy.
Then he hung them both on a wall peg and *made a precise turning gesture (as if turning a screwdriver or key) over the peg.

**Journal entry**

02.08.13

I always have lots to write on Sunday as I have the whole day with Gray, except the first few hours in the morning, when F kindly gets up with him.

*Yesterday he started a new variation on threading and continued it today. He got his threading cord and his rawhide and wound them around drawer handles and around the latch circle. I don't think he can undo them.

He got soaked through twice playing with the hose when it was running. He drenched himself and couldn't figure out how to get out of the way of the icy hose water. He holds it with both hands in the same direction.

After watching F fix up the bike he took the wrench and applied it to the bolts on the bike in the correct manner.

He loves to stand on the deep freeze and twiddle the window latch. Tonight I had my laundry hung up there and he grabbed a sock in each hand and shook them vigorously, laughing loudly. Then I put him on the floor with the socks and panties and with some aid he got on my panties and pulled them up, and pulled up the socks and walked with tiny steps over to show Daddy.

He's so alert to F's presence - and comings and goings - he always goes to hear a word from Daddy.

Post-bottle, he lay snuggled up beside me and touched my nose, smiling up at me.

*Then he grabbed my finger in one hand, held his bottle with the other, and bought them to touch, nipple and finger tip. He loves to line up points like that, at eye level.

**Journal entry**

02.09.25

Another big day for Greebo. *He put a stick through his records to make a top and * he twirled it with the fingers of one hand. He's laughing a lot and * whooped - I've heard it before but he’s doing it more now [wu uuu] in excitement.

Gray went happily to Grandma at her house today, wanting her to hold him, and went to a few door stops, closed a few doors, and threw some rocks down the stairs - that always makes him laugh. He ran to Milton (cat) - pulled his tail and stroked and pounded him.

At M and J's (where he's only been once or twice) he was fairly relaxed, not a “porto-philiac” (F’s word) on the doors. He cried a bit, wanting to hold F's hand and walk around, but the three cats kept him laughing, and * the croquet mallets, as tall as him, were both a joy and an anxiety. He got frustrated because he couldn't hold four at a time, and we kept exchanging them in the game. He’s not interested in balls.

His great other favourite was * watching the fish in the three aquariums - spent a long time vocalising about them to C and pointing at them. * Then he turned to her and touched her fish necklace; she thought the two events were connected.
When he laughs, he often turns to look at someone to share the joke.
 Didn't go around wanting everyone's glasses and dumping stuff in their drinks for a pleasant change.

Summary

During 02.06.00 to 02.09.15, Graeme made cognitive gains in object permanence (Piaget, 1962), categorisation by shape, size, and colour (Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Gopnik & Nazzi, 2003; Mervis & Bertrand, 1994), and skills in object exploration and manipulation. During 02.09, Graeme began to demonstrate some abilities in functional-relational play and in symbolic representation (Lifter & Bloom, 1989). At this point, a social-cognitive spurt began, which appeared to lay the foundation for his more rapid comprehension in the next month. Categorisation continued to be a comparatively advanced skill, with Graeme developing the ability to form class relationships based on similarity. In contrast, imitation lagged, a phenomena noted in several studies (Rogers et al., 2003; Rogers et al., 2008; Stone, Ousley, & Littleford, 1997). Although Graeme spent most of his time in solitary play, the improvement in the social impairments of ASD was evident in Graeme’s relating behaviours through in his affection and his interactive play with his intimates, and in his increased attention to others and to his environment (Charman, 2003).

Chapter Summary

Graeme’s prelinguistic period lasted from his birth to around 02.06. This was a period of slow development in social/cognitive abilities, and stalled development in language. Autistic behaviours predominated in his play and in his social interactions. His areas of cognitive strength were in observing fine levels of differences and in categorising similar objects by stacking and seriating. Until Graeme was 02.06, he communicated his intentions of request and protest through pulling a parent’s hands and crying. He did not have the social/cognitive abilities for word comprehension. At 02.06, he began to develop the joint attention abilities of pointing, understanding pointing, making eye contact, and gaze following, which were the most significant social/cognitive milestones for the onset
of his lexical acquisition. This achievement signalled the end of his prelinguistic period and the onset of his lexical acquisition.

The onset of Graeme’s word learning was characterised by increases in comprehension, the beginning of his intentional communication, and the acquisition of his initial early meaningful word/signs. The contemporaneous development of intentional communication, lexical comprehension, and joint attention is generally typical of children younger than 01.02, but for Graeme these co-occurred during this period, a delay common to children with ASD (Charman, 2003; McCune & Vihman, 2001).

During the four-month period of slow word learning in comprehension, from 02.06.00 to 02.09.28, Graeme added slowly to his comprehension vocabulary, acquiring 30 words overall, one by one, and gradually extending them semantically. His comprehension of a word was dependent on the delivery of the speaker and its setting, both linguistic and physical, because words were associated with routine activities. The words he understood were context restricted, yet more inclusive, because the verbal component of a game or routine was integral to his understanding of the whole routine. Input from adults that assisted Graeme in acquiring meanings and words included: consistent situational contexts, ostensive referents, frequent modelling, and one-word responses or a short MLU with reduced morphological complexity.

Graeme’s intentional communication increased in frequency and developed into more specific and directed gestural requests for objects, actions, and protests. He refined his pointing skills physically, using pointing to request and to comment. His greetings were unusual, reflecting a desire for sameness and difficulty with transitions common to children with autism. In his production vocabulary, Graeme acquired an additional five word/signs that were consistent in meaning and form, and spontaneously produced. The word/signs consisted of non-speech sounds and gestures. He also resumed babbling.

From the onset of his word learning to the middle of 02.09, Graeme made cognitive gains in object permanence, categorisation by shape, size, and colour, and in skills of object exploration and manipulation. During 02.09, a social-cognitive spurt began, which
appeared to lay the foundation for his more rapid word learning in comprehension in the next month. At this time, Graeme began to demonstrate abilities in imitation, functional-relational play, symbolic representation, and pretend play. Categorisation continued to be a comparatively advanced skill, since Graeme developed the ability to form class relationships based on similarity, while imitation lagged. Solitary activities dominated, but social development was evident in Graeme’s relating behaviours: in his affection, interactive play, and increased attention to others and to his environment.

Although at this time his paediatrician stated that Graeme had no need to communicate verbally since I could “read his mind”, in fact Graeme had not yet reached the level of comprehension and cognition where speech would be expected. This period of slow word learning consolidated the lexical acquisition that followed his social/cognitive spurt at the onset of his word learning, and laid the foundation for another period of rapid social/cognitive development preceding the word spurt in comprehension.
Chapter 6: Graeme’s Lexical acquisition from 02.10.00 to 03.00.28 during the Word Spurt in Comprehension

Introduction

This section will examine the three-month period of Graeme’s comprehension word spurt, from 02.10.00 to 03.00.28, in three related domains: in Part 1, Graeme’s rapid word learning, leading to spontaneous lexical acquisition in comprehension; in Part 2, his semantic development in comprehension; and in Part 3, his productions of babble, intentional communication, and word/sign acquisition. The word spurt in comprehension represented the major reorganisation in Graeme’s lexical acquisition during this study. It brought about a qualitative change in the way he learned words and their meanings. The data show that Graeme’s word learning efficiency, and his semantic development in the word spurt in comprehension, developed concurrently with several key areas of social/cognitive development related to language acquisition: attentional engagement, symbolic representational ability, exhaustive categorisation, and the naming insight (Nazzi & Bertoncini, 2003). Graeme’s word/sign acquisition proceeded slowly, with only nine context dependent acquisitions in this period. Two areas (colour and animal sounds), in which Graeme had large increases in lexical comprehension, are discussed in relation to symbolic representation.

Part 1: The word spurt in comprehension

At the end of the period of slow word learning, Graeme entered a period of rapid learning in both social/cognitive development and lexical acquisition in comprehension. Graeme’s abilities in joint attention, exhaustive categorisation, object permanence, and symbolic representation had begun to develop at this time, while his physical and social behaviour had become more adventurous, involving new activities and toys. An environmental contribution to this developmental spurt may have been the additional stimulation of

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66 Discussed in Chapter 2.
more time than usual with me for 2 weeks, and his enrolment in a new intensive learning environment at the Berwick Preschool for special needs children.

During 02.10, Graeme’s major cognitive milestone was the realisation that things have names. The naming insight, identified by Dore (1976) as a prerequisite for lexical acquisition, co-occurred with the acquisition of a gesture to request lexical information. Very rapid comprehension began at 02.11 when he acquired a vocalisation for this purpose. Graeme began to understand words spontaneously in the following month, coinciding with his apparent awareness that everything has a colour, and with his acquisition of colour names. At the end of 03.00, his production became the focus of the diary.

**Quantitative changes in acquisition in the comprehension word spurt**

During the three months of the word spurt in comprehension, 02.10.00 to 03.00.28, Graeme had exponential growth in his vocabulary. He acquired six new words in comprehension in five days, ending 02.10.05. During this month, he steadily acquired 24 words in total, almost doubling his receptive vocabulary from its onset, three months previously. The next month, 02.11, saw Graeme’s comprehension almost triple, as he became efficient at rapidly adding words to his lexicon. On one day, at 02.11.02, I confirmed Graeme’s acquisition of 18 words, although many of these had been partially learned earlier. After Graeme had made 50 requests for my repetition of *duck*, he learned it in just two days, at 02.11.00, his fastest acquisition in comprehension to that point. A week later he had become even more proficient, acquiring *string* in comprehension after only 10 repetitions in response to his requests. A week later, Graeme was learning words that named objects of interest after hearing only a few labellings; for example, *chips* was learned in the course of eating this rare treat. During the month of 03.00, he learned at least 98 words; by that time, he learned most nominals after only four or five repetitions or demonstrations.

By 03.00, the WE list of acquired words in comprehension was no longer completely inclusive. Graeme was learning his receptive lexicon too quickly for me to track his AoA,
the context of acquisition, or his full understanding of individual words, nor could I maintain awareness of all the words he had learned at his preschool. During the comprehension word spurt, Graeme learned to understand at least 200 words, compared to the 30 he had acquired in his period of slow word learning, as illustrated in Table 6.1.

Table 6.1 The number of words per month Graeme acquired in comprehension

<table>
<thead>
<tr>
<th>Age</th>
<th>No of words acquired</th>
<th>Total of words acquired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02.06</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>02.07</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>02.08</td>
<td>7</td>
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<td>126</td>
</tr>
<tr>
<td>03.00</td>
<td>99</td>
<td>225</td>
</tr>
</tbody>
</table>

The naming insight, attentional engagement, and the name question sign

New social behaviours and cognitive developments at the start of 02.10 signalled the onset of the word spurt in comprehension as Graeme began to employ efficient strategies for rapidly adding to his vocabulary. He became noticeably more attentive to language when being directly addressed. His attitude towards word learning changed from indifferent or averse to keen, insistent, even voracious, as he gained in joint attention ability and developed the means to elicit names.

As a non-verbal child, Graeme used gestural attention-getters to ensure co-operation and to ask for a name. His improved attentional engagement in initiating joint attention (IJA) through alternating gaze and pointing was an important tactic in eliciting names to acquire his vocabulary in comprehension. After he indicated what he wanted to be named, by pointing or touching, he glanced at the adult’s eyes to check their direction of gaze, then looked back to the object, and touched it again. This body language of imperative pointing (Tomasello & Camaioni, 1997) and triadic gaze switching (Baldwin & Moses, 1996; Hollich et al., 2000; Mundy et al., 2009; Tomasello, 2003) demonstrated
that he had overcome the characteristic ASD deficit in the IJA skill of triadic gaze
switching (the ability to change the direction of gaze to monitor and respond to verbal
and non-verbal cues that indicate the referential intention and focus of the speaker)
(Charman, 2003; Leekam et al., 1998; Mundy et al., 1994; Sigman & Kim, 1999). I
termed his combination of initiating joint attention with imperative pointing, eye contact,
gaze following and gaze switching, the name question. It became his word/sign specific
to eliciting nominals, and was the 11th acquisition in his productive lexicon67, acquired at
02.10.13 (Figure 6.4).

Graeme demonstrated that he had achieved the cognitive milestone of the naming insight
with this acquisition of the name question to request lexical information (Dore et al.,
1976). His realisation that all objects have names became apparent with remarkable
suddeness at 02.10.11, when he arrived home from his second day at his new preschool
and began to actively elicit my labelling response of eye, nose, and mouth for each of his
stuffed animals, by repeatedly touching the toy, then swiftly turning to look at my face to
ensure I was naming the object he was indicating. At 02.10.13, he used this behaviour at
preschool, lining up the plastic animals there and touching their noses to elicit nose from
his teachers. His name question requests were then employed for other names, but
initially only for those words already in his comprehension, not for new vocabulary.

Journal entry

02.10.25

Gray off to school, reached to touch my nose as he was being strapped in. I said “yes,
nose” and little J beside Gray enthusiastically touched her button nose. Gray regarded
her curiously.

* He pointed to the sky when it was really windy. After I said the word windy he pointed
again, to get me to say it again.

* He’s asking all day for new words by pointing, listening and turning to me and pointing
again. The wind in the trees made him *point to a tree, I said tree and * he pointed to
another tree. More new words.

I’m sure he knows more words now than I have any idea of, it's hard to keep track. When
he’s running away he turns when I say * “Come on”; I think he also knows this to mean
come with me. He responds to go up and go down in a very general way, e.g. * tonight
he turned and went back upstairs.

67 The section on the name question vocalisation describes a further development in this word/sign.
I showed him a new book - photos of a baby and mature duck, and he touched his plastic mother and baby ducks. He studied the book, sitting down to hold it, then remembered that “The Jolly Barnyard” with more duck pix was on the table in another room, and ran to climb up on a chair to get it.

He had a bath and is very adroit at putting back the showerhead (with which he sprays relentlessly) when I call “No Graeme, put it back”.

He was interested in the labelling of light (electric) today, and ears yesterday and confused tummy as tongue several times.

No speech sounds today.

Lots of socks from every drawer for the past two days * getting us to put them on his hands like mittens.

**Representational ability and picture books**

The development of representational ability, at the onset of the comprehension word spurt, was another breakthrough in cognition related to both the naming insight (Anglin, 1993; Bates & Benigni, 1979; Golinkoff et al., 1994; Lifter & Bloom, 1989; Mervis & Bertrand, 1994) and the acquisition of IJA (Hirotani et al., 2009; F. Kaplan & Hafner, 2006; Mundy & Newell, 2007). This manifested first in Graeme’s identifying images of the family by pointing to slides and photos (02.10.16). The next example was his identification of the facial features of animals in his picture books, at 02.10.22, when, for the first time, he regarded books not simply as hinged mechanisms to stack and line up but as containing pictures that were symbolic representations of real objects. With this realisation came the further understanding that spoken words represented those images.

One of Graeme’s unusual comprehension strategies was using the resource of second-order representations, in the form of picture books, as an initial means to acquire vocabulary, particularly nominals. Much of his new vocabulary was learned from long hours with his books, particularly the illustrated British children’s Ladybird books, whose one clear and colourful image per page appealed strongly to him. During the word spurt he brought these to his parents for lengthy interactive labelling sessions three to five times a day, eliciting words (Figures 4.2 and 6.1).
In his impatience to hear favourite words, such as the names of the animals and their sounds, he developed a brute force strategy of lexical acquisition. He escalated from touching a picture in his book, for elicitation, to insistently jabbing at it, if F and I had not responded quickly enough, progressing to nudging and even pushing us for a repetition of a favourite name.

Graeme also became very swift at identifying the pictures of the words that were labelled. He usually signified his knowledge of a word by touching or pointing to an object when he was asked to identify it, as well as spontaneously pointing when an object was named. Morford and Goldin-Meadow (1992) found that in TD children of 01.02 to 02.04, gestures supplemented and substituted for speech in comprehension.

Another variation in Graeme’s gestural questioning was to tap tentatively on an unfamiliar picture and poke more forcefully on familiar ones, which were the ones he preferred to have repeated, perhaps from an autistic desire for sameness, or from the need for reinforcement. He often requested the names of images of special interest items, like button and pool, more than 20 times in a row. His frequency of requesting, and ours of
responding, functioned as an aid to his word learning, as well as a means of prolonging the conversational focus on the object of his fascinations.

He also pored over his books in solitary vocabulary practice, holding his books right side up to study them closely. Heartache appropriate to his mental age inevitably ensued when he deliberately ripped up his books and then with immediate regret tried frantically to put them together, tearfully imploring his parents to help (Figures 6.2 and 6.3).

Figure 6.2   Engrossed in picture books (03.04)
The pictures aided Graeme in establishing the connections between non-linguistic referents and words, in determining a concept for a word, and in acquiring a word for the concept. Graeme's first exposure to many words was in their pictorial representations, before their definitions were extended to include real objects, even for common household objects. For example, after I had labelled the spoon picture he searched for an actual spoon, to confirm it had the same name. Words learned at 02.11 that had their original referents in the picture books were: duck, brush, bus, orange (fruit), pool, button, spoon, candy, bath, cat, book, tap, stairs, cow, car, pig, boy, house, key, pen/pencil, sheep, egg, chicken, goat, words/writing, hand, grass, flower, horse, man, peg, umbrella, glasses (spectacles), and lady. Their semantic range was extended to include the real objects as Graeme’s comprehension became less limited to the context of picture books.

Graeme then began to test the range of what else could be named, asking for lexical information by pointing to people he encountered, events and actions, the music from the speakers, large structures such as walls, and tiny parts of objects. His requests for names
of physical objects were not as frequent as they had been for pictures during 02.11, when
the study of pictures occupied much of his waking time at home. The backgrounds in the
picture books also attracted his attention, necessitating an expansion of the one-word
responses of F and myself. Working from pictures to real-life objects in his lexical
acquisition, Graeme developed a broader representational ability to understand that
pictures could symbolise real life. He demonstrated his word/image recognition by
licking a picture of candy, and kissing a picture of a cat.

Because the Ladybird books were designed to be early readers, each picture was
identified in printed text that intrigued Graeme almost as much as the illustrations
themselves. Though not, of course, actually reading, nevertheless in his solitary perusal
he seemed to make an association between the written word and the picture, touching the
one as often as the other. F and I often read the written word as we labelled, substituting
the Canadian dialect forms by changing *sweets* to *candies*, and *lorry* to *truck*. Though of
course each written word visibly varied in shape, we responded to his queries by referring
to all text as *words* or *writing*, as we did for text from other sources that excited his
curiosity; hence Graeme’s unusually early understanding of *word* and *writing*. Magnetic
letters of the alphabet and numbers were added to the cache of treasures he carried
around, and he frequently asked his parents to name them. Though Graeme would not
have made any symbolic sound association with a letter at this age, he began to learn the
letter names as shape labels.

**Journal entry**

02.10.24

Graeme climbed on to the bed first thing in the morning to wake me up as usual, with a
big pile of socks he’s garnered from our drawers and his. He started touching my nose
etc. for labels. I said, *socks - where’s the socks?* and *he turned and pointed to the pile,
picking it up. New word.*

Home from school to the two barnyard picture books, more socks, and the photo of
Grandma, which always makes him smile. The books are so fascinating to him - he
studies one page for 10 minutes, or longer if we’re involved. He points to all the animals,
knows *doggie* for sure. Tonight Graeme was obsessed with the cover of The Jolly
Barnyard, spent the better part of an hour placing his index finger on the various
animals, so I would name them. I took a dog, sheep, and duck from his toy box (small 3-
D figurines) and placed them over their matching drawings. *He picked up and handled
each one, placing his finger on it to get me to name it, then placing his finger on (usually) the right image.

*He also transferred information about the name to animal pictures of a drastically different graphic style, e.g. photos, drawings, plastic animals.

*New words: *pigs, sheep, ducks/chickens maybe. It was hard to check if he knew the new words because he was so involved in touching the plastic animals, the photos, and drawings that he was too busy to point when he heard us name. We named after he pointed, and "it's now a reward to him to hear the sound of the word, eliciting the name from us.

Hardly any speech sounds - I heard none.

This past week he’s realised things have names.

**The name question vocalisation**

A significant milestone affecting rapid comprehension, at 02.11.15, was the acquisition in Graeme’s productive lexicon of a consistent grunt vocalisation for the name question (McCune et al., 1996). This utterance was not a conventional word, with speech sounds, but a vocalic grunt, lower than a stressed schwa, with a sharp questioning intonation, usually repeated though not reduplicated, and almost always accompanied by the earlier gestural requests for name identification, of pointing and touching, with eye gaze. I transcribed it broadly as [?uh➚ ?uh➚ ?uh➚].

With the attainment of the name question sound, Graeme slightly modified his procedure for requesting names, and for ascertaining the consistency of our responses. He vocalised while looking at, and touching, a picture or object; then, as F and I named it, he turned to us and repeated the question, removing his finger from direct contact, but still pointing. Like the gestural form, the name question sound operated as a request for repetition more often than it did for new information, which had the effect of giving Graeme more exposure to the word. To acknowledge that we had repeated the word he expected, and to request a further repetition, he modified the form of the vocalised *name question* by consistently using an intonation that was more level than the rising intonation of the original question.

The acquisition of the vocalised *name question* utterance indicated a shift in Graeme’s cognitive and social growth in three areas: first, his understanding that language was
social and interactive; second, his knowledge that things have names; and third, his ability to use language itself as the means of learning words. The vocalisation had significant bearing on Graeme’s rapid learning of nominals, in that it enabled him to request information by more reliably attracting an adult’s attention with sound, rather than depending on his silent gestures being noticed. He now had the capacity for the pragmatic intention of gaining attention with vocalisation, which is a contemporaneous development to referential word use in production for TD children (McCune et al., 1996; McCune & Vihman, 2001). The immediate result was a large increase in his asking for names, so much so that it no longer became possible to record every inquiry in the diary.

A graphic representation of the developmental relationship between the gestural and vocalised name question and the rate of lexical acquisition in comprehension can be seen in Figure 6.4. It illustrates the relationship between Graeme’s rate of acquisition of in comprehension and his acquisition of the socio-cognitive skill of initiating joint attention through intersubjectivity. Before the acquisition of the gestural name question, which combined pointing and triadic gaze switching, Graeme, at 02.10.13, understood 40 words. Now that he had a means to request lexical information, his rate of receptive acquisition rose sharply to a gain of 67 words (for a total of 107 words) in the next month. At 02.11.15, Graeme added a grunt vocalisation to the name question. This resulted in a more effective method of initiating joint attention for his lexical requests, demonstrated graphically by the rapid increase in his rate of acquisition. He added another 200 words in the next six weeks, until the end point of spontaneous comprehension.
Throughout the month of 03.00, Graeme continued to actively seek words for meanings, and meanings for words, with his name question. The name question also fulfilled an interactive function of conversational turn taking for Graeme, in such situations as toy animal play and eating, as well as in learning names through picture books. His word learning became more proficient as his lexicon grew, and as he accumulated more information on which to base his expectations for a response. An illustration of this occurred at 03.00.09, when he touched his “Little Duck” picture book and asked his name question, holding the book in such a position that I could not see it. Guessing on the basis of the previous 100 inquiries, I answered, “It’s a duck.” He had, however, been pointing to the hay, that had also been named several times, earlier. He informed me that it was not the word he expected to hear by adamantly repeating his name question, forcefully
jabbing at the picture until I had identified it correctly. A variant lexical marker during this month was Graeme’s wave at more distant named objects in the real world, such as cars and bikes, in place of pointing or touching.

Journal entry

02.11.18

He got up very early and started right in on the dreadful talking animals toy. In the garden again to pick flowers - he carries them around in one hand in a bunch.

When Grandma and Grandpa came he came running out of his room where he’d been looking at "new books and the duck book and ran straight into Grandma’s arms and eagerly touched her eyes and nose, then turned to me to touch mine.

Pointed for records and to his Grandpa for Where’s Papa? Responded to music again, and very interested in picture of clothes pegs, as well as in the usual animals, birds, buttons, and bike pix. *Interested in umbrella and glasses (new words) pix too. * Said [?uh] a couple of times in request of a name.

Asks very specifically for bread by leading us to the counter and pointing, jabbing with his finger. * Also jabbed his finger into his cup to ask for milk.

Played the taut string game with Grandma - really cried when I took it away. It makes him cranky and demanding. He can sometimes be distracted by a book though, or the talking animals. Likes it (very serious face) when we make the animal sound after the word - no imitation.

Lots of vocalisation [owuhwei:] and [wawa] and [yiyyi].

More paintings at school this week. They had been going to keep an easel standing in every room at the beginning of the programme but that was the only thing Gray would do so they put them all away until painting time.

Journal entry

02.11.19

I went to observe Gray on his last day of school. He was part of a singing circle - he was reluctant to sit down and didn’t stay for more than 5 minutes - only one other child (who was deaf) had left before him. But C and G (teachers) said it was a record time for Gray. * He sat in the centre while they sang Graeme got his hair cut (3X) by Breeze while Breeze imitated cutting his hair. He got a lot of attention, and hammered pins and used play dough and threaded animal shapes.

In the circle song "X loves his bear, he loves his bear, he takes it everywhere" Graeme screamed for the bear for a minute * (instead of throughout the whole song) then followed the bear around as it was passed around the circle.

At home more duck book - he would touch the picture, turn to look at me, then say [?uh] (his name question) to elicit names. Because we didn’t respond until he used his name question he asked verbally about 20 times each for grass, pool, water, boy, baby duck, egg, duck stand in the water/duck lie down, duck close eye. We’ve expanded the MLU to him but still simplify the morphemes. He read his book (Ladybird and duck) by
himself - he jabs several times at a specific place, then turns the page, repeats jabbing. You can see he’s hearing the words in his head, not saying them to himself of course because he doesn’t say anything.

He put his bears standing up in the drawer and did spool threading.

G said he’s imitated (roughly) moo and ‘: today he responded [a:] (down) to my [muuw] moo but not baa, oink etc., although he’s interested.

**Input, MLU, and verbal processing in the comprehension word spurt**

As Graeme became more proficient at word recognition in continuous speech during 02.11, F and I increased the MLU with which we addressed him to at least three. F and I also began to include colour words and to describe relational, possessive, and diectic aspects of nominals and action words; for example, *Kiss the cat, close the door, make bear walk, give me a kiss and where’s the book?* During 02.11 and 03.00, whenever Graeme repeated his name question, we expanded our responses with new information on aspects of the referent, including colour words as they were acquired. Thus the original label bear, with its simplified length and lexical load, became *that’s the bears leg, duck became the duck is standing in the puddle, pig became hi, black pig with a pink stripe, oink oink, while it’s a horse expanded to that’s the white horse. He jumps.* These responses would usually generate yet another name question about the additional information, with Graeme pointing specifically to the new referent, or making the horse jump, or, later, imitating the sound. He also began to elicit longer utterances with more relational complexity, by using his name question as he was performing an action, such as inserting keys and cutlery into furnace grates or tossing stuffed animals into the full bath. A favourable reply such as *spoon in the hole or horse falls down in the water* would prompt two or three repetition requests, as opposed to something like “No, Graeme, don’t do that. Bad boy!” which would have provoked a tantrum.

One measure of Graeme’s spontaneous word acquisition in 03.00 was his new ability to isolate and recognise words in a stream of speech that was not addressed to him. A demonstration of this occurred at 03.00.04 when I remarked to F, about a Ladybird book, “Everything Graeme knows is in this book,” and Graeme touched the picture of the dog’s nose on the cover, interpreting *knows as nose.*
Graeme obeyed increasingly complex commands during the word spurt in comprehension, perhaps recognising one or two key words and guessing the rest, aided by his knowledge of the expected response in a routine. He became more adept at following locative directions and prepositional phrases, possessive relations, and agent-action-object relations such as *Graeme kiss bear*. The agent-action-object relations were not fully sorted out, however. At 03.00.09, I said, *Mummy kiss the bear*, and suited action to word. To my subsequent prompt of *Graeme kiss the bear*, Graeme did kiss the bear, but when I later directed him to *Kiss the bear*, he kissed me. Pronouns were acquired late. F and I began to address Graeme with space preposition phrases, and with inflectional morphemes that clarified possessive relationships. For example, at 03.00.08, F and Graeme were looking at a picture of a boy’s hand holding a duck. F asked, *Where’s the hand?* and Graeme put his own hand down on the picture. When F asked, *Where’s the boy’s hand?* Graeme pointed to it. Two days later, he brought one after another of F’s socks into the room to prompt me to repeat, *Daddy’s sock*, though in this case the possessive morpheme was probably not perceptible.

**Lexical misunderstandings during the word spurt in comprehension**

Graeme’s misunderstandings in comprehension reveal his phonetic perceptions, as well as his assumptions about possible lexical choices, based on the phonological similarity between the word that was said and the one he thought was said. Many of these misunderstandings occurred repeatedly over a week or two, and Graeme would frequently request their repetition, showing that he realised there was a sound difference.

**Table 6.2  Words confused in comprehension during 02.11 and 03.00**

<table>
<thead>
<tr>
<th>Input word 02.11</th>
<th>Word Graeme perceived 02.11</th>
<th>Input word 03.00</th>
<th>Word Graeme perceived 03.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tongue</td>
<td>Tummy 02.11</td>
<td>Tummy</td>
<td>Tongue</td>
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<tr>
<td>Cup</td>
<td>Duck</td>
<td>Put</td>
<td>Book</td>
</tr>
<tr>
<td>Hi</td>
<td>Eye</td>
<td>Monkey</td>
<td>Mummy</td>
</tr>
<tr>
<td>Toes</td>
<td>Nose</td>
<td>Monkey</td>
<td>Knee, mummy</td>
</tr>
<tr>
<td>Cup</td>
<td>Brush</td>
<td>Under</td>
<td>On</td>
</tr>
<tr>
<td>Book</td>
<td>Foot</td>
<td>Put it in your mouth</td>
<td>Wipe your mouth</td>
</tr>
<tr>
<td>Chair</td>
<td>Bear, hair</td>
<td>Turtle</td>
<td>Turkey</td>
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</tbody>
</table>
During 02.11 and 03.00, vowels were more perceptually salient for Graeme than consonants. He confused words that had the same or similar vowels in CVC syllables containing consonants that were either identical or had similar phonetic features. While he did not confuse *crayon* and *Graeme*, he smiled several times at their coupling, aware of their different meanings but perceiving the similarity of their palatalisation and nasality. Dr. Ingram suggested that this confusion related to the sonority feature in hearing vowels and might be indicative of a possible hearing loss, as vowels are perceived in terms of loudness. Graeme’s hearing, however, insofar as could be determined with his marked lack of cooperation in testing, was normal. The recommendation from the testing doctor and the sign language specialist consultant was that F and I commence signing with Graeme, in light of his delay in verbal comprehension.\(^{68}\)

### Comparative rates of acquisition in comprehension

Quantifiable measures of word learning in comprehension for TD children are available for comparison with Graeme’s rate of lexical acquisition. TD children acquire their first 50 words in comprehension slowly over a period of four to five months, between the ages of 00.09 and 01.03. Researchers show evidence of a word spurt in comprehension in many TD children, occurring at 01.03 to 01.04, around the 50\(^{th}\) word understood (D. Bauer et al., 2002; 1979; Fenson et al., 1994; Gibson & Ingram, 1983). Graeme, however, began his word spurt in comprehension at 02.10, when he understood only 30 words. As Table 6.3 shows, he took almost eight times as long as TD children to acquire his first 20 words in comprehension, at 02.08.19 (Benedict, 1979). From that point on, however, he exceeded Benedict’s figures for the rate of comprehension acquisition for eight TD children. He reached 100 words in only 61 more days, whereas the mean number of days

\(^{68}\) Berwick preschool began to teach signs to Graeme when he was around 03.02.
for Benedict’s subjects was 75 days. Graeme took only 26 days to acquire his next 100 words in comprehension.

Table 6.3 Graeme and Benedict’s subjects rate of comprehension acquisition

<table>
<thead>
<tr>
<th>No. of words</th>
<th>Benedict’s mean age of comprehension</th>
<th>Mean no. of additional days to attain</th>
<th>Graeme’s age of comprehension</th>
<th>Graeme’s no. of additional days to attain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00.10.14</td>
<td></td>
<td>02.00.00</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>00.11.15</td>
<td>32</td>
<td>02.08.19</td>
<td>263</td>
</tr>
<tr>
<td>30</td>
<td>01.00.03</td>
<td>20</td>
<td>02.09.28</td>
<td>15</td>
</tr>
<tr>
<td>40</td>
<td>01.01.05</td>
<td>16</td>
<td>02.10.12</td>
<td>15</td>
</tr>
<tr>
<td>50</td>
<td>01.01.21</td>
<td>17</td>
<td>02.10.25</td>
<td>13</td>
</tr>
<tr>
<td>100</td>
<td>01.02.12</td>
<td>22</td>
<td>02.11.12</td>
<td>18</td>
</tr>
<tr>
<td>200</td>
<td>n/a</td>
<td>N/a</td>
<td>03.00.17</td>
<td>26 (or less)</td>
</tr>
</tbody>
</table>

By 03.00.28, the age at which this study ends, Graeme had at least 225 words in comprehension, and his acquisition was too rapid to track accurately. By 03.02.15, Graeme understood at least 262 words, probably closer to 300, and for the three months prior, his learning rate of lexical comprehension had been the same as that of TD children. By this age, when Graeme elicited a word with his name question, I listed the word as acquired immediately.

Unlike most TD children, Graeme had a lag between the word spurt in comprehension and the onset of language production. Rather than having the onset of the 20th word produced precede the 100th word comprehended, as in TD children, Graeme took 104 days after his 100th word in comprehension to acquire his 20th word in production (Gibson & Ingram, 1983)\(^{69}\), even with my more inclusive definition of word/sign.

Social and cognitive growth from 02.10.00 to 03.00.28

In addition to the naming insight, representational realisation, and joint attentional engagement abilities discussed above, Graeme’s social and cognitive growth in other areas facilitated his rapid word learning. The SCD list data show that he developed in

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\(^{69}\) Samples of the Word Event list showing Graeme’s receptive lexicon are given in Appendix B, including data on the linguistic and non-linguistic context, AoA, the order of acquisition, and comments.
exhaustive categorisation, pretend play, and knowledge of the properties of objects, as well as in object permanence. Regarding the latter, he looked in three separate places for things I had hidden, under each of my hands and the rug at 02.11.21.

Graeme’s categorising during 02.10 included grouping sets with more defined inclusion properties, such as matching animals to an image (02.10.24), placing a tiny miniature bear into a line-up of bears (and touching its nose ritually at 02.10.18), and choosing three dog-like stuffed animals to group together and line up (02.10.23). He grouped his musical toys together, recognising their common function. Graeme also matched picture dominos, at 02.11.05. During 03.00, he sorted objects into narrower, more refined sets: grouping his animal toy line-ups into species of animal (03.00.05); alternating line-up patterns of nose-to-nose with behind-to-behind (03.00.04); and organising animals on two legs versus those on all fours. Graeme jabbed crossly at any empty spaces in his jigsaw puzzles, figured out how to turn a piece around to make it fit, and dismantled them in order to redo them, tantruming at his own act of destruction (03.00.10).

As in his slow learning period, Graeme’s engineering feats increased in complexity during 02.10, as he made toys into multi-purpose mechanisms; for example, the moveable part of his talking toy was employed to spin smaller treasures (02.10.10). Deeply satisfied at being in control of his own music, he learned how to operate a toy record player: winding it up, placing the records on, and lowering the arm onto the records (02.10.04). More usually, however, the record player served as a mechanism to spin items such as puzzle pieces and animal toys. Graeme used three containers to pour water from one into another (02.10.04), and made sand castles with cups as moulds, learning to fill the cups with sand first before turning them over (02.10.20). He boldly investigated many new activities in his preschool playground, and painted, using a paintbrush in each hand (02.10.11).

Popular amusements for Graeme during this period were: playing musical toys and instruments; having his parents’ socks tightly pulled up on his hands; and making taut, elaborate, ultimately frustrating, cat cradles of string on everything from furniture to bike wheels, with the trying addition of removing our shoelaces as a string source, despite
strong discouragement (03.00.25). His preoccupation with doorknobs diminished, while his uncanny skill at opening locked deadbolts and childproofed doors improved, with new (undesirable) achievements noted at 02.10.00, 02.10.10, 02.11.02, 03.00.04, and 03.00.06. He continued to have a short attention span for many activities and to perseverate on others. In his solitary play, rather than the appropriate play use of his toys, he still preferred to line up, and try to stack and tie together crayons, toy animals, puzzle pieces, and shaped blocks. Household items, including pet food tins and cutlery, were included in these constructions (00.03.06). Graeme liked to pick bouquets and carried them around to various places to admire them in a new setting (02.11.16 on). Tennis courts, with their orderly painted lines, enthralled him, and he pointed to each side of the court as the ball went back and forth (02.11.25). New variations on stuffed animal play included lining them up in drawers (02.10.18), in addition to overturning the coffee table to make a fort for all the bears and himself to sit in (03.00.14).

Graeme began to be amused by my engaging the toy animals in symbolic activities, such as giving a bear a bottle, sitting it down, making it fall down, and play the piano (02.11.20). Although he would sometimes imitate my actions (02.10.18), or respond to commands to make the animals walk and jump and give the dog a drink (at 03.00.04), he seldom spontaneously engaged in pretend play. The few exceptions were his walking a bear towards me on one occasion (02.10.17), wanting to put socks on all his animals (02.10.18), and sliding them down the banister (02.10.23). He frequently kissed his animal toys spontaneously, and touched their noses (03.00.22).

Graeme became more socialised, and his relating behaviours improved during his rapid word learning. Formerly solitary toys such as books, crayons, and toy animals became interactive as Graeme engaged with others in his quest for names. Picture books became his favourite choice of activity, both shared and solitary. Graeme used gaze switching whenever a name was supplied at his request, and made eye contact for all verbal exchanges with his intimates, except when being directed to do (or not do) something against his will. He continued to tantrum when unable to get his own way, when
frustrated, and when he had to change activities (Figure 6.5), though he had become a
more easy-going child (Figures 6.6 and 6.7).

Figure 6.5  Tantruming over problems with the crayon lineup

Figure 6.6  Relaxing with a bottle and a bell rattle (02.11)
His initial isolation at his new preschool diminished as he began to observe other children and occasionally imitate them, as well as joining in circle and music activities for short periods. Graeme interacted primarily with adults, in order to learn words, and for cuddles and roughhouse games, although he did spend time with one child at preschool. At the beach it was difficult to set boundaries with him; rather than withdrawing, he became unruly and obnoxiously social with unsuspecting people lying on blankets, flinging his wet and sandy self on them, screaming when I removed him (02.10.03). Graeme connected more incidents to the consequences of past events; for example, at 02.10.26 he clung to F in bed and went to sleep right away, remembering earlier punishment for post bedtime rampaging.

His autistic mannerisms included his unfocused blinking (this became more a response and less undirected); continuing hand play; attention to irrelevant details (02.11.05);
compulsive doorknob perseverations; interest in spinning, lining up, and manipulating objects; and uncommon fears, such as of accordions and corrugated tubing (02.09.10).

His greetings remained idiosyncratic. On one occasion at 02.11.17 he gave me a hug when I returned home, but usually when he had not seen me all day it would take 10 minutes for him to come to me. His most common greeting continued to be touching our eyes or noses. F and I rejoiced in his achievement of becoming potty trained (02.11.07).

Summary

In the three-month period of his comprehension word spurt, from 02.10 to 03.00.28, Graeme reorganised the way he learned words, from slow, one at a time, acquisition, to rapid, efficient acquisition. He gained 225 words in his comprehension lexicon, compared to the 30 he had learned in the previous three months. Once the word spurt began, Graeme’s comprehension vocabulary increased more quickly than TD children with the same number of words in their lexicon (Benedict, 1979; Ingram, 1989).

During 02.10, Graeme had the naming insight (Dore et al., 1976), which co-occurred with the onset of his word spurt in comprehension. He employed gaze switching and imperative pointing as a gestural name question to elicit new words and repetitions (Baldwin & Moses, 1996; Hollich et al., 2000; Tomasello & Camaioni, 1997; Tomasello, 2003). With this new elicitation acquisition, Graeme demonstrated his joint attention skill of gaze following frequency and intersubjectivity, characteristically impaired in children with ASD (Charman, 2003; Leekam et al., 1998; Mundy et al., 1994; Sigman & Kim, 1999; Tomasello, 1995). Graeme also used pointing to identify objects that were named, which supports the observation of Morford and Goldin-Meadow (1992) that gestures supplemented and substituted for speech in comprehension in TD children.

In 02.11, Graeme acquired a grunt vocalisation, which he added to his signed name question, at which time his very rapid word learning in comprehension commenced. He was now able to employ the pragmatic function of gaining attention with vocalisation, which co-occurs with development to referential word use in production in TD children, and in Graeme’s case, with referential word comprehension (McCune et al., 1996;
McCune & Vihman, 2001). In 02.10, he most often requested the names of known words, or asked for the name of a familiar object, but during 02.11 he began to request names for unfamiliar objects. With his gains in symbolic representation (Blanc et al., 2002; Lifter & Bloom, 1989; Piaget, 1962), picture books became the initial and main source of new nominals, with a swift progression from virtual to actual referents. Graeme’s comprehension increased to the point that he understood utterances with an MLU of six, and in this was also the case in speech that was not directed at him (Akhtar & Tomasello, 1998).

Graeme’s solitary play primarily involved the exploration of objects, particularly string, crayons, building materials, and his favourite, picture books. His musical interest continued, and he enjoyed watching me pretend play with his animals. Like other children with ASD, his symbolic play was not well developed at this time (Mundy et al., 1987; Reijonen, 1997; Sigman & Ungerer, 1981), nor were his imitative abilities (Rogers et al., 2003; Rogers et al., 2008; Stone, Ousley, & Littleford, 1997). Socially he became more outgoing, engaging, however, principally with adults for lexical acquisition and affection, while largely ignoring other children.

Graeme’s social, cognitive, and linguistic developments emerged, and began to operate together (Nazzi & Bertoncini, 2003). His gains in attentional engagement (Meltzoff & Brooks, 2009; Sabbagh et al., 2007), symbolic representation (Anglin, 1993; Bates & Benigni, 1979; Blanc et al., 2002; Golinkoff et al., 1994; Lifter & Bloom, 1989), exhaustive categorisation (Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Gopnik & Nazi, 2003; Mervis & Bertrand, 1994), and the naming insight (Dore et al., 1976), in addition to the acquisition of his name question, appeared to enable him to acquire vocabulary after progressively fewer exposures, and, by the end of this period, to learn words spontaneously.
Part 2: Semantic development in the word spurt in comprehension

During the word spurt in comprehension, from 02.10.00 to 03.00.28, Graeme’s semantic comprehension changed, from slowly learning one word at a time in limited semantic categories, as he had in the previous three months, to rapidly adding words to his existing semantic categories, adding new categories, and extending the meanings of existing words. This section will examine the qualitative changes in Graeme’s comprehension: his words becoming increasingly less context bound; the development of semantic extensions and intensions; his acquisition of generic words; and his understanding of a lexical item as representing a group of exemplars; i.e. a category. It will also discuss the ways in which his semantic fields and his comprehension vocabulary differed from TD children.

Semantic categories in comprehension

The cognitive correlate specific to Graeme’s semantic development in the comprehension word spurt was the ability to perceive class relationships based on similarity. This conceptual advance was closely associated with Graeme’s recognition of lexical categories. New categories of semantically related words (clothing; animals and their sounds; motions, actions, locations, commands; household and everyday objects; generic words; and colours) emerged at this time, as shown in Table 6.4.

Table 6.4  Semantic categories\textsuperscript{71} added in word spurt in comprehension.

<table>
<thead>
<tr>
<th>New semantic category</th>
<th>Age of addition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clothing</td>
<td>02.10</td>
</tr>
<tr>
<td>Animals and their sounds</td>
<td>02.10</td>
</tr>
<tr>
<td>Motions, actions, locations, commands</td>
<td>02.10</td>
</tr>
<tr>
<td>Household and everyday objects</td>
<td>02.11</td>
</tr>
<tr>
<td>Generic words</td>
<td>03.00</td>
</tr>
<tr>
<td>Colours</td>
<td>03.00</td>
</tr>
</tbody>
</table>

Graeme added words to these new semantic fields, as well as to those from the slow learning period (social action games and routines; toys and objects of fascination; proper

\textsuperscript{71} These categories are compiled from those of Nelson (1973), Benedict (1979), Dromi (1987), Rescorla (2001) and the CDI (1994).
names; food and drinks; attributes and states; and parts of the body). For example, in the body parts category, he had first distinguished *leg, ankle, and foot*; in the word spurt, he acquired *hair, face, finger, arm, tummy, tongue, ankle, toe, tail,* and *mouth.* The category of toys and objects of special interest, which originally included names of objects from home and school, expanded to include natural objects outdoors.\(^{72}\)

**Journal entry**

**02.10.27**

He learned *ear(s)* today (the plural inflection is not meaningful). He was interested in my ears yesterday, but today I taught him on the bears and then I generalised to mine and his. * He recognized mine, the dolls and the bears as the same, but not his own. We looked at one bear * (he chose a bear not a dog or horse when I said *bear*) for facial features. * He planted it firmly down beside me (I was lying on his mattress) and then got three more, one at a time, and identified *mouth, eyes, ears, nose* and *tongue,* (a bear’s red felt tongue, as well as mine and his own). He still points to his tongue for *tummy.* Each time he got a bear, * he shoved my head down after lining it up next to the others, leaning on me. Maybe I ruined the line.

I got down the big (3/4 his size) Eskimo doll for the first time- he pointed at my command to her *foot, ear, eyes, nose* (she has no mouth). The doll has a dispirited, melancholy head droop, and * he irritably pushed her head back, in the same way he gets mad if the bears don’t sit or the horses don’t stand up.

He was interested in my childhood doll, too, * especially that her eyes shut when she lay down.

**Context dependence in the word spurt in comprehension**

In addition to the speed with which Graeme acquired new vocabulary during this period, there was a major qualitative change in his comprehension of words as referential names, rather than context bound. Graeme’s understanding of his newly acquired nominals was no longer dependent on whole routines. Instead, he began to learn the names of objects and people without the immediate presence of the referent or context, in a manner analogous to the acquisition of referential symbolic words in the productive lexicon.

Graeme still learned action and relational words (for example, *kick, sit, lie down, fall down, put it back, come on, go up and go down*) in a narrow context of specific events,

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\(^{72}\) Graeme’s entire comprehension lexicon in the WE list, ordered chronologically according to his AoA, is attached in Appendix B.
accompanied by physical demonstrations. Relational and action words were also more
dependent on the linguistic context; for example, the addition of up and down aided his
comprehension. He extended the meaning of words in the category of motions and
actions, from initially referring solely to the actions of his body, to more general actions
by other agents. Gradually he generalised the meaning of words such as wash, roll over,
and blow, that had been initially restricted to specific routines. Other examples of words
whose meanings were extended included hold, which had only referred to holding hands;
put on and take off, which had been limited to getting dressed and undressed; open and
close, which had referred only to doors and drawers; and wipe, which had meant wipe your mouth. Graeme first understood hit to refer to his drumming on me, then extended it
to flattening sand castles, then to hitting a ball.

Table 6.5 demonstrates Graeme’s understanding of aspects of relatively context bound
words during the first month of the comprehension word spurt. The number column is the
order in which he acquired the word in comprehension.

<table>
<thead>
<tr>
<th>#</th>
<th>AoA</th>
<th>Word said</th>
<th>Learning context and Graeme’s response.</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>02.10.01</td>
<td>Cookie</td>
<td>Came running, on hearing it.</td>
</tr>
<tr>
<td>35</td>
<td>02.10.03</td>
<td>Water</td>
<td>G turned sharply when thirsty on hearing it.</td>
</tr>
<tr>
<td>36</td>
<td>02.10.04</td>
<td>Kick</td>
<td>Did it on command in bath, had not already been doing it.</td>
</tr>
<tr>
<td>37</td>
<td>02.10.04</td>
<td>Mummy</td>
<td>Touched my nose, looked, no pointing</td>
</tr>
<tr>
<td>38</td>
<td>02.10.05</td>
<td>Eye/s</td>
<td>Touched Daddy’s, Mummy’s, Lenny’s, learned quickly.</td>
</tr>
<tr>
<td>39</td>
<td>02.10.05</td>
<td>Milk</td>
<td>Responded to being asked if he wanted milk.</td>
</tr>
<tr>
<td>40</td>
<td>02.10.09</td>
<td>Grandma</td>
<td>Touched her photo to show name recognition.</td>
</tr>
<tr>
<td>41</td>
<td>02.10.09</td>
<td>Lorna</td>
<td>Pointed upstairs after her.</td>
</tr>
<tr>
<td>42</td>
<td>02.10.12</td>
<td>Baby</td>
<td>Turned to point at visiting baby.</td>
</tr>
<tr>
<td>44</td>
<td>02.10.14</td>
<td>Mouth</td>
<td>I labelled, and touched his and my mouth, he pointed to my mouth.</td>
</tr>
<tr>
<td>45</td>
<td>02.10.15</td>
<td>Sit down</td>
<td>Obeyed, in water, also in high chair.</td>
</tr>
<tr>
<td>46</td>
<td>02.10.15</td>
<td>Bear</td>
<td>Generalised to all stuffed animals.</td>
</tr>
<tr>
<td>47</td>
<td>02.10.19</td>
<td>Lie down</td>
<td>Responds in bed.</td>
</tr>
<tr>
<td>48</td>
<td>02.10.19</td>
<td>Fall down</td>
<td>Acquired in game context.</td>
</tr>
<tr>
<td>49</td>
<td>02.10.21</td>
<td>Bike</td>
<td>Pointed to it for Where’s bike?</td>
</tr>
<tr>
<td>50</td>
<td>02.10.24</td>
<td>Sock/s</td>
<td>Pointed to the pile he’d collected, for Where’s the...</td>
</tr>
<tr>
<td>#</td>
<td>AoA</td>
<td>Word said</td>
<td>Learning context and Graeme’s response.</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
<td>-------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>51</td>
<td>02.10.24</td>
<td>Dog</td>
<td>I put a toy dog on a dog pic and G asked for the name, matched them himself.</td>
</tr>
<tr>
<td>52</td>
<td>02.10.25</td>
<td>Put (it back)</td>
<td>Put the showerhead back on its holder, likes to spray all over in the bath.</td>
</tr>
<tr>
<td>53</td>
<td>02.10.25</td>
<td>Come (on)</td>
<td>Turned back from running away.</td>
</tr>
<tr>
<td>54</td>
<td>02.10.25</td>
<td>Go (up, down)</td>
<td>Responds and obeys within physical context.</td>
</tr>
<tr>
<td>55</td>
<td>02.10.25</td>
<td>Tree</td>
<td>Pointed to wind blowing trees.</td>
</tr>
<tr>
<td>56</td>
<td>02.10.27</td>
<td>Ear</td>
<td>Pointed to bears, pics, mine, dolls, Lenny’s, not his own.</td>
</tr>
<tr>
<td>57</td>
<td>02.10.28</td>
<td>Shoe</td>
<td>Pointed to his shoe on his foot.</td>
</tr>
<tr>
<td>58</td>
<td>02.10.29</td>
<td>Bird</td>
<td>Pointed when I said <em>birds</em>, chased them.</td>
</tr>
</tbody>
</table>

Because proof of comprehension was generally based on Graeme’s identification of an object or his action in my presence, it was difficult to determine the extent to which his understanding was independent of the context throughout this period. One exception at 02.11.02 was his demonstration of his context free comprehension of *bad*, invoked many times previously for the crimes of peeling wallpaper and gouging plaster from the walls. In a later instance, he cried and ran away after hearing me use *bad* without exaggerated intonation or threatening body language, and in a reference unrelated to any current mischief of his own. During 02.11 and 03.00, most initial evidence of lexical understanding occurred in the presence of the referent, the action, or with a deictic expression. Increasingly, however, Graeme responded to words, especially nominals, in the absence of their referent.

Graeme enjoyed interactive exchanges in which F and I tested his comprehension with questions like, *Where’s the bear’s mouth?* He usually signified his knowledge of a word by touching or pointing to an object spontaneously when he was asked, as well as when an object was named.

At the beginning of 02.11, the preschool noted that they felt Graeme understood less than F and I perceived he did (See Appendix A). This observation accurately reflected the fact that some of Graeme’s understanding was dependent on the linguistic context of familiar
speakers who were accustomed to modifying their speech for his level of comprehension. It also reflected his narrow, underextended context of reference. His toy bears were not exactly the same as the bear at preschool; shoe may only have pertained to one pair of Graeme’s shoes; the action words were dependent on context; and proper nouns were, of course, specific to one person.

**Anomalies in Graeme’s comprehension lexicon**

Graeme’s comprehension vocabulary contained words that did not occur in the lexicons of TD children of 01.04 ranked by the CDI as having a comprehension lexicon greater than his. Their inclusion in his lexicon was most likely caused by three factors: first, normal language variation; second, Graeme’s comparatively advanced physical skills as an older child; and third, his autistic enthusiasm for objects and activities that might not be typically appealing. These lexical exceptions are in Table 6.6.

<table>
<thead>
<tr>
<th>Graeme’s category</th>
<th>Uncommon words in his comprehension lexicon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical abilities</td>
<td>Sit down, lie down, make, spit, hold, stand up, this way</td>
</tr>
<tr>
<td>Spinning and turning</td>
<td>Round/round about, top, umbrella</td>
</tr>
<tr>
<td>Collecting and dumping</td>
<td>Basket, box, peg</td>
</tr>
<tr>
<td>Stringing</td>
<td>String, thread, shoelace, spool</td>
</tr>
<tr>
<td>Beach play</td>
<td>Sand, log, puddle</td>
</tr>
<tr>
<td>Music</td>
<td>Music, record</td>
</tr>
<tr>
<td>Colour</td>
<td>Colour, crayon, stripes, red, blue, yellow, green, brown, orange, pink, black, white, purple</td>
</tr>
<tr>
<td>Other favourite activities</td>
<td>Hole, wall, locked, gate, tap, wood, fire</td>
</tr>
</tbody>
</table>

**Semantic extensions in word categories**

As Graeme became more experienced at learning words, and extended semantically the meanings of some of his early words in comprehension, the category membership of the early words also changed. The earliest category of *social/action games and routines* was
the only group from his early words in the slow learning period that was not later expanded in the word spurt when Graeme began to learn words that named referentially rather than those that were context bound. Many words initially listed in the games and routines category were later extended to the newly acquired categories of attributes, locatives, more general actions, and more specific names in the comprehension word spurt, as shown in Table 6.7.

Table 6.7 Extensions of the semantic category of early words in comprehension

<table>
<thead>
<tr>
<th>Social/ action word</th>
<th>Early meaning /category</th>
<th>Meaning after word spurt</th>
<th>Class after word spurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Down</td>
<td>Game</td>
<td>Down (direction)</td>
<td>Locative</td>
</tr>
<tr>
<td>Up</td>
<td>Game</td>
<td>Pick me up, up</td>
<td>Action</td>
</tr>
<tr>
<td>Hide and seek</td>
<td>Game</td>
<td>Where’s x?</td>
<td>Locative</td>
</tr>
<tr>
<td>Jump</td>
<td>Game</td>
<td>Jump with both feet</td>
<td>Action</td>
</tr>
<tr>
<td>Step</td>
<td>Dressing routine</td>
<td>Walking</td>
<td>Action</td>
</tr>
<tr>
<td>Hot</td>
<td>Danger, don’t touch</td>
<td>Temperature</td>
<td>Attribute</td>
</tr>
<tr>
<td>Round about</td>
<td>Game</td>
<td>Shape, spinning</td>
<td>Attribute and action</td>
</tr>
<tr>
<td>More</td>
<td>More food</td>
<td>Additional</td>
<td>Attribute and action</td>
</tr>
<tr>
<td>Nose</td>
<td>Game</td>
<td>Nose</td>
<td>Body part</td>
</tr>
<tr>
<td>Foot</td>
<td>Game</td>
<td>Foot</td>
<td>Body part</td>
</tr>
<tr>
<td>Here</td>
<td>Here’s some food</td>
<td>Here</td>
<td>Locative</td>
</tr>
<tr>
<td>Kick</td>
<td>Bath routine</td>
<td>Kick</td>
<td>Action</td>
</tr>
</tbody>
</table>

Graeme’s strategies for determining semantic extensions and intensions in comprehension

Over time, Graeme learned that not only do words have consistent referents and meanings, but that they also have testable intensions (the comprehension of the ideas and properties suggested by the concept) and extensions (the set or category of the things the word applies to) (Anglin, 1978). He employed many strategies to investigate the consistency, range, intensions, and extensions of words in his comprehension lexicon. Graeme’s initial requests for names generalised, from the specifics of an animal’s facial features, to the names of the animals and their sounds. Another progression in his elicitation was from pictures of known animals, to his stuffed animals, and then to pictures of unfamiliar animals. He also tested the mapping of the words by asking for names of animals represented in various styles and media, such as real, plastic, and
stuffed animals, as well as photographic images, realistic coloured illustrations, and images that were more abstract and stylised. For example, at 02.11.14, when he discovered the unfamiliar giraffe silhouette lightly embossed on the bottom of a cup, he sought out the rest of the cups in the set, in order to have all of the animal designs named, demonstrating his abilities in deduction, categorisation, and lexical acquisition.

At 02.11.00, Graeme employed several methods to determine the properties of consistency and range for his newly acquired words. When another speaker labelled a picture he would look inquiringly at F or me to confirm that we would say the same word. I interpreted this as an inquiry on the conventionality of the word’s use by a larger community. He explored a word’s intensions by touching every part of each newly named picture, such as a duck’s back, head, and tail. My interpretation of this was that Graeme wanted to see if we would name them all duck, perhaps exemplifying the establishment of the whole object assumption in comprehension (Golinkoff et al., 1994). It was my impression that by touching each image of the varieties of ducks, including wet, dry, baby, and mother ducks at 03.00.09, Graeme was actively testing the semantic extensions of duck, to see if we named duck in each case. At 02.11.02, Graeme failed to recognise the Mallard ducks in the park that I was labelling and pointing out, probably because they differed from the pictures of domestic ducks in “The Little Duck” book. However, when I called them birds, a word acquired a few days earlier that had applied to real birds, he responded by pointing and happily chasing them. By our next park visit, he recognised them when I said ducks. He investigated semantic distinctions in finer categories as well; for example, bringing me two different kinds of shoelaces at 03.00.16, possibly to determine if they were both called shoelace.

An example of semantic extension occurred at 02.11.05, when I labelled Graeme’s new toy monkey, monkey. Graeme ran to get his other toy monkey, which, until that point, had been labelled only as bear, F’s and my generic word for all stuffed animals, that F and I had used for simplification when his lexicon was smaller. In another instance at 02.11.06, when Graeme’s grandfather labelled cow in a picture, Graeme jumped up to get a previously unremarked china bull, which then he lined up beside a china bird and the cow.
picture, showing a recognition of commonality in the china medium of one pair and in the species category of the other pair. The species of animal was his primary basis of exhaustive sorting. For example, at 02.11.16, Graeme asked for the name of his huge stylised stuffed lion (a new lexical item), then placed a tiny plastic lion beside it, using his name question to inquire if it had the same name. With this action, he nicely illustrated that the taxonomic assumption (novel names extend to members of a category) applies in comprehension, as well as production (Markman & Hutchinson, 1984; Markman, 1992).

Subsequent to Graeme’s acquisition of the name question at 02.11, he further explored the semantic intensions of his vocabulary. He began to ask for the names of parts as well as the whole. For example, he asked for the word dog, and then for the word tail; likewise with monkey (02.11.16). My responses, dog’s tail and monkey’s tail, were examples of the intensions of the words dog and monkey, each of which had the necessary property of a tail. He was then able to extend the reference of tail to other animals, like horse. Much excited pointing, grunting, and running, from toy to picture to pet, accompanied these generalisations, which were based on the identification of similarity within a semantic class. Graeme was especially intrigued by new images that illustrated variations of objects he recognised from real life, such as the representation of a familiar, yet slightly dissimilar, item. An example was a picture of a red double-decker British bus, so unlike his yellow preschool bus that when F and I called it bus he brought the book right up close to his eyes to examine it.

**Lexical classes in the word spurt in comprehension**

A major change in Graeme’s semantic organisation occurred as his comprehension increased rapidly during 02.11. Prior to the word spurt, his words appeared to refer to one specific referent in a particular context, and were learned individually, without generic identification or group categorisation. By 02.11, the development of his cognitive ability to categorise on the basis of similarity relations was closely associated with his recognition that each lexical item is in itself a generic class, containing many exemplars. For example, he accepted, at 02.11.04, after many inquiring jabs at each picture, that
brush was the generic for a category that included brushes for hair, shaving, and teeth. Although I was not certain at this point that Graeme understood the words hairbrush or toothbrush, he showed his symbolic understanding that they were all members of the same class when he brushed his hair with the shaving brush at 02.11.02.

Graeme’s word meanings and their class status were difficult for me to determine because, as reported by Dromi (1987), they were unconventional and subject to rapid change, owing to his initial uncertainty about the basis for object-label extension. For example, flower at first included foliage until he learned plant a week later at 02.11.21. When he first acquired plant, it meant something between tree and flower, possibly not including either, but referring instead to a plant that was smaller than a shrub and had foliage rather than flowers. Graeme expanded button to include nipples and navels, while pee pee included both pee and penis. String extended to include hair at 03.00.20, revealing Graeme’s semantic feature classification of a long, thin, and flexible appearance, rather than a category based on function, material, or body part. Graeme was rather slow at generalising words for body parts, either from other people’s to his own, or vice versa (02.11.05). Body part words gradually moved from applying initially to his parents and to pictures, to himself, then to animals (at 03.00.14) as he generalised the meaning of one feature, such as nose, to include a class of features called nose. Increasingly, lexical items began to stand for more than one referent, symbolising a whole class of similar objects. Examples of these include: pen/pencil, crayon, book, candy, bus, door, car, key, flower, string, words/writing, light, all the animal names, and all the colours.

Along with generalising words to a whole class, Graeme began to acquire more broadly inclusive words that defined many classes in one named generic category. Animal, acquired at 03.00.10, was his truest exemplar of a generic word; it definitely included all the species of animals, whether or not Graeme knew their species names. The acquisition of this generic word appeared to be directly related to his capacity for exhaustive sorting, spontaneously separating objects into groups. Music was another example, although its
generic status as an adult word may not have been parallel for Graeme, because it may have only referred to one or two songs.

**Words for animals and their sounds in comprehension**

Graeme’s deep and prolonged enthusiasm for animals warrants detailed examination because it was reflected in both his comprehension and his productions in this period. His preoccupation with animals, whether real, toy, or visual representations, started at 02.11, fostered by his books and a visit with his grandparents to a petting zoo at 02.11.07, though he devoted as much attention there to the gates as to the animals. Graeme at 02.11.05 began to differentiate the animals’ species names from the generic bear that F and I had initially used for all his animal toys. He also began to associate the animal with its sound at 02.11.00. In most cases, the sound was acquired in comprehension a week or two after the animal’s name, and was entered in the WE list as part of the animal’s name, since they were synonymous in reference\(^\text{73}\).

Graeme became insatiable in his requests for animal sounds, bringing old picture books out to elicit endless repetitions of *quack*, *moo*, *oink*, and *baa*. He smiled at F’s and my renditions of familiar animal sounds, but, for those he was learning, his serious expression\(^\text{74}\), along with the *name question* request for repetition, indicated intense interest (02.11.18). The more realistic and less like speech sounds they were, the more attentive he was. This preference for wild onomatopoeic non-speech sounds, using the scale of Rhodes, (1995) was paralleled in production of animal sounds\(^\text{75}\).

\(^\text{73}\) As a result, the animal sounds are not included in the totals of his lexicons.

\(^\text{74}\) The serious expression was characteristic of the deficit in shared positive affect in children with ASD (Lord et al., 2000).

\(^\text{75}\) See Part 3 on Graeme’s productions.
As Table 6.8 shows, the category of animal names and sounds comprised one sixth of Graeme’s vocabulary in comprehension by 03.06.00, with 51 animal names and sounds, two generics, and semantic distinctions within classes.

Table 6.8 Animals and/or their sounds in comprehension

<table>
<thead>
<tr>
<th>Age</th>
<th>Animal and sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>02.06.02</td>
<td><em>Lenny</em>, the family cat</td>
</tr>
<tr>
<td>02.10.08</td>
<td>Bear/growl</td>
</tr>
<tr>
<td>02.10.18</td>
<td><em>Bear</em>, generic for all his animal toys</td>
</tr>
<tr>
<td>02.10.24</td>
<td>Dog</td>
</tr>
<tr>
<td>02.10.27</td>
<td>Dog/woof</td>
</tr>
<tr>
<td>02.10.29</td>
<td>Bird</td>
</tr>
<tr>
<td>02.11.00</td>
<td>Duck</td>
</tr>
<tr>
<td>02.11.02</td>
<td>Cat</td>
</tr>
<tr>
<td>02.11.03</td>
<td>Cow, pig</td>
</tr>
<tr>
<td>02.11.07</td>
<td>Sheep</td>
</tr>
<tr>
<td>02.11.08</td>
<td>Chicken, goat</td>
</tr>
<tr>
<td>02.11.15</td>
<td>Sheep/aa</td>
</tr>
<tr>
<td>02.11.16</td>
<td>Pig/oink, horse/neigh</td>
</tr>
<tr>
<td>02.11.19</td>
<td>Bird/tweet, duck/quack, cat/miaow, cow/moo</td>
</tr>
<tr>
<td>03.00.03</td>
<td>Bunny/rabbit, rooster/cock a doodle do, puppy, kitten, frog/garumph</td>
</tr>
<tr>
<td>03.00.10</td>
<td>Chicken/tweet, animal/s</td>
</tr>
<tr>
<td>03.00.11</td>
<td>Teddy bear, tiger, turkey, turtle</td>
</tr>
<tr>
<td>03.00.16</td>
<td>Fish</td>
</tr>
<tr>
<td>03.00.20</td>
<td>Monkey, mouse</td>
</tr>
<tr>
<td>03.00.22</td>
<td>Giraffe, zebra</td>
</tr>
<tr>
<td>03.00.23</td>
<td>Dinosaur</td>
</tr>
<tr>
<td>03.00.28</td>
<td>Lion</td>
</tr>
<tr>
<td>03.01.15</td>
<td>Elephant</td>
</tr>
<tr>
<td>03.01.25</td>
<td>Donkey</td>
</tr>
<tr>
<td>03.02.04</td>
<td>Deer, panther</td>
</tr>
<tr>
<td>03.02.08</td>
<td>Goat/bleat</td>
</tr>
<tr>
<td>03.04.00 on</td>
<td>Milton, Lupin (extended family pets) fox, kangaroo, snake, bug, worm, owl, bee</td>
</tr>
</tbody>
</table>

Synonyms in comprehension

At 02.11, animal sounds became the first exception to Graeme having only one name for each referent. *Cow* became interchangeable with *moo*, *bear* with *growl*, *bird* with *tweet*, *duck* with *quack*, *dog* with both *woof* and *bow wow*, *cat* with *miaow*, *pig* with *oink*, *sheep*
with *baa*, and *horse* with *neigh*. In addition to their sounds, many animals were called by multiple names. For example, *cat* was synonymous with *kitten, kitty*, and originally with the proper names *Lenny* and *Milton*. *Bunny* overlapped with *rabbit*, and *dog* with *doggie, puppy, bow wow, woof*, and *Lupin*. The many synonyms Graeme understood demonstrate that he readily learned multiple labels for the same category, as Mervis, Golinkoff, and Bertrand suggested for the lexicon in production (1994). The synonyms also show that the mutual exclusivity constraint did not appear to apply to Graeme’s lexical comprehension. In addition to synonym acquisition, semantic distinctions appeared at 02.11.08 with the separation of *chicken, duck and bird*, and at the point at which *teddy bear* distinguished a stuffed animal from a plastic toy bear.

**Colour names**

The concept of colour, and colour names, had a key role in Graeme’s lexical acquisition in both comprehension and production. Synchronous with Graeme’s major lexical achievement in comprehension during 03.00, the commencement of spontaneous word learning, was his cognitive realisation that colour could be named. Compared to TD children, according to the CDI, Graeme comprehended colour words unusually early in his comprehension lexicon, which at that time had less than 250 words.

Graeme had difficulty in communicating his intention to elicit colour names. Just before the word spurt at 02.09.28, he was sorting sticks into orange, yellow, and green groups, recognising the category distinctions by sight, without any comprehension of the colour names. During 02.11, he frequently requested vocabulary for picture backgrounds, to which F and I responded with nominals such as *lawn and sky*; however, in retrospect, these might well have been his requests for *green and blue*. At 03.03.03, he touched many blank, coloured areas in pictures. When we randomly named the colour plus object, e.g. *blue sky*, Graeme showed instant appreciation, in the form of an earnest and emphatic request for repetition, but as this was his general method of eliciting any kind of additional information, we failed to recognise it as a specific request for a colour name, instead providing a lengthier response with a preposition or another nominal (e.g. *up in the sky, or sky and trees*). When, at 03.00.05, he asked for the names of tiny areas of
colour in the carpet pattern, we first supplied carpet and then pattern. The next day, he tried to elicit colour names by pointing to the shading, colours, and printed text on tin labels and in pictures. The following day, at 03.00.07, he finally figured out a way to isolate his request in order to elicit only the colour name, transcending what must have been a frustrating dilemma for a nonverbal child. He lined up his blocks and asked for the name of each one, given as block. He asked again, more emphatically, and I responded with wood block. As both words were not yet firmly acquired, he touched each block again to ascertain that I named them identically as wood block. Then he chose a red-topped wooden block, touching the red portion and using his name question. I labelled this red wood block. Excitedly, he asked for repetition, and then contrived a strategy to determine if red described the colour, by bringing me a red ball and a red toy dog, since both ball and dog were already in his lexicon. After I had named each, red ball, red dog, and red block, he lined them up, and looking intently at me and saying his name question, made a circling inclusive gesture with his hand to indicate the whole group and to establish it belonged to the category red. After much satisfying repetition of the colour word from me, he ran around finding every other red coloured object available, for me to label. He was insistently curious when I labelled one of them orange, the word being in his lexicon at that point only as a fruit or juice. Within a few days, Graeme acquired the names yellow, red, and green through his queries about crayons, walls, clothes, labels, pictures, and many other objects. Once he recognised a colour by name, he tested its semantic range by quickly touching many examples of that colour. This process revealed that F and I have different definitions of blue and green, and quickly stretched our labels into shade and hue descriptions such as light pink and yellowish-green, invoking Graeme’s great curiosity.

Within 3 days, at 03.00.10, Graeme had grasped the symbolic concept that everything has a colour, and that every colour has a name. He then used colour names to enlarge his lexicon, with name questions for the colour, plus the object name, for many new vocabulary items; for example, white cupboard, green kite, red coffee pot, and red, pink, and brown painting. He pored over his older books in solitary play (Figure 6.2) before bringing them to his parents to enquire about the colour of a pictured object, particularly
asking about colours in pictures that had been favourites previously. For many months, he noticed and asked about colour in all environments: pointing at items around the room from his high chair, pointing to the flash of a red storefront as F biked by it (with Graeme in the bike seat), to the blue seat cover in the taxi cab, his yellow raincoat, everyone’s clothing, as well as the colours in tiny patterns and those of very tiny objects, an action that harkened to his earlier fixation. He began to want more neutral colours named, again revealing dialectal differences between his parents over distinctions among fawn, beige, tan, olive, and khaki. By 03.00.10, colour names had surpassed animal sound questions. At this point, F and I labelled every nominal by colour and name.

Colour and animal name questions became his new greeting routine, and the topic of most interactions. Crayons became as popular as animal toys: he lined them up, waved at them, placed them tips-up in a glass, stuffed them into socks and dumped them out again, and continuously inquired about all their aspects, including their tips, their flat ends, their paper wrappers, and the colour of the lines he drew (Figure 6.8).
Figure 6.8    Crayon lineup, all points forward

Crayons superseded taut string as the primary object of fascination, and of frustration when tips were worn down or wrappers came off. Crayons were stuck in keyholes, broken, unsuccessfully stacked and tied together, and thrown down the furnace vent with the contents of the pen and cutlery drawers.

*Crayon* became a generic word, as did the words for many other objects he now distinguished by colour. Along with understanding that colour names labelled distinct category members, Graeme also comprehended that there were descriptive words for aspects of their class members, such as *pale, light,* and *dark,* although his comprehension of these words was partial.

Journal entry

03.00.11

Not nearly as much bear play – they just sat in a box all day. Colours have taken over – he’s 100% right on yellow and red, 90% on green, 60-70% white, and blue and orange. Interested in purple, black, every colour except real neutrals. * Since 3.0.4 or so
interested in stripes – colour distinctions – first I labelled *stripes* before I realized he wanted colour names.

Learned *crayon* yesterday along with *shirt, pants, hammock* (picture). David Ingram said last night re colours that *G* is starting to learn spontaneously and it’s very true – despite the fact that I lost track for two weeks word-by-word, I realise he knows so many words that I haven’t taught him, that I don’t even think to test.

New sitter, A, 12, very sweet and relaxed with Gray – told him colours. He wanted them named all day – pointing again and * again to things I’d identified by colour – e.g. on our walk I said “brown car” and he asked [*uh-*] for every car after. A also satisfied his need for hearing animal sounds and picture books identified for an hour. On our walk * Gray didn’t stop pointing, touching, and asking for names. Non-stop all day except short intervals.

Table 6.9 shows the colour words acquired in comprehension this month, although there were many more of which he probably had a partial understanding through his enquiries. Related words were *light*, acquired at 01.11.21, *crayon*, at 03.00.08, and *colour* and *stripes*, acquired at 03.00.11.

**Table 6.9  Colour word comprehension during 03.00**

<table>
<thead>
<tr>
<th>Age acquired</th>
<th>Word event #</th>
<th>Colour word</th>
</tr>
</thead>
<tbody>
<tr>
<td>03.00.07</td>
<td>148</td>
<td>Red</td>
</tr>
<tr>
<td>03.00.10</td>
<td>162</td>
<td>Yellow</td>
</tr>
<tr>
<td>03.00.11</td>
<td>170</td>
<td>Green</td>
</tr>
<tr>
<td>03.00.11</td>
<td>176</td>
<td>Colour</td>
</tr>
<tr>
<td>03.00.15</td>
<td>200</td>
<td>Brown</td>
</tr>
<tr>
<td>03.00.20</td>
<td>211</td>
<td>Orange</td>
</tr>
<tr>
<td>03.00.20</td>
<td>212</td>
<td>Pink</td>
</tr>
<tr>
<td>03.00.20</td>
<td>213</td>
<td>Blue</td>
</tr>
<tr>
<td>03.00.20</td>
<td>214</td>
<td>Black</td>
</tr>
<tr>
<td>03.00.20</td>
<td>215</td>
<td>White</td>
</tr>
<tr>
<td>03.00.21</td>
<td>216</td>
<td>Purple</td>
</tr>
</tbody>
</table>

**Summary**

Graeme’s semantic development in comprehension underwent a gradual reorganisation in the period of the word spurt in comprehension, as his word meanings began to change from context bound to categorical and referential. In the period of slow word learning, Graeme’s understanding of his comprehension lexicon of 30 words was dependent on the context of his experience. Like TD children, his early comprehension was composed of unrelated words from a limited number of different semantic categories, was learned one
word at a time, and had no generic or lexical class identification, as described by Benedict (1979), Dromi (1987), and Nelson (1973). Aided by his recently acquired ability to form class relationships based on similarity (exhaustive categorisation), Graeme re-organised his lexicon in the period of rapid word learning in comprehension (Gopnik & Meltzoff, 1987). His recognition of lexical groupings with shared semantic categories allowed him to generalise from learning one item at a time to rapidly learning many words of the same semantic category (Gopnik & Meltzoff, 1992; Mervis & Bertrand, 1994). He added his new words to his existing semantic categories, added new categories of semantically related words, changed membership in earlier categories, made distinctions within semantic classes, acquired categorical words, and refined and extended the meanings of existing words, as described by Dromi (1993; 1999) and Lucariello (1987).

Table 6.10 gives examples from Graeme’s lexicon of his semantic developments in the word spurt in comprehension.

**Table 6.10 Examples of semantic development**

<table>
<thead>
<tr>
<th>Semantic Development</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>The meanings of existing words were refined and extended.</td>
<td><em>String</em> became extended to include hair, <em>orange</em> to refer to colour as well as fruit.</td>
</tr>
<tr>
<td>New related words were added to existing semantic categories.</td>
<td>The objects of fascination expanded to include <em>trees</em> and <em>flowers</em>.</td>
</tr>
<tr>
<td>New categories of semantically related words emerged.</td>
<td>Animals and their sounds, and colour words were acquired.</td>
</tr>
<tr>
<td>The category membership of early words changed.</td>
<td><em>Nose</em> changed from meaning a game to referring to a body part.</td>
</tr>
<tr>
<td>Words became categorical as they included many examplars.</td>
<td><em>Brush</em> included shaving, hair, and tooth brushes.</td>
</tr>
<tr>
<td>Distinctions were made within semantic classes.</td>
<td><em>Flower</em>, <em>plant</em>, and <em>tree</em> were separately defined.</td>
</tr>
</tbody>
</table>

In the word spurt in comprehension, Graeme began to learn new words that were independent of situational and linguistic contexts and of pragmatic function. After his naming insight and the acquisition of his *name question*, most of the context free words Graeme learned were nominals, as are those of TD children described by McCune and Vihman (2001). The meanings of his early words, from the social/action games and
routines category, were later extended to other categories as the words became less restricted to their original context (Dromi, 1993). The meaning of action words, however, remained more tied to a situation. By this time, some of the new words in comprehension were learned in the absence of their referents, in the transition to becoming arbitrary, symbolic terms of reference, as described by Dromi (1993; 1999; 2008), Lucariello (1985), and McCune (2001).

Graeme employed strategies to map the meanings of words in his comprehension lexicon by determining their referents, semantic categories, range, consistency, intensions and extensions, as TD children do, in research by Anglin (1970; 1978), Clark (2003) and Dromi (1993). He acquired synonyms (animal sounds) and generic words, and made fine distinctions of meaning based on category, shape, flexibility, and colour. At this time, he generalised names to a whole class, demonstrating his understanding of the concept that words symbolise object categories, described by Cohen and Brunt (2009) as a fundamental language-related behaviour, acquired by around 02.00 in TD children.

Graeme’s semantic classes and word meaning were subject to rapid change as he established reference, and determined semantic category and the basis for object-label extension, as in the case study by Dromi (1987). Two categories, colour words and words for animals and their sounds, generated the most name question inquiries, and comprised one quarter of his lexicon at the end of the word spurt in comprehension. Graeme was most strongly attracted to wild, onomatopoeic animal sounds that did not contain speech sounds, as described by Rhodes (1995).

Graeme’s semantic category organisation and his comprehension lexicon were the same as those of TD children, supporting the findings of Boucher (1988) and Tager-Flusberg (1985). Exceptions were the inclusion of categories of words used by TD children with a larger vocabulary: colour words, and the words that named his unusual special interests, such as tools. This supports the observation of Ungerer and Sigman (1987), that category knowledge of function, form, and colour was not impaired in the children with autism in their study. Moreover, Graeme had amassed all his semantic knowledge in
comprehension by means of a single strategy, the name question, which consisted of just one grunt and one gesture.

Part 3: Graeme’s production during the comprehension word spurt

Introduction

This section will examine the continued development of Graeme’s babble, intentional communication, gestures/signs, onomatopoeic animal sounds, and phonological contrasts between 02.10.00 and 03.00.28. During the three months of his rapid and significant gains in the word spurt in comprehension and advances in social/cognitive development, Graeme acquired nine new words/signs in production, extended the meaning and function of his earlier word/signs, and improved the hand shape and gestural control of his signs.

With reference to my second research question of the definition of the earliest words, this section demonstrates the development from Graeme’s earliest word/signs to those acquired in this period, towards the meeting the criteria for word status of early words for TD children.

Babbling between 02.10.00-3.01.00

During this three-month period, Graeme’s babbling evolved in frequency and form, though he babbled almost exclusively with glides and vowels. During 02.10, he produced variants on strings with [y] plus front vowels, and with [w] plus back vowels. He babbled these most commonly when he was by himself, addressing objects of interest, or at bedtime, with the accompaniment of hand play. During this month, Graeme experimented with blowing, aspiration, and exhalation vocalisations in sound making activity at bedtime. He was mostly silent, babbling between one and five strings a day at home, augmented by a repertoire of various expressive ways of crying and laughing. These included the introduction of an appreciative, deep, throaty [o ho ho ho] when, for example, he was watching me pretend play with his bears, a chuckle for solitary
mechanical play, and wild, loud, affected show-off laughs for attention. He used one string, [owuhwei:], occasionally during 02.10, accompanying the vocalisation with an action, wrinkling his nose, looking and smiling at us, as if in communication, though F and I could not interpret the meaning of either gesture or vocalisation.

Babble increased throughout 02.11, although, unusually, he began to whisper most of his babbling. Graeme added a new favourite of fricative, spitting, raspberries, which replaced coos and laughing in bed, and by 02.11.20 were produced all day long. He refused to imitate speech sounds, with two exceptions. Once, at 03.00.11, he imitated me with a single whispered [wa wa]. Graeme produced a single consonantal exception to the glides, at 02.11.10, when he imitated [buh buh buh] twice, shyly turning to look at me. On the same day, he made two tiny nasal sounds to get my attention when I had failed to notice him, but these were never repeated. Graeme typified preschool children with ASD in his production of sounds with unusual vocal quality, such as tense, high-pitched, squeaky squeals, creaky growling, whining, whooping, and yelling (Sheinkopf et al., 2000).

Graeme would occasionally imitate non-speech sounds, such as snoring and teeth chattering. Near the end of 03.00, Graeme became very amused by F’s whistling. He was particularly fascinated by F’s imitation of the warbling sound of the weak batteries in the toy organ, feeling F’s face and throat, and pushing his head away from his book, in a brute force request for repetition. Acutely intolerant of my inability to sing in tune, Graeme closed my mouth when I sang, an early indication of his (non-genetic) gift of perfect pitch perception.

During 03.00, Graeme added his new favourite vocalisations, animal sounds, to his babbling, along with much growling. His back glide was now paired with many front vowels in variegated babbling [wuh wee wi way] and [oweewuh wuh weh uh wee]. The biggest change at this age was the introduction at 03.00.27 of supraglottal consonants,

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76 This was a precursor to his first whispered speech sounds, which occurred after the time period of this study.
prognostic of speech (McCune & Vihman, 2001). Table 6.11 contains samples of his babbling during this period.

Table 6.11  Babble between 02.10 and 03.01

<table>
<thead>
<tr>
<th>Age</th>
<th>Babble</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>02.10.02</td>
<td>[yae yei yei] [whouh?whouh?whouh?]</td>
<td>Jargon babble, stringing syllables that have the intonation of speech, ending with laughter.</td>
</tr>
<tr>
<td>02.10.23</td>
<td>[wuh]</td>
<td>Babbled to objects of interest.</td>
</tr>
<tr>
<td>02.11.05</td>
<td>[wawuh wawuh]</td>
<td>Whispered.</td>
</tr>
<tr>
<td>02.11.06</td>
<td>[wawa] [wwuh ?wwuh ?]</td>
<td>Twice said loudly and clearly.</td>
</tr>
<tr>
<td>03.00.11</td>
<td>[wa wa wa_yae yae yae]</td>
<td>Imitated only when D whispered.</td>
</tr>
<tr>
<td>03.00.20</td>
<td>[wuh wee wi way]</td>
<td>Front vowels, long strings with animal sounds and growling.</td>
</tr>
<tr>
<td>03.00.21</td>
<td>[oweewuh wuh wheh uh wee]</td>
<td>When stimulated or angry, front vowels, vigorously moving his tongue.</td>
</tr>
<tr>
<td>03.00.26</td>
<td>[wa wa dyuh dyuh dyuh dyuh]</td>
<td>While playing with crayons.</td>
</tr>
<tr>
<td>03.00.28</td>
<td>[dae dae dae], [dyae], [wap wap wap], [duh duh duh di di dyuh dyuh]</td>
<td>Many new productions.</td>
</tr>
</tbody>
</table>

Journal Entry

03.00.11 continued

I’ve been rushing around since I got home organising sitters, rides, lessons, plans, funding, and measuring and assessing all the rapid development that took place during my 13-day absence including a 6-page letter for preschool to bring them up to date on his comprehension – he’s learned about 30 verbs. Knows * says, roll over. (yesterday), turn around. Especially rapid compared to last year (same 2 weeks in August) when there was hardly any change discernible. He was slow in understanding then but he’s speedy now.

Interested in (*since 3.0.9) the ankle/foot/leg distinction and today finger, hand, wrist, arm, asked 2 different times.

First correctly pointed at D and C when asked, then pointed to D for Where’s C? I said no, and C said I’m C. And he pointed at her, process of elimination but showed he knows people have names. * Ran to her for a hug.

Kissed me on request 60% and * spontaneously 3 times. Dear little monkey.

Gray verbalised all day but imitated [wa wa wa] and [yae yae yae] only when I whispered. He made some [brrrr] raspberry-type strings – attractively fricative, i.e. spitting, then he energetically wipes his mouth, sometimes even without being asked. Was full of conversational squeaks and grunts and vowels with D and C His facial expressions are very communicative and charming now– he can express curiosity,
interest, puzzlement, slight to severe anxiety, pleasurable versus serious intensity of concentration and lots more, all just for learning words. I can tell by his face when he’s remembering and what. Its amazing – like the book “Your Child’s Silent Language” and ethno-methodology. More subtle than I can relate alas. Many social expressions too – mischievous, showing off, giggly, inciting (for more game play) - so many more. Gets all steamed up for company. *Waves goodbye at everybody, but only after they've gone out of sight so it's not to communicate, it expresses all gone.

Over half hour door/doorknob/locks play at D and C’s – just 2 minutes on the doorstop however. *Went to a book before going to the doorknobs, that's a change. * He fit the end of a shoelace into a hole in the bottom of his cow (he loves a collage) and swung, wrapped and dragged it over rugs, grass, and carpet, made a pulley and pendulum of it, and cried in an irritated way when it worked apart but learned to jam it back in. He still gets close-up at eye-level to fully appreciate his creations.

Intentional communication during 02.10.00 to 03.00.28

Graeme’s intentional communication developed slowly during the three-month period of the comprehension word spurt. He continued to use the nonverbal pragmatic functions of protesting, and of requesting objects, actions, and information and he added a new pragmatic function, commenting on an action (sharing a positive affect about an object or event). For some of these communications, Graeme employed mimetic and invented gestures. The intentional communications, pragmatically functioning as requests for objects and information, and as comments on actions, overlapped with his word/signs.

Graeme became more specific in his requests, using his pointing and touching gestures, as well as other clear and obvious acts of intention. Some examples of requests for actions were: dragging me downstairs to watch him wade across his little pool (02.10.05); sitting down and putting sand on his leg to induce me to repeat burying his legs in sand (02.10.25); getting his potty and bringing it to F so that F could help him undo his pants (02.11.07); and pushing me to initiate the roll over game (03.10.13). Requests for objects involved firm specific pointing or touching, with his grunted I want it word from 02.06, as well as the older form of whining and pulling his parents’ hands. Occasionally, new gestures would be used once or twice and drop out, such as his idiosyncratic invented request for a milkshake, which consisted of him clasping his hands together at his face and shaking them together.
Graeme began to use his word/sign *look* (pointing) to comment on actions, such as the play activities of a visiting child, and noises such as the sound of the upstairs neighbours vacuuming. F and I supplied the names of the actions, but, as Graeme did not use his *name question* and there was no evidence of comprehension, this pointing seemed to indicate his attention to sounds and actions, rather than a request for name information. During this period, Graeme did not use his *name question* for actions: requests for names were reserved for objects only. For actions, he pointed, instead, to comment. He also began to employ mimetic gestures for commenting, such as when a picture of a hairbrush prompted him to mime brushing my hair. Another intentional communication with a comment function was an idiosyncratic short-lived gesture; a deliberate tumbling of both hands together as a private sign of pleasure; for example, after filling my arms with bears, or over a satisfying stack of crayons.

The *name question* grunt\(^{77}\), in addition to being a request for information, served an additional communicative function. Graeme employed it as interactive conversational turn-taker when he was addressed, in situations that included bear play, and eating pizza. In 03.00, Graeme also made various unique facial expressions, and snapped his teeth, as turn-takers to prolong a conversation.

Still the norm were his high pitched, tense, whining that signalled protest, and his frequent tantrums, for greater resentments, in which he would fall suddenly forward from the waist, hit his forehead on the floor, pound the floor with his hands, and wail furiously while giving his parents angry looks. These full-blown *broken puppet* tantrums usually did not last more than two minutes. By 03.00.11, they had decreased in frequency to two or three a day.

Graeme’s increased fluency in using a variety of pragmatic functions to express his intentions was an encouraging sign of his progress in communication. Not only did it decrease his frustration, but it also improved the success of Graeme’s father and myself in bonding interactions with him.

\(^{77}\) Described in Part 1 of this chapter.
Word/signs acquired from 02.10.00 to 03.00.28

Graeme’s early word/sign production proceeded slowly during the three months of rapid word learning in comprehension, with the acquisition of only nine new early words/signs. All of these were context bound. The name question, his 11th lexical acquisition, acquired in sign at 02.10.13 and vocalisation at 02.11.15, was the most significant, not only in its function of appearing to facilitate rapid acquisition in lexical comprehension, but as the most frequently used by far, surpassing the previously most used grunt for I want it. The name question preceded the other new productions, all of which were acquired during 03.00. After Graeme acquired the vocalisation component of the name question, he often used it so many times in the course of a day that it was impossible to count. Another important achievement in production was the advent of animal sounds to represent animals.

Table 6.11 shows the AoA of the developing forms of the word/signs acquired during this period. The number column indicates the order in which he acquired the word/sign in his productive lexicon. The first tries are noted to show consistency of use, as a criterion for acquisition. The age dates that Graeme acquired the conventional word forms, usually over a year after these early forms, are shown for interest, although they lie beyond the scope of this study.

Table 6.1278 Acquisition of word/signs 02.10.00 – 03.00.28

<table>
<thead>
<tr>
<th>#</th>
<th>Word/sign</th>
<th>AoA</th>
<th>First try</th>
<th>AoA Sign</th>
<th>AoAVocalisation</th>
<th>AoAConventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Name question</td>
<td>2.10.13 79</td>
<td>2.10.10</td>
<td>2.10.13</td>
<td>2.11.15</td>
<td>&gt;5.0</td>
</tr>
<tr>
<td>12</td>
<td>Bye bye</td>
<td>3.0.5</td>
<td>2.6.12</td>
<td>3.0.5</td>
<td>3.5.21</td>
<td>3.11.19</td>
</tr>
<tr>
<td>13</td>
<td>Dog/bark</td>
<td>3.0.8</td>
<td>3.0.5</td>
<td>3.0.17</td>
<td>3.0.8</td>
<td>4.0.16</td>
</tr>
<tr>
<td>14</td>
<td>Pig/oink</td>
<td>3.0.8</td>
<td>2.11.16</td>
<td>3.0.8</td>
<td>4.2.0</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Cow/moo</td>
<td>3.0.11</td>
<td>2.11.19</td>
<td>3.0.11</td>
<td>4.0.14</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Horse/neigh</td>
<td>3.0.12</td>
<td>2.11.16</td>
<td>3.0.12</td>
<td>4.1.26</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Bear/growl</td>
<td>3.0.14</td>
<td>3.0.12</td>
<td>3.0.14</td>
<td>3.10.8</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Cat/miaow</td>
<td>3.0.17</td>
<td>3.0.17</td>
<td>3.2.15</td>
<td>3.0.17</td>
<td>4.4.25</td>
</tr>
<tr>
<td>19</td>
<td>No</td>
<td>3.0.24</td>
<td>2.5.27</td>
<td>3.0.24</td>
<td>3.10.28</td>
<td>4.4.4</td>
</tr>
</tbody>
</table>

78 The IPA for these signs is given in Table 6.12.
79 The age date form is abbreviated in the table. For example, 3.0.5 represents 03.00.05.
Three of Graeme’s new word/signs were initially signs (the name question, bye bye, and no) and the other six were onomatopoeic vocalisations of animal sounds. Though a wave for bye bye had been taught and encouraged for months, Graeme first waved voluntarily at 03.00.08, when it became the 12th acquisition in his early word/sign lexicon. The meaning was at first closer to all gone, because he did not wave until the person was out of sight, or the toilet had been flushed. At 03.00.24, he shook his head with a clear intention of refusing food. This was the AoA for no, as earlier head-shakings were reflexive acts of rejection. No was the 19th early word/sign in his lexicon.

Graeme also extended the meaning and function of his earlier signs. Though the early/word sign for greeting continued to be touching noses, Graeme extended the form by adding new methods of greeting. For a few days in 02.10, he used an invented greeting gesture in which he pointed in the direction of the person, jerked his arm up high while looking up at it, then jerked it down. By 03.00.09, he waved spontaneously in response to a greeting, and by 03.00.11, he began to wave at objects he recognised and liked, such as crayons and houses, especially after they had been named. A frequent interaction from this time was:

Graeme: Name question.
Deborah: (Supplies name).
Graeme: Greeting (waves at object).
Deborah: Hi, (repeats name).

The day after he began to wave at objects, he waved at himself in the mirror, and at the telephone receiver, when he heard Hi Graeme. Graeme’s early flapping wave was less marked (well-formed), which is common in the child forms of signs (Morford & Goldin-Meadow, 1992; G. Morgan et al., 2007). By 03.00.25, he put one hand on my shoulder and pursed his lips appropriately for kissing, though this was not restricted to greeting. The most common new greeting act, one that he used continually for two months, was the idiosyncratic sign he also used for dog: a blinking, open-mouthed, eyes-rolled-up facial expression, to which he later added nodding. Enthusiastic barking and growling later augmented this greeting routine.
During 03.00, Graeme began to extend the function of his early word/signs *up* and *down* to comment on relational actions. For example, while looking at a picture of stairs, he vocalised and gestured *down* and *up*. At 03.00.26, he began to use *up*, with a high rising intonation and repeated upward arm movements, to accompany actions such as lifting his toy out of the water. At 02.11.10, he volunteered *down*, to request that F make the bear fall down, and at 03.0.11 he commented *down* when he made the sheep fall down. As mentioned in the section on intentional communication, Graeme began to use his word/sign *look* to comment on actions, rather than its original function of indicating objects.

The word/signs acquired in this period met the criteria for inclusion in Graeme’s productive lexicon as word/signs on the basis of their consistency of use and form, their productivity in more than one situation and pragmatic function, their spontaneous use, the lack of inappropriate use, their relation (in some cases) to earlier imitated forms, and their extension to multiple exemplars.

**Production of animal sounds**

Though Graeme was still usually silent, his understanding, during 02.11, that animal sounds meaningfully represented the animals, prompted a major development in production, as he began occasionally to imitate a few animal sounds. At 02.11.15, the very day he acquired the *name question* vocalisation, Graeme first attempted to imitate the sound for *sheep* (*baa*), after weeks of encouragement from his speech therapist at preschool. The following day, he tried sounds for *pig* (*oink*) and *horse* (*neigh*), and, three days later, the nasalised sound for *cow* (*moo*). Initially these sounds were alike\(^80\). By 03.00.04, *moo* had its own intonation pattern [\(\text{uh} \uparrow \text{uh} \downarrow \text{uh} \uparrow\)]. On this day, Graeme brought us all his animal toys to be labelled, which F and I did with both the animal name and sound. I considered this to be his acknowledgment that animal sounds had meaning and represented animals. The first imitation of *bowwow* or *woof woof* (*dog*) was at 03.00.05. Table 6.13 shows the beginnings of these acquisitions in the order of Graeme’s

\(^{80}\) Discussed in detail below.
first attempts to imitate them, because first imitation signified a landmark willingness to attempt a new vocalisation.

**Table 6.13 Animal sounds in production**

<table>
<thead>
<tr>
<th>#</th>
<th>Word</th>
<th>Imitated</th>
<th>Acquired</th>
<th>Sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Pig/oink</td>
<td>02.11.16</td>
<td>03.00.08</td>
<td>[uwae uwae] creaky, long</td>
</tr>
<tr>
<td>16</td>
<td>Horse/neigh</td>
<td>02.11.16</td>
<td>03.00.12</td>
<td>[?a?a?a?] grunt</td>
</tr>
<tr>
<td>15</td>
<td>Cow/moo</td>
<td>02.11.19</td>
<td>03.00.11</td>
<td>[?uh ?uh ?uh] nasalised</td>
</tr>
<tr>
<td>23</td>
<td>Sheep/baa</td>
<td>02.11.20</td>
<td>03.01.19</td>
<td>[?a?a?a?] grunt, falling</td>
</tr>
<tr>
<td>13</td>
<td>Dog/bark</td>
<td>03.00.05</td>
<td>03.00.08</td>
<td>[?uh ?uh ?uh] grunt</td>
</tr>
<tr>
<td>20</td>
<td>Chicken/cheep</td>
<td>03.00.10</td>
<td>03.01.17</td>
<td>[i: i: i:] high squeaky</td>
</tr>
<tr>
<td>24</td>
<td>Duck/quack</td>
<td>03.00.11</td>
<td>03.01.25</td>
<td>[aek aek] croak</td>
</tr>
<tr>
<td>17</td>
<td>Bear/growl</td>
<td>03.00.12</td>
<td>03.00.14</td>
<td>[grrr] deep growl</td>
</tr>
<tr>
<td>18</td>
<td>Cat/miaow</td>
<td>03.00.17</td>
<td>03.00.17</td>
<td>[?ng] nasalised, gargled</td>
</tr>
</tbody>
</table>

Acquisition status as a word/sign in production was granted when Graeme spontaneously volunteered the sound. This occurred only in the presence of the toy, a picture, or the actual animal. The acquisition of animal sounds was a significant advance in Graeme’s productive lexicon. Because they are onomatopoeic words, and are imitations of words in his phonological environment, the animal sound word/signs are closer to meeting the criteria of Vihman (1994) and McCune (2001) for word status. They did not meet their criterion of matching two segments of the adult form, being on the wild end of the onomatopoeic scale (Rhodes, 1995).

These early productions involved intense effort by Graeme, in trying to form his lips to make the sound. Initially, they were all variations on nasal vocalic grunts, and sounded much the same as *down* (minus the sign). Throughout 03.00, Graeme differentiated them, trying various suprasegmental features. He employed height (*horse* versus *dog*), pitch (*chicken*), length (*pig* versus *duck*), and intonation (*cow* versus *dog*; *sheep* versus *horse*), along with such non-phonetic qualities as squeaking, croaking, growling, gargling, and creakiness. This differentiation was variable and inconsistent. When Graeme was naming one animal after another (see Figure 5.4), he made an effort to distinguish their sounds, usually by pitch or height, but in general *sheep*, *horse* and *dog* were very similar. I represented them rather crudely in the WE list with IPA (in Table 6.12 above), though
none were speech sounds. Onomatopoeic sounds and idiosyncratic inventions figured largely in Graeme’s early word/signs, an individual proclivity that is not uncommon in TD children, as variations in using more conventional early words (Nelson, 2007b; Peters, 1994).

**Journal Entry**

03.00.11

I say “The cow/pig/duck/dog/bird/chicken says ___?” and Graeme makes his grunted nasal sound *. I cued him with an exaggerated silent lip position for /m/ yesterday and today. * He squeaks [I˘ I˘ I˘] for the chicken sound imitating my high pitch. Taped him playing with animals, book, colours. Why didn’t I tape him all this past year so I could have measured the great recent change that’s taken place? Discouraged by my inability to generate any sounds from him initially probably.

The usual plastic animal line-ups and sound making – consistent on cow, pig, dog – * same for duck. * Working on turtle and sloth comprehension. Must test turtle/turkey. Maybe that's why he wants turtle named so much in pix, they're so similar phonetically.

On a walk we saw a crow which cawed several times – he was enthralled and was very interested when I imitated (laughed and looked intently) and * 3 hours later he saw a tiny woollen bird knickknack at D. and C.’s and made a creaky /a/ sound. So smart to associate the category despite the differences of one being alive, large, and feathered and the other a tiny wool representation, and smart too to remember and replicate the sound.

**Phonological contrasts**

Graeme used several non-English distinguishing features to meaningfully contrast his early paralinguistic grunt words. These included intonation and reduplication. Intonation was a contrasting feature between variations of the name question. A rising intonation distinguished the name question used for the first request, and for answers he was unfamiliar with. The same grunt used with a level intonation served as an acknowledgement of a known word and as a request for a repetition. Because both forms served as requests for name information, they were not treated as separate word/signs, although they had separate functions. Halliday (1975) and Bates et al. (1975) note that a rising intonation on early demonstratives is contrastive, changing its meaning to a request for a naming label. An example from a tape on 03.00.11 is:
Graeme: [?uh↗] [?uh↗] (name question with rising intonation, touching the colour yellow in the picture).  
D: Yellow.  
Graeme: [?uh↗] (name question with level intonation, meaning he is familiar with the word, that I have given the anticipated response, and he wants a repetition).  
D: Yellow.  
Graeme: [?uh↗] (name question, level intonation, indicating he wants a repetition, and to continue the conversation).  
D: It’s a yellow house.  
Graeme: [?uh↗] [?uh↗] [?uh↗] (name question with rising intonation, meaning he wants a repetition of the new information).

Graeme would typically ask the question form first, then ask again with the acknowledgement intonation two or three more times, to satisfy his need for repetition to reinforce a familiar word. If his first question resulted in an unknown word being supplied, he would repeat the question form two times quickly, with increasing insistence, and then use the acknowledgement form several more times for repeated exposure.

The rising and falling intonation of moo, [?uh↗ ?uh↘ ?uh↗] along with its nasality, also distinguished moo from the other grunts for I want it [uh uh uh] and the name question [?uh↗ ?uh↘ ?uh↗]. In order to differentiate I want it from the single syllable name question Graeme employed reduplication, a non-English contrastive form. Though the name question was usually quickly repeated, it was a monosyllable.

As mentioned in the animal sounds section above, Graeme used height, intonation, length, and pitch, with the paralinguistic sound effects such as creakiness, squeakiness, growling, gargling, and pitch, as distinguishing features, although these were used variably and inconsistently.

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81 Graeme continued to touch the picture throughout the exchange.
Assessments

Towards the end of the developmental phase under consideration, Graeme had an assessment with a neurologist at Children’s Hospital in Vancouver. The journal entry for 02.10.27 contains the notes I wrote during the visit.

Journal entry

02.10.27

Gray and I went to visit the neurologist who said Graeme’s “abnormalities” were caused by a “gross insult at birth” and were not “congenital or from any syndrome”, that he was not “retarded”, and was “not autistic” (relates too well to me). He probably isn’t having seizures when he blinks in his unfocused way, it’s a “self-stimulating mannerism”. His tonic seizure at 3 weeks old gives a “bad prognosis, shows lots of damage to the central nervous system”. The Dr will order a CT scan – “It's justified by the fact that it's now clear that his handicap is severe enough to affect him for life”. There is “bilateral temporal lobe brain damage, with the left side more affected, but because the right side is also damaged it hasn’t taken over the language (not a good prognosis)”. He still has “floppy muscles and a left weakness” (left toes don’t curl down, one leg comes up higher). He isn’t as delayed in other areas, e.g. fine motor skills, as in language. His “hypoxia at birth usually results in mental retardation and /or cerebral palsy rather than aphasia” but Gray has good eye movements, no tremor in his hands. So he’s unusual for this sort of abnormal birth in his “severe language delay and neurological deficits”. He reminded the Dr. of “another kid in Boston with a difficult C-section birth”.

Not good news.

In other physical assessments of the time, periodic EEG tests showed a spike focus in the left temporal lobe at 00.06, although subsequent EEGs were normal. Some months later the CT scan found normal ventricles. The paediatrician diagnosed possible mild cerebral palsy in Graeme because of his hand tremor during fevers, but there was no further manifestation of cerebral palsy. Graeme had difficulty with balance, and at 02.11 he could not jump or hop. He first jumped with both feet off at 03.00.12. Hearing tests at 03.0.12 revealed no hearing loss, but resulted in a recommendation of teaching him sign language.

Because of Graeme’s difficult birth and the early signs of his delayed development, Graeme had received a great deal of excellent medical and therapeutic attention, for which Graeme’s father and I were profoundly grateful. I had sought diagnoses, prognoses, and therapeutic approaches from every source available to me, requesting the
official reports on all assessments, rather than the less clinical version for mothers, which was what I was first given. The appointment with the neurologist had been long awaited. By that time, I had become conversant with paediatric medical language, which I employed in an effort to present as an informed professional myself, and so receive, I hoped, as accurate and true an opinion as the specialist could give me. Although I was successful in obtaining the information I sought, both the prognosis, and the terms in which Graeme’s condition was described, were emotionally affecting.

And yet, the tangible, daily evidence of Graeme’s rapid improvement in social responsiveness, and in his ability to understand language and to communicate, mitigated the harshness of the report, and gave F and me hope.

**Summary**

Graeme’s production gains over the three months of the comprehension word spurt, between 02.10.00 and 03.00.28, included growth in babble, intentional communication, word/signs, onomatopoeic animal sounds, and phonological contrasts. His acquisition of word/signs, although not great in number, was significant in two ways: first, the name question appeared to facilitate his rapid word learning in comprehension; and, second, his onomatopoeic words in production were an advance towards the criteria for word status in TD children.

The biggest change in Graeme’s babbling was the introduction, at 03.00.27, of supraglottal consonants, which are necessary for later speech production in words (McCune & Vihman, 2001). Graeme engaged in sound making activity, exploring his vocal tract for sound, particularly spitty raspberries (Stark et al., 1993). His production of non-meaningful sounds with unusual vocal quality, consisting of tense, high-pitched, squeaky squeals, creaky growling, whining, whooping, and yelling, was typical of preschool children with ASD (Sheinkopf et al., 2000).

Graeme’s intentional communications increased in specificity, in fluency, and in the variety of their pragmatic functions. He began to comment on actions, using pointing, or,
like some hearing and deaf babies, using mimetic and invented gestures (Abrahamsen, 2000; G. Morgan, 2006). The frequency of the pragmatic acts of commenting and requesting has been found to predict later production in children with ASD (McDuffie et al., 2005; Sigman & Kim, 1999; Tager-Flusberg et al., 2009).

Graeme acquired nine new word/signs in this three-month period, and extended the meanings, form, and function of his earlier productive lexicon. Of these new acquisitions, the name question, a pointing sign functioning as a request for information, had the most significance. It facilitated the word spurt in comprehension in 02.10. When Graeme acquired the grunt component for the name question, in 02.11, he became able to gain attention with vocalisation, which appeared to trigger his very rapid acquisition in lexical comprehension. McCune (1996) and Vihman (2001) noted that the pragmatic function of gaining attention with vocalisation co-occurs with development to referential word use in production. In Graeme’s case, this co-occurred with categorical word acquisition in comprehension as well. The name question was Graeme’s most frequent utterance of this period.

Graeme acquired two signs, no and bye bye, and improved the hand shape and gestural control of his sign for bye bye. He used intonation to distinguish his grunts for I want it, give it to me from the one for the name question, and to distinguish the functions of question and acknowledgment in the name question. Halliday (1975) and Bates et al. (1975) note that a rising intonation on early demonstratives is contrastive, changing its meaning to a request for a naming label.

The acquisition of animal sounds in Graeme’s production, towards the end of this period, was the first imitation of words from his phonological environment. Having a preference for non-speech sounds, Graeme used wild onomatopoetic sounds (1995), which were so faithful to the animal sounds they mimicked that they were difficult to transcribe, as noted in a case study by Morgenstern (Morgenstern, 2007). He also used non-English contrastive suprasegmentals as distinguishing features for these word/signs. Though these word/signs were all context bound, he uttered them spontaneously in reference to his
picture books, animal toys, and live animals, demonstrating growth in his symbolic conceptual knowledge.

Graeme’s tantrums decreased in frequency, probably due to his increased capacity for specificity in requesting names, objects, information, and actions, which improved communication.
Chapter 7: Conclusions and Implications for Further Research

Dissertation questions

Introduction

This chapter presents substantive conclusions to my two research questions, based on the findings presented in Chapters 5 and 6. The chapter is organised into a discussion of the first research question, followed by a discussion of the second research question. Limitations to the study, with reference to the methods of data collection and analysis will be discussed. Implications for further research follow, with proposals based on questions that arose from the present study’s findings.

First research question

What is the relationship between the delayed and unusual early lexical acquisition, in both comprehension and production, of my son Graeme, who has autism, and the major developmental milestones in his cognitive and social growth?

This section will discuss the principal findings of the study and relate Graeme’s social-cognitive development to the acquisition of his lexicons in comprehension and production. The developmental span of this dissertation covers a period of six months, from the genesis of Graeme’s lexical acquisition at around 02.06.00, to the point that his spontaneous acquisition of words during the comprehension word spurt became too rapid to observe, at 03.01.28. In this period, the eight major linguistic transitions and achievements, in order, that signalled new phases of lexical acquisition were:

1. The transition from the pre-linguistic period to the onset of comprehension and the production of early word/signs, around 02.06.00, which began the period of slow word learning in comprehension.
2. The development of canonical babble, and of intentional communication for the pragmatic functions of requesting, commenting, protesting, and greeting, during the slow learning period between 02.06 and 02.09.

3. The transition from the slow-learning period to the word spurt in comprehension, at the end of 02.09.

4. The acquisition in production of a pointing sign name question, at 02.10.13, which functioned as a means of acquiring words in comprehension.

5. The acquisition in production of a grunt vocalisation for the name question, at 02.11.15, as a means of rapidly acquiring words in comprehension.

6. The semantic reorganisation during the word spurt in comprehension, leading to the acquisition of categorical words in comprehension.

7. The acquisition of onomatopoeic words in production, starting at 03.00.08.

8. The transition to learning words spontaneously in comprehension, near 03.01.28.

I will address my first research question by examining the correlation between Graeme’s social/cognitive developmental milestones and these linguistic achievements, with reference to research literature. The correlation will be discussed within four developmental periods: the prelinguistic period (to describe Graeme’s development prior to onset), the onset period, the period of slow learning in comprehension, and the period of the word spurt in comprehension, which will include the semantic reorganisation.

**The transition to lexical onset**

Graeme’s prelinguistic period lasted for approximately two and a half years following his birth. During this time, Graeme displayed no comprehension of speech or gesture other than four context-dependent word events. At 00.06, Graeme showed early babbling, with vocalic and glide sounds, and occasional supraglottal consonants. The cessation of his early babbling after 01.01 points to a possible language regression, with his language loss concealed by language delay (Pickles et al., 2009). By 02.00.00, he was mainly silent. During this second year, his vocalisations consisted of occasional meaningless cooing
sounds and laughter, usually in solitary play. Rather than attracting attention with objects (Curcio, 1978), Graeme focused on partial or irrelevant features of an object in solitary play (Carpenter et al., 2002). For the intentional communications of requesting and protesting, he whined and tantrumed, banging an object in frustration, or guiding his parents’ hands as tools (Donnellan & Mirenda, 1983; Loveland & Landry, 1986; Stone, Ousley, Yoder et al., 1997; Tomasello & Camaioni, 1997). These delays in lexical comprehension, and in the production of first words, are early indicators of ASD (Lord, 1995; Lord & Pickles, 1996; Mitchell et al., 2006; Rice et al., 2005; Rutter & Schopler, 1992).

During this time, Graeme displayed the characteristic joint attention impairments in eye contact, and in attention, point, and gaze following, associated by many researchers with comprehension delay in children with ASD, while joint attention acquisition is associated with language acquisition in TD children (Bono et al., 2004; Carpenter et al., 1998; Carpenter & Tomasello, 2000; Charman, 2003; Dawson et al., 2004; Delinicolas & Young, 2007; Leekam et al., 1998; Leekam et al., 2000; Mitchell et al., 2006; Mundy et al., 1994; Schertz & Odom, 2004; Sigman & Kim, 1999; Zwaigenbaum et al., 2005). He did not look in the direction of a conversational partner, and had difficulty in orienting to speech, including his name (Lord, 1995; McDuffie et al., 2005) and his mother’s voice (Klin, 1991). Gestural development involving shared reference, such as pointing and showing, was lacking (Carpenter et al., 2002; Parisse, 1999), as was his response to verbal and non-verbal directives (Baird et al., 2000; Baron-Cohen et al., 1996; Carpenter et al., 2002; Landry & Loveland, 1988). Graeme’s noticeable deficits, at 02.00, in gestural joint attention in pointing and showing, support Mundy, Sigman, and Kasari’s (1990) observation that these deficits are predictive of delayed language development a year later. His delays in both gesture and language also support the findings of Luyster et al. (2008), that gesture use is related to concurrent language skills in toddlers with ASD. His delay in joint attention and communicative intentions support Rollins’ suggestion that these pragmatic skills are associated with the rate of vocabulary acquisition (Rollins, 1995; Rollins & Snow, 1998).
Overall, in his prelinguistic period, Graeme had not acquired the social orienting skills of shared affect, attention, and relating behaviour that are the prerequisites for lexical comprehension (Jones, 2003; Paul, 2008; Yoder & Warren, 2001). Other than some tool use (keys, hammers, and screwdrivers), Graeme had difficulties with most motor imitations, as do many children with ASD (Rogers et al., 2003; Rogers et al., 2008; Stone, Ousley, & Littleford, 1997). Immediate motor imitation has also been shown to predict concurrent language skills (Sallows & Graupner, 2005; Stone & Yoder, 2001).

In his prelinguistic period, then, the findings suggest that Graeme’s absence of lexical acquisition was related to lack of the social-cognitive abilities which researchers have found to be related to the onset of lexical acquisition: joint attention, early object categorisation (Clark, 2003; Gopnik & Nazzi, 2003), and imitation. Prelinguistic intentional communication, comprehension acquisition, and joint attention skills emerge concurrently in TD children from 00.09 to 01.02 (Bates et al., 1975; Nelson, 1991). During his prelinguistic period, Graeme’s social/cognitive abilities did not reach language readiness until he was almost 02.06.00, nearly three times the age at which a TD child attains those benchmarks.

It is interesting to speculate on the implications of Graeme’s first diagnosis from the B.C. CHDC, of receptive and expressive aphasia. Newer, more inclusive definitions of ASD accounted for Graeme’s behaviour and his language delay, but further research could determine whether the possibility of dual diagnosis is significant, predictive, and useful.

After Graeme’s diagnosis, F and I increased our language interactions with Graeme, addressing him more frequently, incorporating words into our shared routines, and labelling whatever he was focused on, to encourage the beginnings of lexical acquisition. The frequency of these parental behaviours has been found to scaffold comprehension in TD children, and in children with ASD (Akhtar et al., 1991; L. Bloom, 2000; Gopnik & Meltzoff, 1992; Gopnik & Meltzoff, 1997; McDuffie et al., 2006; Nelson, 1988; Nelson, 2007a; Rescorla, 1980; Siller, 2007; Snow, 1999; Tan & Schafer, 2005). At 02.03, Graeme began language therapy at the CHDC preschool 12 hours a week and with a language therapist at home once a week. His onset of comprehension supports studies
proposing that increases in lexical acquisition can be attributed to the amount of therapeutic intervention the children receive (Bibby et al., 2001).

The transition from the prelinguistic period to the onset of slow word learning in comprehension followed a social/cognitive developmental spurt around 02.06, which may have been a consequence of his enriched learning environment at home, preschool, and in his language therapy. At this time, Graeme’s attentional engagement skills in eye contact, gaze and point following, and pointing emerged. These joint attention milestones are correlated with word learning skills, and emerge at the same time in a TD infant, usually around 08.00 to 09.00 (Baron-Cohen et al., 1997). At 02.06.01, Graeme first looked at what was indicated by F’s and my pointing, rather than at our pointing fingers. While pointing is typically acquired at 00.10 (Casadio & Caselli, 1989), Graeme began to point at 02.06.08. Gaze following is considered to be essential for the development of the ability to associate label with objects and events, in order to understand the meaning of words (Hollich et al., 2000; Meltzoff & Brooks, 2009; Sabbagh et al., 2007). The co-occurrence of Graeme’s pointing, gaze and point following, with the onset of his comprehension, supports research which identifies the abilities of social gaze and child-initiated pointing and showing as the strongest predictor of concurrent language ability in children with ASD (Charman et al., 2003; Dawson et al., 2004; Leekam & Ramsden, 2006; Paul, 2008), and as one of the strongest predictors of later word comprehension (Luyster et al., 2008; McDuffie et al., 2005). Graeme also began voluntarily listening to someone address him and became responsive to salutations.

At the onset of lexical acquisition, the initiation of spontaneous communications, although very infrequent in children with ASD, is associated with early language comprehension and production abilities (Landry & Loveland, 1988; Stone & Caro-Martinez, 1990; Wetherby & Prutting, 1984). Around 02.06.00, Graeme began to initiate interactive games involving a verbal component and eye contact. By 02.06.04, Graeme began to use his first word/signs meaningfully, consistently, spontaneously, and productively82. Graeme’s first context bound early words/signs had the pragmatic

82 Graeme’s production of word/signs will be discussed in detail in relation to my second research question.
functions of requesting actions (mainly games), and objects (food or toys). At 02.06.11, his referential pointing began, which initially had the functioning of commenting.

In addition to gains in joint attention abilities, Graeme developed in other areas of cognition at this time. He demonstrated increased skills in categorisation, as his line-ups became more complex and his sorting abilities improved. His symbolic capacity increased with his recognition of pictures. An instance of miming a drinking gesture to indicate his desire for milk showed an early use of symbolic representation. His tinker toy constructions and tool use demonstrated functional relational practise play (Piaget, 1962). These accomplishments, in conjunction with his commencement of comprehension and production, support the research of Luyster et al. (2008), who found comprehension was predicted by non-verbal cognitive abilities in toddlers, which were also related to concurrent language use in both comprehension and production. Among the prerequisites and conditions for learning words noted in Chapter 2, social interaction, joint attention, caregiver input, the child’s contents of mind, perceptual cues, motor maturation, and categorisation abilities all played a role in the onset of Graeme’s word comprehension.

In spite of Graeme’s delay, his onset of word production, language comprehension, and increased specificity in intentional communication emerged at the same time as his acquisition of referential pointing and his co-ordinated visual attention to an adult. This timing supports Calandrella and Wilcox’s (2000) observation that these skills are related to later word production; and that gestural indicating behaviours are predictive of language comprehension in children with ASD. The findings show that the social/cognitive abilities Graeme achieved at the onset of his lexical acquisition were the foundation for the genesis of his lexical comprehension, his intentional communication, and his first four word/signs in production. His enriched language input and therapy were additional (or precipitating) factors.
The acquisition of comprehension and production during the slow learning period

After the developmental spurt at the onset of comprehension, Graeme entered a four-month period of slow word learning in comprehension, from 02.06 to the end of 02.09. In this period, he added 17 words to his comprehension vocabulary, reaching a total of 30 words. He also made slow gains in production of babble, intentional communication, and word/sign acquisition at this time. His social/cognitive development likewise progressed slowly.

Like TD children, Graeme first understood his early words in highly restricted ranges of meaning (Dore, 1985; Dromi, 1993; Ferguson & Farwell, 1975; Halliday, 1975; Nelson, 1988; Rescorla, 1980). His comprehension depended on the following: his close relationship with the speaker; a familiar, consistent context of verbal interaction; non-linguistic routine; and the presence of referents. Graeme’s dependence on the cues of temporal continuity, perceptual salience and prosody supports the observations of many researchers (Akhtar, 2005; Cohen & Brunt, 2009; Dromi, 1999; Hirsh-Pasek et al., 2004; Hirsh-Pasek & Golinkoff, 2008; Hollich et al., 2000; Nazzi & Bertoncini, 2003; Werker et al., 1998). F and I continued to engage Graeme’s interest with pictures and actions, and to supplement our speech to him with an exaggerated delivery, frequent modelling, and ostensive labelling of objects on which Graeme was focused, as described to be very important by several researchers (Cohen & Brunt, 2009; Meltzoff & Brooks, 2009; Sabbagh et al., 2007). We used simplified language, limited to single words or a short phrase with reduced morphological complexity.

Graeme began to attend to and comply with a few directives, behaviour which has been found to relate positively to speech outcomes and vocabulary increases in young children with ASD (McDuffie et al., 2005). His earliest lexicon in comprehension was comprised primarily of relational words, including directives, as described for TD children (McCune & Zanes, 2001; McDuffie et al., 2005). Proper names, and a few food-related names, were his only nominals in comprehension. Notably, all of his comprehension lexicon was
on the CDI of early comprehension vocabulary for TD children at 01.04 (Fenson et al., 1994).

Graeme acquired his words in comprehension one word at a time, gradually extending them semantically by adding broader linguistic and environmental contexts, as Clark described in her study of TD children (2003). He began to understand his nominals independent of the presence of the referent. While his action and instructional words in comprehension remained embedded in their context, their meaning was extended to other actions and routines. Although Graeme’s words understood were acquired in limited semantic categories, these categories, and the order in which they were learned, were the same as those of other verbal children with ASD, and those of TD children as well (Benedict, 1979; Charman et al., 2005; Dromi, 1987; Fenson, 1989; Nelson, 1973; Rescorla et al., 2001; Tager-Flusberg, 1985). The rate of his word learning in comprehension averaged six words a month during this period, very slightly in advance of the rate of acquisition for TD children at the same stage in their word learning (Benedict, 1979). Graeme’s lexicon, his semantic organisation, and his rate of acquisition in comprehension after the onset of his lexical acquisition were the same as those of TD children at the same stage.

Graeme’s production of babble, intentional communication, and earliest words and signs, emerged at the same time as his comprehension and his gains in joint attention. This convergence is consistent with TD children, though delayed (Bates et al., 1975; Nelson, 1991). Although Graeme’s babble was delayed, its progression after resumption was also the same as that of TD children (Stark et al., 1993). Graeme began sound-making activity in his babble at 02.07, compared with TD children who show such patterns at 00.04 to 00.05 (Stark et al., 1993). The onset of babbling has been shown to be significantly correlated with first words in the production lexicon of children with ASD (Kim, 2008).

Graeme’s acts of intentional communication were delayed, limited, and infrequent, as they are in many children with ASD (Camaioni et al., 1997). As is typical for other children on the spectrum, Graeme frequently whined or guided his parents’ hands as a tool, rather than using conventional attention-directing pointing or eye contact to
demonstrate his wishes and to request help (Donnellan & Mirenda, 1983; Loveland & Landry, 1986; Stone, Ousley, Yoder et al., 1997; Tomasello & Camaioni, 1997). Between 02.00 and 02.10, however, his intentional communications increased in frequency, becoming more specific and interpretable. Two milestones in the acquisition of pragmatic functions were that Graeme used joint attention, including pictures, to make his requests clear, and that he began to use pointing, to comment. Like other children with ASD, he employed few vocalisations, with no consonants, but many atypical and distress vocalisations (2009).

During 02.06.00 to 02.09.00, Graeme made slow but steady cognitive gains in areas related to language acquisition: categorisation, object permanence, general symbolic ability, and functional-relational play skills in object exploration and manipulation (Piaget, 1962). He demonstrated symbolic capacities through his awareness of the relationship between objects and events, and between cause and effect, similar to what Gopnik and Nazzi observed in their study of (2003). Growth in symbolic representation, as defined by Lifter and Bloom (1989), was also evident during 02.08, in his recognition of his stuffed animals as representing animate objects, and in his identification of photographs, pictures, and packaging of favourite items. Graeme’s skills in imitation lagged, as other researchers have noted in children with ASD (Rogers et al., 2003; Rogers et al., 2008; Stone, Ousley, & Littleford, 1997).

During 02.09, near the end of the period of slow comprehension word learning, Graeme began another social/cognitive developmental spurt in areas associated with lexical acquisition: exhaustive categorisation, and, to a lesser extent, pretend play (Sigman & Ungerer, 1984; Ungerer et al., 1981). Categorisation continued to be a comparatively advanced skill, as Graeme developed the ability to form class relationships based on an identification of similarity. In 02.09, he displayed exhaustive categorisation: in sorting objects by shape, size, colour and kind in his line-ups, and in his threading, stacking, and object construction (Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Gopnik & Nazzi, 2003; Mervis & Bertrand, 1994).
Noticeably less fearful, both physically and socially, at 02.09, Graeme began to overcome some of the developmental motor delays common to children with ASD (Eisenmajer et al., 1998; Lord et al., 2004). He demonstrated new physical prowess: his balance improved, his walk matured, he was able to walk on uneven ground, and to run.

Graeme also began to overcome the social deficits characteristic of ASD noted by Charman et al. (Charman, 2003). Although he still spent most of his time in solitary play, development in attentional engagement was evident in Graeme’s relating behaviours: in his affection for, and interactive play with his intimates; and in his increased attention to others and to his environment. He participated more in pointing and touching games, and liked family members to be pointed out and named, in photographs and in person.

Pointing, and point following with labelling, are both precursors to requesting names in TD children (Hollich et al., 2000). By 02.09, Graeme would make direct eye contact for approval and to share a joke, a difficult achievement for children with ASD, as noted in several studies (Drew et al., 2007; Mitchell et al., 2006; Zwaigenbaum et al., 2005). By the end of the slow learning period, around 02.10.00, the foundation was laid for the transition to his more rapid word learning in comprehension in the next month.

The acquisition of the name question

The word spurt in comprehension that began at 02.10 brought a qualitative change to the way that Graeme learned words. In the three-month period of his comprehension word spurt, from 02.10 to 03.00.28, Graeme reorganised the way he learned words and their meanings; from slow, one at a time, context bound acquisition, to rapid, efficient, context free acquisition. Words emerged concurrently with the more highly developed joint attention skill of intersubjectivity (Charman, 2003; Tomasello, 1995), the acquisition of the naming insight (Dore et al., 1976), and the growth in his symbolic representational ability (Blanc et al., 2002; Lifter & Bloom, 1989).

The word spurt in comprehension commenced through a combination of Graeme’s growing awareness, during the first part of 02.10, that objects have names, and his further growth in joint attention skills. The awareness that attention on an external entity is
shared enabled Graeme to take advantage of the visual and auditory cues of another speaker’s direction of gaze, words, and gestures, in order to determine which object or action was being labelled. Such patterns of acquisition have been noted by several researchers for TD children (Baldwin & Moses, 1996; Hollich et al., 2000; Tomasello & Camaioni, 1997; Tomasello, 2003). The more mature strategy of using the speaker’s direction of gaze to map a new word was indicative of his recently acquired language ability, as described by several researchers (Akhtar et al., 1991; Carpenter et al., 2002). Graeme used pointing to identify objects that were named, which supports the observation of Morford and Goldin-Meadow (1992) that gestures supplement and substitute for speech in comprehension in TD children.

As a non-verbal child, Graeme developed attentional gestures to achieve intersubjectivity and ensure co-operation in naming. At 02.10.11, he acquired imperative pointing (Tomasello & Camaioni, 1997) gaze following frequency, and triadic gaze switching, described in TD children by several researchers (Baldwin & Moses, 1996; McCathren et al., 1999; Tomasello, 1995; Tomasello, 2003). This combination was his name question, used as a means to request names. The use of his name question illustrated that he had gained the naming insight, and overcome the earlier joint attention deficits noted by researchers to be characteristic of ASD (Leekam et al., 1998; Mundy et al., 1994; Sigman & Kim, 1999), that had caused his delays in lexical acquisition. At 02.11.25, Graeme added a grunt vocalisation to his name question. Now able to employ the pragmatic function of gaining attention with vocalisation (McCune et al., 1996), his very rapid word learning in comprehension commenced. Figure 6.4 illustrates the affect that Graeme’s acquisition of the social-cognitive ability of initiating joint attention through his gestural and vocalised name questions had on the rate of his rapid word learning in comprehension. The name questions were a combination of triadic gaze switching that created intersubjectivity, with pointing and a grunt vocalisation that allowed Graeme to initiate joint attention.

The naming insight, and the achievement of intersubjectivity through triadic gaze shifting, emerged with Graeme’s development of symbolic representational ability.
Anglin, 1993; Bates & Benigni, 1979; Golinkoff et al., 1994; Lifter & Bloom, 1989; Mervis & Bertrand, 1994). This ability was demonstrated by his unusual comprehension strategy of using the resource of second-order representations, in the form of picture books, as an initial way to acquire nominals. The frequency with which Graeme initiated interactive labelling sessions with books, and with favourite words, had three apparent effects: first, it appeared to function as an aid to his word learning (Tan & Schafer, 2005); second, it prolonged the conversational focus on the object of his fascinations; and third, it possibly contributed to his understanding that words and pictures could symbolically represent objects. Graeme’s frequent pragmatic requests, in the light of his later production acquisition\(^{83}\), may support researchers’ observations that the frequency in the pragmatic acts of requesting predicts later production in children with ASD and in TD children alike (McDuffie et al., 2005; Poon, 2005; Sigman & Kim, 1999; Sigman & McGovern, 2005; Tager-Flusberg et al., 2009).

Actively asking for names signalled a shift in Graeme’s cognitive and social growth, providing evidence of his understanding that words name things, and that language is social and interactive, as described by Bloom (L. Bloom, 2000; Nelson, 2007a).

**The semantic reorganisation and the acquisition of categorical words in comprehension**

During the word spurt in comprehension, there was a gradual but major shift in Graeme’s semantic organisation, as his word meanings began to change from context bound to categorical and referential. Graeme’s early comprehension lexicon, like that of TD children as described by Benedict (1979), Dromi (1987), and Nelson (1973), was composed of unrelated words from a limited number of different semantic categories, and had no generic or lexical class identification. During the comprehension word spurt, aided by his recently acquired cognitive advance of exhaustive categorisation as noted by researchers (Gopnik & Meltzoff, 1987; Gopnik & Nazzi, 2003), Graeme appeared to re-organise his lexicon. His analogous recognition of lexical groupings with shared semantic categories allowed him to generalise from learning one item at a time to rapidly learning

\(^{83}\) This occurred after 03.01.28, beyond the scope of this study.
many words of the same semantic category (Gopnik & Meltzoff, 1992; Mervis & Bertrand, 1994).

After Graeme’s naming insight and the acquisition of his name question, new words acquired in Graeme’s lexicon in comprehension, mainly nominals, ceased to be dependent on a pragmatic function or environmental and linguistic contexts. Instead, like words in the production of TD children, described by Dromi (1993; 1999; 2008), Lucariello (1985), and McCune and Vihman (2001), they began to be learned in the absence of their referents, in the transition to arbitrary terms of reference. The meanings of his early words from the social/action games and routines category were later extended to other categories, as the words became less restricted to their original context (Dromi, 1993). The meanings of the more complex relational action words, however, remained more tied to a situation, in the fashion described for TD children by McCune and Vihman (2001). Symbolic representation increased as decontextualisation continued. As Graeme began gradually to gain an understanding of categorical words, he was developing the underlying principles for representing relations or sets of referents in his lexicon in comprehension, as Barrett described for the production of TD children (Barrett, 1999).

At this time, the meanings of existing words were refined and extended, new related words were added to existing semantic categories, new categories of semantically related words emerged, the category membership of early words changed, and distinctions were made within semantic classes. This has been described in relation to TD children’s productive word development by Dromi (1993; 1999; 2008), and Lucariello (1987). As Graeme’s words became categorical and included many exemplars, around 03.00, he demonstrated his development toward the concept that words symbolise object categories. Such a milestone is described by Cohen and Brunt (2009) as a fundamental language-related behaviour, which in TD children is acquired by around 02.00.

At 03.00.07, Graeme found a way to isolate a colour in order to elicit a colour name, demonstrating a further refinement in his representational and categorisation skills, with his realisation that every object had a colour attribute and every colour had a name. Graeme employed the strategy of interactive picture naming to map the meanings of
words in his comprehension lexicon by determining their referents, semantic categories, range, consistency, intensions and extensions, as shown in TD children in research by Anglin (1970; 1978), Clark (2003) and Dromi (1993). He acquired synonyms (for animals and their sounds), a few generic words, and made fine distinctions of meaning based on category, shape, flexibility, and colour. Two categories, colour words and words for animals and their sounds, generated the most name question inquiries, and comprised one quarter of his lexicon at the end of the word spurt in comprehension. True to his preference for non-speech sounds, Graeme was most strongly attracted to wild, onomatopoeic animal sounds, as described by Rhodes (1995) for TD children.

As Graeme established reference, determined semantic category, and the basis for object-label extension, his semantic classes and word meaning were often idiosyncratic, unstable, and subject to rapid change, as noted in studies of early words in production by Dromi (1987) and Kay and Anglin (1982). Since I had noted the contexts of use for each repeated word event in the journal, the data on Graeme’s changes in word reference, category membership, and in semantic extensions were readily available. The value of such data is confirmed by researchers with studies based on naturalistic data (Dromi, 1987; Dromi, 1993; Huttenlocher & Smiley, 1987; Ingram, 1989).

Graeme’s semantic category organisation and his comprehension vocabulary were the same as those of TD children, supporting the findings of Boucher (1988) and Tager-Flusberg (1985). The exceptions were the inclusion of categories of words used by TD children with a larger vocabulary as noted in the CDI (Fenson et al., 1994): colour words, and the words that named his unusual special interests, such as tools. This supports the observation of Ungerer and Sigman (1987), that category knowledge of function, form, and colour was not impaired in the children with autism in their study.

As is the case in TD children, Graeme’s lexical maturation and cognitive development correlated as his understood words became symbolic, and began to represent sets of referents or relations with regular extensions and denotation properties, as proposed by Anglin (1970; 1978). Three factors stand out as the means for Graeme’s semantic acquisition in comprehension: first, social interaction, as he overcame the impairment of
joint attention skills in children with ASD and achieved intersubjectivity; second, exhaustive categorisation; and third, symbolic representation.

It is worth repeating that Graeme amassed all his semantic knowledge in comprehension by means of a single strategy, the name question, which consisted of just one grunt [uh] and one gesture.

Graeme’s production gains over the three months of the comprehension word spurt, between 02.10.00 and 03.00.28, included growth in babble, intentional communication, word/signs, onomatopoeic animal sounds, and phonological contrasts. Graeme extended meanings for his early word/signs and acquired the name question. Though his word/signs were all context bound, he uttered them spontaneously in reference to his picture books, animal toys and live animals, a further demonstration of his symbolic conceptual knowledge. Supraglottal consonants, which are predictive of speech, first re-occurred in Graeme’s babbling at 03.00.27 (McCune & Vihman, 2001; Stark et al., 1993; Stoel-Gammon & Cooper, 1984; Vihman et al., 1986). His production of non-meaningful sounds with unusual vocal quality, consisting of tense, high-pitched, squeaky squeals, creaky growling, whining, whooping, and yelling, was typical of preschool children with ASD (Sheinkopf et al., 2000). Graeme’s intentional communications further increased in specificity, in fluency, and in the variety of their pragmatic functions. He began to comment on actions, using pointing, or, like some hearing and deaf babies, using mimetic and invented gestures (Abrahamsen, 2000; G. Morgan, 2006).

The social-cognitive developments that seemed to have the greatest bearing on Graeme’s rapid word learning in comprehension, his semantic reorganisation, and his developments in production of babble, intentional communication, and early word/signs were: the naming insight; the intersubjectivity and triadic gaze shifting of the name question; symbolic representation; and exhaustive categorisation.
Graeme’s lexical acquisition compared with that of TD children

By the end of the three-month period of rapid lexical acquisition in comprehension from which the data were collected, Graeme had achieved the transition to learning words spontaneously in comprehension. At this point, his lexical acquisition in comprehension, although initially delayed, had, since its onset, been acquired at the same rate as TD children. In other words, he had overcome the language delay in comprehension characteristic of children with ASD, after he had gained the social-cognitive prerequisites for word learning. Graeme’s lexical development followed basically the same sequence as that of TD children, and his semantic organisation and pragmatic functions were the same as TD children at this stage in his lexical acquisition. It is interesting to question whether TD children develop comprehension in the same increments of acquisition as Graeme did, and, if so, whether their comprehension is too fleeting a process to observe.

Graeme’s differences in lexical acquisition in comprehension included his initial aversion to being addressed, his delayed onset, his use of picture books instead of first order representations in acquiring his lexicon in comprehension, and some anomalous words that reflected his fascination with colour and his advanced physical abilities (as an older child). Atypical lexical behaviours in production consisted of his delayed onset, avoidance of speech sounds in his productions, preference for onomatopoeic animal sounds, and use of signs. His categorisation skills appeared relatively early compared to his language skills, while his joint attention abilities were very delayed. Like many children with ASD, his social relating behaviour was impaired, and he was uncomfortable with transitions and changes in routine, which resulted in his developing unusual forms of greeting.

The findings provide evidence that Graeme’s social-cognitive developmental milestones relate to his most important achievements and transitions in lexical acquisition in both comprehension and production: the onset of comprehension, the increase in babble and intentional communication, the beginnings of early word/sign acquisition, the transition to the word spurt in comprehension, the acquisition of the signed and grunted name question, the semantic reorganisation during the comprehension word spurt, the
acquisition of onomatopoeic animal words, and, the end point in this study, learning
words spontaneously in comprehension. Graeme’s lexical acquisition was intrinsically
linked to, and emerged contemporaneously with his social/cognitive development.

Models of language acquisition supported by the findings

The first application of the various theoretical models discussed in Chapter 2 is to
determine which theoretical model is best supported by the findings for this case study on
Graeme’s lexical acquisition. Because developmental models incorporate the streams of
social, cognitive, linguistic, pragmatic, and physical development, they are able to
account for the relationship among the many incremental, cumulative, dynamic
components of development that constituted and underlay Graeme’s gradual acquisition
of his lexicons in comprehension and production, over a three-year period (Akhtar, 2005;
Bates & Benigni, 1979; Clark, 2003; Dromi, 2008; Hirsh-Pasek et al., 2004; Hollich et
al., 2000; Pruden, Hirsh-Pasek, & Golinkoff, 2006). The causes and strategies propelling
the milestone achievements and transitions in Graeme’s word learning support research
from several perspectives, including: one based on cognitive developments (Dore et al.,
1976; Gopnik & Nazzi, 2003; Lifter & Bloom, 1989; Piaget, 1962); the
social/interactionist perspective; and the hybrid emergentist models of word learning, in
which social/cognitive developments correlate with lexical acquisition in both modalities
(Hirsh-Pasek et al., 2004; Hollich et al., 2000). Long-term data-based studies provide
useful comparisons with development in TD children and other children with ASD
(Benedict, 1979; Fenson et al., 1994; Nelson, 1988; Rescorla, 1984; V. Smith et al., 2007;
Tager-Flusberg et al., 2009).

Social/interactionist theories account for the learning environment of language learning;
therefore, they are a good fit with the nature of the data, collected in the social context of
day to day Graeme’s family life (Baldwin & Tomasello, 1998; L. Bloom & Tinker, 2001;
Charman, 2003; Halliday, 1975; Sabbagh & Baldwin, 2005; Tomasello, 2007; Woodward
& Needham, 2009). At the time the data were collected, joint attention abilities were not
in the forefront of language learning research, and therefore the journals did not describe
Graeme’s behaviour in those terms. His initial lack of joint attention abilities was so
marked, however, and his gradual acquisition of these skills so evident, that they were noteworthy behaviours in the diary. Because the findings show a strong relationship to joint attention abilities and to both the onset and word spurt in comprehension, research from the social/interactionist perspective provide a framework.

However, while developmental, interactionist, cognitivist, and hybrid emergentist theories were all helpful, and all shed light on the process of Graeme’s lexical acquisition, none were relevant to the totality of this longitudinal and instensive study, with its naturalistic observation of the micro increments in this large corpus. None of the current theoretical accounts provided a descriptively adequate framework for the scope of this study. The quantitative studies such as the CDI, while enormously helpful in providing comparitive data, did not provide explanatory accounts.

**Second research question**

Can the meaning and function of Graeme’s early idiosyncratic productions justify the inclusion of these in his lexicon as word/signs and how does this inclusion explicate the definition of what comprises a word in the lexical acquisition of children with autism?

The findings provided answers to both parts of this question. The findings justified a broad inclusion of early word/signs in Graeme’s productive lexicon for those gestures and utterances that were intentional, meaningful, consistent, productive, continuous, and spontaneous. In presenting the rationale for conferring word status to Graeme’s early word/signs, I propose to extend the definition of the earliest words.

**The rationale for extending the definition of early words**

The rationale for regarding these early word/signs as word acquisitions stemmed from the lack of agreement among researchers on: the terminology for early words; the definition of the earliest, non-referential words; and the distinctions between the earliest words and intentional communications, context bound words, and referential words.
Much of the research on lexical acquisition in the single word stage deals with the productive lexicon and concentrates on the defining criteria for referential, symbolic words, on which there is a fair degree of agreement. Many researchers agree that TD children usually have around 50 early words (for example, idiosyncratic, underextended, non-dictionary, forms that do not match adult words phonetically) in their productive lexicon before their transition to referential words. However, there is less agreement on what to call these early pre-symbolic non-categorical words, and how to define them. Productions that are context bound in meaning and do not extend to other exemplars are not accepted as words by all researchers (Golinkoff, 1999; Hirsh-Pasek et al., 1999). Even less universally accepted as words are onomatopoeic utterances, non-dictionary child forms, homonyms, gestures and signs by hearing children, and vocalisations that are unintelligible to researchers or made with non-speech sounds, as shown in Table 7.1. These kinds of utterances, however, are frequently interpretable to the child’s intimates, and have intentionality, pragmatic functions, and consistent shapes. While they are not accepted as real words, the earliest systematic, repeated, meaningful utterances are often informally referred to under the rubric ‘words’ (with scare quotes) by linguists in the field of child language acquisition on the CHILDES website (Crutchley, 2006; Fleck, 2009a; Nelson, 2007b; Peters, 1994).

Table 7.1 shows research in which specific opinions have been expressed (or where a definition has been offered which is broad enough to be inclusive) about the acceptability of various aspects of defining criteria for word status.
### Table 7.1  Word status criteria of aspects of early words

<table>
<thead>
<tr>
<th>Aspect of early words as a criterion for word status</th>
<th>Researchers who accept the criterion</th>
<th>Researchers who do not accept the criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Onomatopoeic</strong></td>
<td>Dromi, 1999; Fantini, 1985; McCune, 2008; Menn &amp; Bernstein Ratner, 2000; Morgenstern, 2007; Rhodes, 1995</td>
<td>M. Robb et al., 1994</td>
</tr>
<tr>
<td><strong>Idiosyncratic</strong></td>
<td>(Deuchar &amp; Quay, 1999; Dromi, 1999; Menn &amp; Bernstein Ratner, 2000)</td>
<td>(Halliday, 1975; McCune &amp; Vihman, 2001; M. Robb et al., 1994; Vihman &amp; McCune, 1994)</td>
</tr>
<tr>
<td><strong>Non-dictionary forms</strong></td>
<td>Deuchar &amp; Quay, 1999; Dromi, 1999; McCune, 2008; McCune &amp; Vihman, 2001; Menn &amp; Bernstein Ratner, 2000; M. Robb et al., 1994; Vihman &amp; McCune, 1994</td>
<td></td>
</tr>
<tr>
<td><strong>Gestures/signs by hearing children</strong></td>
<td>Acredolo &amp; Goodwyn, 1988; Casadio &amp; Caselli, 1989; Goodwyn &amp; Acredolo, 1993; Pearson, 2006; Volterra et al., 2006</td>
<td>Slobin, 2007</td>
</tr>
<tr>
<td><strong>Homonyms</strong></td>
<td></td>
<td>McCune &amp; Vihman, 2001; Vihman &amp; McCune, 1994</td>
</tr>
<tr>
<td><strong>Vocalisations that are unintelligible to non-intimates</strong></td>
<td>Dromi, 1999; Morgenstern, 2007</td>
<td>McCune &amp; Vihman, 2001; H. Tager-Flusberg et al., 2009; Vihman &amp; McCune, 1994</td>
</tr>
<tr>
<td><strong>Non-speech sounds</strong></td>
<td></td>
<td>McCune &amp; Vihman, 2001; Tager-Flusberg et al., 2009; Vihman &amp; McCune, 1994</td>
</tr>
</tbody>
</table>
Frequency (productivity) and continuity of use are the criteria for determining both a point of acquisition, and for defining a referential, context independent word, according to McCune (2008; 2009) and Vihman (1994). A referential word must have occurred a minimum of twice in a sampling session, in situations that were different enough to demonstrate generalisation. They note that consistency, however, is a relative term in the rapidly evolving forms and inherent ambiguity of meanings of early words. Graeme’s word/signs, while consistent, were context bound.

Some of the definitive studies in lexical acquisition use phonetic criteria to determine the point at which a lexical item is acquired in a corpus-based study. Vihman and McCune (2001; 1994) include context bound words if they have at least two segments of the vocal shape of the adult form. This definition excludes Graeme’s early word/signs from word status. According to the definition for language acquisition stages in children with ASD in Tager-Flusberg et al. (2009), Graeme was preverbal. Lacking their minimum requirements for first words (one CV combination or four consonants, and two referential words), his production did not meet their criteria for the first stage of lexical acquisition (Tager-Flusberg et al., 2009). Menn and Berstein Ratner (2000) have a more inclusive definition: they consider the first non-imitated, spontaneous use of a word to be sufficient evidence of its entry point into the productive lexicon, when the corpus is based on most of a child’s output, as this study is. As the section below shows, aside from the phonetic criterion, Graeme’s early word/signs met many of the criteria proposed for context bound word status for early words in TD children.

The rationale for including Graeme’s early word/signs in his productive lexicon

At onset, Graeme began to use four context bound vocalisations and gestures (knock knock, I want it/ give it to me, up, and down) meaningfully, consistently, spontaneously, and productively. They functioned as requests, comments, and as a greeting. During the slow period, he acquired an additional five word/signs. Four were signs, look, hi, round about, and this little pig, while hide and seek was an idiosyncratic vocalisation with non-

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84 The pre-verbal stage was not examined in this study.
speech sounds. Graeme physically refined his pointing skills, using pointing to comment for *look*. Several word/signs (*look, hi, round about, down, up, knock knock, and hide and seek*) extended semantically from their initial meanings of request for a specific action, object and interactive routine to include a range of actions, agents, and functions.

Graeme’s next nine words, acquired during the comprehension word spurt, also included a grunt and point for the *name question*, a headshake for *no*, a wave for *bye bye*, and a facial expression for *dog*. In addition, he acquired six wild onomatopoeic animal sound words (*dog, pig, cow, horse, bear, cat*) that contained squeaking and growling rather than speech sounds, and which functioned as comments. In lieu of differentiating speech sounds, Graeme used non-English contrasts of pitch and intonation with his grunts, growls, and squeaks for meaningful phonological contrasts. He extended the meanings, form, and function of his earlier productive lexicon.

These 19 lexical acquisitions fulfilled the criteria I set for the earliest word/signs in his productive lexicon. Their qualifications for lexical status were:

1. Graeme used these signs and vocalisations spontaneously.
2. He used them consistently in both meaning and form.
3. He used them frequently.
4. He used them in different situations.
5. He used them frequently for different pragmatic functions.
6. Their forms differed in specificity from the general intentional communications he had used previously.
7. He extended their initial limited situational meanings and functions, to multiple examplars, for both meanings and functions.
8. There were no inappropriate uses.
9. Graeme had used imitated forms prior to acquisition.
10. They had an invariant phonetic stability, and, for *up* and *down*, a prosodic match.
My criteria numbers one, two, three, and four meet the context criteria for word status in Vihman and McCune (1994) of situational consistency, multiple use in multiple episodes, and parental identification. My criteria numbers seven, eight, and nine satisfy part of Vihman and McCune’s criteria for vocal shape and relation to other vocalisations, but not their criteria for resembling adult forms phonetically in at least two segments. Because Graeme’s word/signs were context bound, they could not meet Hirsh-Pacek and Golinkoff’s criteria for early words, although they did extend to multiple exemplars (Golinkoff, 1999; Hirsh-Pasek et al., 1999).

My argument, given the lack of agreement on a definition of what qualifies the earliest meaningful productions for word status, and on what determines their point of entry into the productive lexicons, is that Graeme’s early word/signs qualify for word status, in the entry level of the productive lexicon in his single word stage. In other words, his word/signs production identified him as a verbal child.

**Extending the definition for word as it applies to atypical lexical acquisition**

The argument above, for a broader definition of the earliest word/signs, is possibly applicable to all children acquiring their early production, TD infants and those on the autism spectrum alike. The case for a broader definition for word/signs acquisitions in production is stronger for children with atypical language acquisition, whether nonverbal or language delayed. The earliest productions of gestures, vocalisations, and onomatopoeic forms, while meaningful, are not considered by most researchers to be real words. For children with atypical language development, however, these may be all the words they have for a lengthy period of time. There is no guarantee that children with ASD will acquire all aspects of conventional words with appropriate usage, or, indeed, acquire all the aspects of language as a coherent whole. For children with ASD who have language delay, though their lexical acquisition may eventually commence, their initiation of spontaneous communications is very infrequent (Landry & Loveland, 1988; Stone & Caro-Martinez, 1990; Wetherby & Prutting, 1984). My argument, therefore, is that the early productions of children with ASD have a greater significance than the early productions of TD children, which justifies stretching the definition of early words to
include all meaningful, productive, intentional, consistent, continuous, and spontaneous productions. Though the first meaningful word/signs of children with ASD may be unintelligible to most, the broader definition of words and the qualification for word status should apply, whether or not the early productions meet the phonetic criterion or referential status required for the early words for TD children. An additional argument is that Graeme’s early word/signs were significant in their indication of his potential for language acquisition. Their predictive value was supported by Graeme’s later lexical acquisition in production, although this lies beyond the scope of this study.

Another rationale for regarding very early productions as words in the lexicon of a child with autism comes from a personal communication with Dr. Brian MacWhinney, Professor of Psychology, Carnegie Mellon University. Referring to the cognitive theory of Just (2007), who suggests that integration between normally developing individual brain regions is incomplete in autism, resulting in slow communication between these regions, MacWhinney (personal communication, September 20, 2006) wrote,

In the case of your son, this could mean that the phonological components of words are advancing without full input from the auditory forms of adults. In addition, words are not being fully constrained by their role in communicative interactions. In a sense, it is as if the child is providing his own "definitions" and forms on the phonological, semantic, and functional levels without trying to integrate those definitions with other aspects of the input. In this view, they are indeed words, but words as filtered through the nature of processing in autism.

Such an interpretation fits with the difficulty children with autism have with the recognition of the conventionality and social life of signs (Vygotsky, 1962).

With this consideration, in addition to the arguments stated above, Graeme’s early word/signs are considered to be part of a single productive lexicon, including the words he later acquired.

Data on Graeme’s earliest productive lexicon were collected daily over an unusually long period of time, creating an unusually complete corpus, which contained the full
acquisition history of the word events, as well as the linguistic and situational context of each entry of use. The analyses of these data were based on the history of the word event: each instance of its imitated and spontaneous use; the function of each entry; its continuity and frequency of use; and any semantic generalisation to other examplars. This level of fine grained detail justified some confidence for a decision on the word/sign status for each word event, and for its point of entry (AoA) into the productive lexicon. This data set differs not only in scope, over time and in its level of detail, but also because it offers information on the process of acquisition within language delay and ASD, with a concentration on comprehension and the earliest impressions of lexical emergence. For these reasons, this dissertation can offer a rationale for extending the definition of early words in the acquisition of lexical production.

Other Findings

Although not originally a research question in this dissertation, an observation on the applicability of research in aspects of production acquisition to comprehension acquisition emerged in the course of investigating Graeme’s lexical acquisition. Researchers have frequently related the development of the naming insight (Dore, 1985), exhaustive categorisation (Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Gopnik & Nazzi, 2003; Mervis & Bertrand, 1994), and symbolic representation (Blanc et al., 2002; Lifter & Bloom, 1989; McCune & Zanes, 2001; Piaget, 1962) to lexical production, and, in particular, to the word spurt and to the transition from early words to referential words. My findings, however, also situate them in Graeme’s acquisition of comprehension. Researchers have noted that many of the semantic categories and the frequently acquired first 50 words in the production lexicon also apply to the comprehension lexicon (Benedict, 1979; Fenson et al., 1994). I suggest that, in addition, semantic development commonly ascribed to lexical production, such as the transition to reference (Dromi, 1999; Golinkoff et al., 2000; Lucariello, 1987; McCune & Vihman, 2001); the transition to context independence (Bates & Benigni, 1979; Vihman & McCune, 1994; Vygotsky, 1962); the development of lexical classes (Barrett, 1999); and the addition of semantic categories (Dromi, 1987; Dromi, 1999), may also apply to the
lexicon in comprehension, as supported by the evidence from the findings on Graeme’s acquisition.

When Graeme acquired the grunt component for the *name question*, in 02.11, he became able to gain attention with vocalisation, which triggered his very rapid acquisition in lexical comprehension. McCune (1996) and Vihman (2001) noted that the pragmatic function of gaining attention with vocalisation co-occurs with development to referential word use in production. In Graeme’s case, this co-occurred with referential word acquisition in comprehension as well.

**Limitations of the study**

The limitations of the study are primarily methodological. The findings from a case study of one child have inherent limitations in their generality. When the diarist is also the subject's parent, he or she is also liable to observational subjectivity, posing a threat to reliability of observation. The lack of quantifiable, scientifically measurable detail is an unavoidable deficiency (Braunwald, 1979). In terms of lexical acquisition studies, a diary study, especially in the case of a closely scrutinised language-delayed child like Graeme, can be disproportionately sensitive to the child’s most advanced emergent language. Subjectivity can occur in both the selection of data in collection, and in analysis.

Gaps in the data occur because naturalistic data collected in the home environment cannot record the naturalistic data generated in the other environments of Graeme’s life, even with the addition of vocabulary check lists and reports from preschool, therapists, babysitters, and grandparents. While the WE list for the 3-year period under study is a large database of nearly 1200 entries for the acquisition of 230 word events in both lexicons, the corpus is necessarily incomplete. It was impossible to determine all the words Graeme understood or their precise date of entry into his lexicons, especially after the onset of the word spurt in comprehension. Imprecision in the form of data inaccuracies and possible missing entries in word events occurred because the data were collected from several sources. Other than me, these sources were not trained in linguistic
observation and collection. All of these considerations posed some degree of challenge to the validity of data collected for this study.

The data collection method of audio taping modified Graeme’s language behaviour, because he was fascinated by the machine with its spinning tape cassette and buttons, which greatly interfered with collecting audio versions of his vocabulary acquisitions. It is impossible that, in the close observation of Graeme’s word learning, he was not influenced in some way. Indeed, influence on greater word acquisition was a goal.

**Implications of the findings for further research**

To date, lexical acquisition in infants and toddlers with ASD has not been extensively researched, particularly at the onset of their lexicons in comprehension and production (Gernsbacher, Dawson, & Goldsmith, 2005). Still fewer studies focus on comprehension. In the existing studies, most comparison research has been done with children above 03.00, in the more highly verbal range, who are able to perform on standardised tests (Tager-Flusberg et al., 2009). There is, therefore, a need for studies using natural language samples for children with ASD at the start of their lexical acquisition (Perkins, Dobbinson, Boucher, Bol, & Bloom, 2006). A need has also been identified for longitudinal data-based studies of the earliest lexical acquisition in the modes of comprehension and production (Bailey, 2005), and, in particular, for a fine-grained analysis of the early lexical production in this population. While one case study can provide insight, other case studies, whether narrowly focused on individuals, or studies of larger populations, as well as cross-sectional samples are required for validation, comparison, and to broaden the scope and provide a wider data set. It would, for example, be of interest to compare Graeme’s data to that of the First Words Website, at http://firstwords.fsu.edu/validation.html.

More specifically, this study followed Graeme’s comprehension to a logical end point, where he had begun to learn spontaneously, and too quickly for his comprehension to be tracked. At this point, the focus in the diary, which was continued for another 18 months, turned to Graeme’s advancing production. This productive lexicon has been fully
analysed, and demonstrates unusual features of word acquisition. A study of Graeme’s entire lexical acquisition in the single word stage and in his early word/sign combinations would complete the narrative arc of this unique case study of a child with language delay and ASD. Such a study would verify the predictive value of his earlier acquisition and support other prognostic research. A complementary follow-up would offer a refinement of my major claims by addressing the residual questions of my work through the extension of the corpus, and cross validate the view on the dynamics of the research questions. Like Dromi (2008), I also attempt to show that a rich child language database can be used over many years for testing competing theoretical accounts. My intention has been to demonstrate the value of investing that extraordinary effort into collecting a complete data set and of analysing it at various levels of specificity.
Afterword

Afterward!

My name is Graeme Gibson; I decided to assist my mother in her PHD as a means to have my own voice heard in the main project. Also to add, since the PHD is about my language developments or lack thereof in my childhood. I felt a strong desire to have a say in the direction of this project and to whom this project will be used by. I hope that those who read the PHD will come to know that autism is different person to person, case to case basis. Some themes of behavior maybe the same, but when it comes to us as persons. It is best to treat us individually and not under some labels or boxes to classify us under. We are humans and we are a demographic with in human society.

I hope this project falls into the right hands of those who have a genuine interest in learning about us as humans and not as research projects. Certainly PHDs, academia do help to understand the inner-workings about autism. The best way to know us is to deal with us.

My own areas of expertise focus primarily on “ethnic music” or music from all over the world. I fell in love with traditional or experimental forms of world music some 14 years ago. Being introduced to Randy Raine Reusch and my teacher Rene. Both teachers are great instructors and also friends of mine. Personally I’m sick and tired mainstream pop-music. Be it over the radio or on TV it all sounds the same and lacks emotion and depth and its generated for profits rather than substance in music, that is my own critique on the subject. I enjoy building things in electronics and also wood work and metal work as my non-musical projects.

Upon my introduction to the concept of work and work experience or “volunteering”. After returning from Douglas College, studying in a course focusing on electronics-assembly. I decided to return back to the Museum of Vancouver. In total I have been working there since the year 2001. I started volunteering from December 2001 to today 2010, that is a long time. I’m very proud of this record and I plan on keeping it. I chose
database entry because of my interest in working with computers and history in general. I really don’t like working with too much people. Through my time in college I learnt I really despise customer-service and day-care related positions (I’m glad I did not sign up for day-care).

Although I enjoy living within my community I do have my difficulties too; I don’t deal too well with loud parties close by or within my apartment. However I’m thankful to have good neighbors for the most part and a great apartment-manager for when these situations arise.

I don’t really have much plans for the future, although I do plan on travelling (if time and finance) allow me to do so. I will continue on with my music and projects. My family and friends are important in my life. I don’t have large circle of friends but I prefer it that way though. I’m one who likes to know those people person, to person and get to know them and let them get to know me. I enjoy visiting my aunt and her partner Steven on Salt Spring island and other relatives. And I enjoy going to my parents cabin on Saturna island.
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Appendix A  Original Data Sources

Samples of the original data sources

This Appendix contains a sampling of the data sources. It includes the complete entries from the daily diary for the journal excerpts chosen for Chapters 5 and 6 from each period of Graeme’s lexical acquisition. Also included are an assessment from Berwick preschool, and a tape transcript, both of which were done on the date of one of the diary entries.

Journal Entries

The 13 journal selections below are from a total of 220 during the seven-month period of the diary collection, between 02.05.27 and 03.01.30. The tape selection is one of 37 made in this time period. The assessment is one of seven from preschool reports and medical diagnoses.

<table>
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<th>Graeme’s age</th>
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<th>Period</th>
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<tr>
<td>02.06.05</td>
<td>Journal entry</td>
<td>Onset</td>
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<td>02.06.12</td>
<td>Journal entry</td>
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<td>02.07.11</td>
<td>Journal entry</td>
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<td>03.00.11</td>
<td>Journal entry, tape transcript</td>
<td>Comprehension word spurt</td>
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Journal entry at the end of the prelinguistic period

02.05.28

G went to Kim's to play with M (5) and A (1.6) with F on the bus. Cried at preschool when F85 came to pick him up--realised F’s arrival meant leaving his new delight--crayons. F bought him some today. He grasps one in his fist and bangs it on the paper to create dots. When shown hand-on-hand he moved the crayons back and forth to make lines and circles. He puts all the crayons at the same level, same end up, in one hand, as he’s been doing with all pen-like objects since 02.04. Lines up crayons side by side and gets the tops even. Hunkers down beside coffee table to gaze at the crayon line-up at eye-level, whispering his pleasure sounds [uwau], or "creaking". Occasionally says [waːu waː], [aːŋː] is a sound he makes when he discovers something, e.g. some tidying up to be done in the crayon line-up. All these sounds are non-communicative expressions, in solitary play. Runs a few steps back and stamps his feet happily, then runs back to the line-up. He put crayons against different surfaces e.g. the wall, the fireplace.

He took the crayons into his place behind the bedroom door to peel the paper off them. Brought them back and lined them up end to end along the coffee table. Protested shrilly when I took 2 crayons from line-up, laughed when I held one in each hand and drew parallel lines. He changed the line-up to a more complex pattern: point to point, end to end, point to point, end to end. Put 2 crayons on the rug and ran in circles around them for several minutes, calling [aaayuh] at a very high pitch, which seemed to express delight and possession.

Initiated [aː\] and looked at me. I said "down," G signed down with the crayon and said [aː\].

Journal entries at the onset of lexical acquisition

02.06.05

*Graeme looks up anxiously when he hears bye bye, a new word he understands. He doesn't wave or vocalise except with tears. He’s more saddened by F leaving than by me. Today he tried to pull me to follow F, then escaped through a crack in the old garage to follow him down the lane. He’s very happy to see F return with a paper bag, recognises that it's a food treat.

*At home he ate about 10 pieces of double-salted liquorice!

On our walks he prefers the sidewalk to grass. He tries to turn back onto the sidewalk but will trot along the grass once started. Doesn't run across the open fields as he loved to do last summer--maybe the rubber boots? Played with me on the monkey bars, but was very fearful when held on my lap on the swing, clung on and buried his head in my jacket--no sounds. He likes the wooden footbridge, leans through the railings to look at

---

85 F is Graeme’s father
the puddles in the streambed. Also stood under a 60 foot tall evergreen and looked up through the branches and smiled. He doesn't usually look up, except at aeroplanes. I'm reiterating these words: up especially for picking him up, sock and shoe when putting them on, aeroplane, Daddy (when F is heard), run when he's running, come on and come here, and bye bye.

On the beach he sat down and immediately trickled the sand through one hand. He found a stick and put sand on the point and tasted it a few times speculatively—didn't gorge on it like 6 months ago. He's Mr. Picky with his food but will eat sand, ink, double-salted liquorice, and any medicine! He likes to sit down any place with small stones or gravel, pick up a handful and throw it down. After 10 minutes of sand play, he got up and ran to within a yard of the water, to stand and look at the incoming waves, then ran and clung to me when I joined him, scared of the larger waves. He watched me throw stones in the water but didn't imitate. I ate a bit of seaweed but when I offered it to him he buried his head in my lap, then pushed my hand away. I accidentally dropped the seaweed on his boot and with an expression of distaste and a sound of protest he knocked it off with the stick in his hand. *The first time he's used a stick in that way, as a tool. He distinguishes shells and other debris from the stones on the beach.

When he was tired walking home he whined and clung to my legs, stepping on my feet to be picked up. He gives a little bounce of pleasure when he's picked up and hugs very tightly around my neck, but if he doesn't want to be carried he struggles and arches, kicking. When tired he objects to his lead, pulling on it and puts his head on the sidewalk, bum up, to cry. He doesn't climb, but *today he put his foot up on the gate cross bar to try and follow F. He's very interested in gate hinges now. He sits on the sidewalk to investigate odd patches, still loves tiny imperfections but not as constant an activity.

More lining up and playing with spice bottles on the counter—I don't like this: it's wasteful and messy, though he shakes the spices out rather than pours. It's dangerous—he's gotten knives out of the sink. He loves it though. *After a demonstration, he poured a raisin from a box. First tried to pick it out, then tilted the box.

He watches other children now—stands near and stares—no smiles, vocalisation or approaches.

02.06.09

Since 2.4, especially in the last few weeks, Graeme has been learning and syndissertationing in a lot of simultaneous and cumulative ways—e.g. communicating, with sounds, gestures, looks, and touch; watching an object or activity with careful interest and curiosity, learning from it. He's more at ease socially, with strange people, and places. He's engaging people he knows more frequently in communication, games, cuddles and affection. He holds tightly when being held, pulls down for a hug and asks to be picked up. Since 2.4 if we're at his eye level and he's in the mood, he'll put his face about an inch away—eyes open, or touch noses. It's his kiss. He still waits for us to come to him usually when he's crying.

His crying is finely differentiated in terms of duration, pitch, volume, onset, tears, and breathing. Some examples:
-phony cry--frustration, temper, rage, manipulative intent, but not very successful in results. Immediate onset, choleric (“plethoric”) face, hands up to eyes, big loud furious /w√→/, looks at us around hands out of the corner of one angry eye. Sinks to floor--bum first, then rolls over to put his face down on the floor, still looking out of his eye, then gets very sorry for himself and sobs. Usually of short duration with no tears. Depending on how much he wants what he is being denied, stops after first /wa/. If picked up, he arches away, struggling to get down, hitting at our hands.

-long sad cry--This starts with agitation and a deep indrawn breath, then lots of tears and runny nose, usually running around or standing or asking to be held. Will stop if picked up, though his sobs catch in his breath for a long time, even when asleep, after this kind of crying--poor little sad man. This occurs when he's put to bed or when Daddy leaves.

-hurt cry--tears, sudden loud onset, it sounds (I can't describe how) hurt, not angry. We run to him for this one. Frequently preceded by a crash or thud--he's fallen or pulled something over. Often splits his lip and swats unhappily at the blood. Comforted by kisses and cuddles, buries in and hugs tight as in sad cry. * This week he's started holding or touching the part of his body he's hurt.

-scared cry, whining, cranky, and tired cry--These can be combined.

He went to B’s 2nd birthday party--this is the second time in a few months that G's been to the T’s for a big party, with cakes, candles, paper blowers, lots of adults and 10 kids from 9 years to babies. Overwhelming (for all concerned). Last time G didn't leave the doorknobs and cried a lot. This time he wandered around, a few doorknobs, especially those of the French glass door--perfect, the crystal knob came off! J (1 1/2) and L (4) played with him occasionally, opening and shutting the door, looking through the glass door at each other. G's still beloved Beethoven top is broken; at the party he found a working top, and carried it around to various places to spin it. When B took it he did angry cry, as when L took back her cake and ice cream. He didn't try to get the things back, didn't try to get adults to intervene, save by crying. When spinning the top, he lies right down flat on his tummy with his face turned to it. Doesn't like to let the handle go after pumping. G watched all the other kids, didn't approach them until B took the top a second time and put it on the coffee table in front of him--he and G stood at right angles. Then G moved to stand beside B, the better to see the top. My eye has been sharpened by writing this journal--I can read G's thoughts more acutely--his motives, desires, analyses, logic, fears, interests, and feelings. I guess the attention to detail has improved my comprehension of his communication devices. He only cried a few times though he stayed up till 10:30 and he'd got up at 6:30 with poor Daddy. Then he was miserable--exhausted, overwhelmed, and with a painful inflamed diaper rash. Changed, with a bottle, he and I lay down on A and G's room-sized bed and he was asleep in 2 minutes. He would NEVER have gone to sleep, however tired, in a bedroom (especially a strange one) before his bedtime initiation (almost a month ago). Now he's in bed by 8 instead of midnight, a regular routine of bath, dinner and play. Was afraid of the balloons at the party. Went to C for cuddles. Except right at first, spent the first few hours away from F and I for the most part. Used the spoon 2 or 3 times for ice cream.

G usually sits at the table with something to drink and some of our food to muck on the table. Gets up and stands or sits on the top of the seat back so we'll say "down"--a game if he's not hungry. Until 2.4 he insisted on sitting in F's lap for his dinner and during ours.

Two days of lining the spice bottles on the living room floor. Played outside a lot in the backyard this nice sunny day. Used shovel in dirt.
02.06.12

* A big exciting first today: he waved *bye bye* (no sound) to F! When we leave by the front door, he scrambles onto the window seat to look out of the window to watch us go down the porch stairs. F, L, Grandma, me, and others have been waving to him and calling *bye bye* for a while. I've been waving his hand with mine—today he did it on his own. F jumped up and down on the stairs and I rushed over and hugged the sweet boy and we praised him. He didn't repeat it but he knew something was good and he didn't cry when F left. Then 6 hours later when I left for ballet he waved to me, after F waved Graeme's hand first. * When we say *bye-bye* he turns to look now with an apprehensive expression. * Another new word receptively, *Lenny!* Our sweet 12 yr old white cat was on the couch, being tormented by Gray for about 20 minutes. Graeme was biting and sucking his tail tip, pulling his tail, pounding him, touching his nose, and laying his head on Lenny's stomach, finally sticking his tinker toys in Lenny's bum, whereupon Lenny, easy-going to the point of sloth, chose his moment and sneaked out without Gray's noticing. Graeme had returned to his minute examination from all directions, angles and distances, of the elaborate tinker-toy construction he and F put together—a major play activity in the past 2-3 weeks. Then I said, *Lenny! Where's Lenny?* (special cat talk intonation) and Gray turned and looked at where Lenny had been on the couch. He looked surprised and looked around for Lenny! So he understands *Lenny* now and maybe *Daddy*. I can't tell if he hears F coming or if he's responding to *Daddy*.

Graeme picked up the cup again today to ask for milk and mimed drinking—the onset of symbolic representation. When we get the carton from the fridge he flaps one or both hands rapidly—a kind of nod of the hand, definitely an affirmative gesture.

He seemed rather vaguely to look at where I was pointing—to Lenny, to a banana—looks more at me, as I'm naming, paying attention to speech.

Doesn't imitate hand clapping.

Red dot revisited: I put him in front of the floor-length mirror and he flapped his hand at his image. I have to knock on the glass to get him to look at first or to get him to keep looking. Then I put a red dot on his nose—he wanted to grab the lipstick all the time. When he looked at himself again he smiled tentatively and shook his head. He left the room after Lenny, returned a few minutes later and went straight to the mirror rather than touching his nose, he touched his nose to the mirror! When I put the dot on my nose he smiled in the mirror but immediately turned back to face me—touched my nose. He touches everyone's nose now. A kissing variant maybe, but it started after the first red dot occasion. I always touch his, saying Graeme's nose.

He used to go straight to my bangles when I came home from work, and he'd put my hand on them so I'd take them off and he could hang them off doorknobs and twirl them on his fingers for long periods. Sometimes he'd just twirl his fingers, but all this has been tapering off the last few weeks since he's had his own set of 7 bangles. Today he got me to take off my bracelet and ran with it to the tinker toy construction to put it on that—from ritualistic to creative!

He's getting lots of loud 'no's' for pouring water on the floor from a cup after he's drunk most of it, or in the bath, or while doing the dishes. Loves those new pouring skills.

He took me to the door by pulling my hand to ask to go out. We went for a long walk in the chilly rain today, Graeme a B.C. boy in his Cowichan sweater, rubbers, and a woolly
tam. His hair curls up, his nose and cheeks get red, and he is so beautiful. We went to our favourite Tatlow Park, stopping at many car door locks on the way, and with lots of naughty playful running in the opposite direction. At the park, he always runs straight to the horrible musty, wet, old concrete ladies toilet, having for my boy a door knobs and house-type security appeal. He looked with interest at the jungle gym and watched briefly as I climbed up, ran for the Ladies as soon as I was on top. Afraid of swinging again--played a while with the swing, pushing it.

At the beach the tide was way out so he didn't get to the water, as the inter-tidal zone is a mud flat--muck, barnacles and slippery seaweed-covered rocks. Yet he didn't hesitate too long to get onto this surface and walked quite sure-footedly but wanted to be carried after a while. This time without me modelling he picked up stones, carried them to the edge of the mud flat and pitched them about 2-3 feet forward at the puddles*. I had modelled throwing stones at the beach for him a week ago. Stares, turns and looks after people who greet him on the street as they pass, rather than ignoring them.

Played with but wouldn't eat spaghetti.

Journal entries in the period of slow word learning in comprehension

02.07.11
Gray hasn't been interested in the kitchen sink, pulling up a chair and ‘helping’ F do dishes for more than a week, not since he got well. The spice jars have been forgotten since then too, thank God.

It's quite relentless how Gray goes through trying periods of interest (passionate obsession) with our things, behaviour which causes us a lot of time and work in putting things out of reach, tidying, and repairing. Yesterday he stripped another huge amount of the old and painted-over wallpaper in his bedroom. * He'd closed the door, whether to get at it better or to hide what he was up to, I don't know. F had to strip the rest of the wall today before repainting and Gray was with him every step of the way, pulling it off, stepping on F’s feet, breaking up and mashing the torn-off paper, imitating with the scrapers. He (Gray, not F) was in gales of laughter the whole time.

* He laughs all the time since he's been feeling good again--he has a few different laughs: a giggle, a teasing interaction laugh (when he's running away), a big belly-laugh when he's been tickled, a solitary amusement chuckle (toys), and merry squeals of delight for teasing Lenny, digging up my plants, and wallpaper destruction.

* He's very alert, curious and friendly to a lot of people these days--held up his arms to D. I. last night, whom he hadn't seen in a couple of weeks. Then he acted a little shy in D's arms and reached over to me.

I wrote some "Recent Development highlights" for R at the preschool. He's going back after the two-week break tomorrow. A conference is coming up soon.

I spoke with Dr. X--VGH, EIA psych ward today to try and arrange neurological testing so Gray wouldn't have to spend three weeks in VGH next May--what could they tell us? An EEG, physiotherapy and school assessment (he's too young anyway Dr. X says) and psychiatric observation--well, I know his behaviour and why he behaves that way and it's not pathology. He behaves like a 1 1/2 year old, who doesn't have language. Talked to Dr. XX as well--both said to talk to Dr. XXX (of course, that's who I want to talk to) but she's off this week. However, they reassured me that time wasn't crucial. I'd like to get
their info. when it wasn't redundant and when it's a better time for Gray. He would be unhappy, and upset in his routines, and we can't explain to him.

02.07.12

I went back to work today--Graeme and F asleep at 8 when I left, on Graeme's mattress in his room. F frequently lies stretched out with the blanket completely covering his head, looking like a 7' mummy while Gray lies parallel, with his head at F's hips and his feet at F's head. It's odd.

* Today he did something amazing and new--instead of using his touch to lead us to what he wants, he used it to push me away. When he has a 1/2 cup of juice or milk he drinks most of it nicely, then starts to slobber and muck with it, waving the cup to make it slop over, smearing the spills with his hand, then emptying the last bit on the floor and puddling in it--happy laughs the while. Naturally, we discourage this. Today when I gave Gray his juice he ran in the living room with it. I followed him, which he heard, and he knew why--it was to stop him from pouring it on the rug. He put the cup down on the floor, ran back to me, and pushed me vigorously on the legs, to stop me and send me back. He was protesting--little sounds. I stayed where I was and he went back to the cup and drank it, not all, then ignored it. He was watching me and he knew the consequences of pouring it on the rug: "No!" and a hand smack. F said he did this (pushing F away) a couple of times just before he got sick (2 weeks ago).

* Later, he was standing on a box to look out the window and play with a tinker toy on the windowsill. He got off to get something and I went over to the box and put my foot on it (in order to do something, not to deliberately irritate Gray). He came right back and pushed my leg off the box. More gestural communication.

F, with Gray on the back of his bike, and me blissfully alone on my bike, went shopping--in and out of 10 stores and all the way to Arbutus. Gray was smiling; he kicked his shoes off and held onto the bar. He looks very professional in his helmet. He also put his fingers under F's bum on the seat. * In Produce City, he behaved naughtily in the cart seat; up until now he's sat nicely facing us. Today he was reaching for all the produce, throwing it on the floor and in our "baskart" and turning around to fool with the things in our cart. A good sign (but trying!)--he's much more alert to his surroundings.

Lately, he's been just as happy to put things in a container as to empty it. He put endive (from F's dinner salad) into his blueberry yogurt and fed it to poor Daddy. He feeds us so fast we don't have time to chew.

* Another first, he got a piece of paper, 2 pens from the pen drawer and scribbled. The first time he's put the implements/ ingredients together himself.

Had a few pieces of pepperoni and beef jerky sticks and 2 lamb bones (refuses chicken bones) at dinner. Refused a strawberry, but very cautiously took a minute amount of Tartare cream cheese off my finger with his finger and tasted it. He makes such a disgusted, apprehensive face at tasting food. I have six gallons of home-made apple sauce in the deep freeze--he won't touch it--not sweet enough I guess.

When I was sorting through the big pile of D's baby clothes he was interested--seemed to recognize them as his clothes and that they were new. He tried to do up and undo the clasps, made me demonstrate a few times. We dressed him in a new shirt and jeans and he seemed to know they were new--he ran around a bit and looked at his sleeves and pant legs.
02.07.15

(By F) Slept poorly; coughing; woke early, went back to bed, slept late (9:00). To H's (babysitter) at 9:30. Enjoys new bike seat. Left him quickly, as I felt guilty about it. Returned 1:00 and found him happy. I like H; she's very aware of what he's doing at a given time.

(By D) He played with tinker toy sticks, bunching them in his hand and dropping them in the crack of the window sill.

* Discovered a new pleasurable sound-making activity--turning a plastic container upside-down under the running tap to make a drumming sound. When I said brrr he did it again.

Played on the basement stairs, looking up at us, and down through the stairs into the basement.

Long game of hide and seek--he really runs and hides in good places now and laughs his head off when he's found (with eye contact).

He recognized my sister and brother-in-law when they came this evening--ran to M especially delighted, laughed, touched her nose, looked in her mouth, hugged her, sat on her lap, crawled all over her (investigating buttons, bracelets, etc.) and wanted her to pick him up all evening. He initiated lots of socialising with her--hide and seek, showing off by running in and out of the room we're in and crowing, holding things between his legs and laughing, hugs and cuddles. She gave him her wristwatch--he dangled it and * held it close to his face, over his closed eyes (while walking!) and against different surfaces (her sweater, the wall). She showed him how to hear the tick and then he vaguely held it up to his ear. He fed her at dinner. He was also all over L for loves this afternoon and slobbered all over her blouse. * (He licked her and M's cardigan.)

* I threw his bed sheet over his head--he could see through it and loved it--ran all around laughing like a little ghost with it draped over him.

More sound imitation--he looks at me when he imitates [wa wa], [yae yea], [?uo] and whispers [dae dae]. Did this yesterday for a few minutes a few times. He gets bored quickly and stops and runs away.

He has liked wine glasses with liquor in them since he was in his walker--more than 1 1/2 years--likes to put things in them, stack them, shake them, line them up, and take them away. Today L gave him her empty wine glass and * he put it on the floor and moved it across the floor by pulling the door to push it. He knows that L has desirable keys and today she gave him two bunches--he danced around and jingled them, one in each hand, then twirled around a bit till he got dizzy. Then he hung them both on a wall peg and * made a precise turning gesture (as if turning a screwdriver or key) over the peg.

02.07.16

Graeme ran around jiggling a plastic bag full of little things today--F gave it to him and he added a few treats to it.

It was the first really warm (T-shirt only) day of the year. J (next door) took Graeme, who was standing (on my fern) by the fence * with his arms up, over to play in their yard.
Gray led them to all the doorknobs, wanting the doors opened. They were fixing their bikes and he spun the pedals industriously and climbed (crawling) up and down their stairs for about an hour. Earlier N and W from upstairs were sitting out in the backyard, where he's never seen them before. He was delighted and ran over to them, stopped a few feet away and crowed with laughter, bending over to put his closed hands between his thighs. He knows them, and crawled all over them, then found their sweatshirts and dragged them around by their drawstrings. He loves a drawstring or tassel or dangling strap end. N rescued his sweatshirt and found an old piece of cord and had a tug 'o war with Gray, then tied the cord around Gray's middle. When I undressed Gray after the cord was untied, Gray * draped it around his neck, and ran around, torn between its appeal and the patch of sun on the wall, where he was playing with his shadow. I did pincer hands in shadow and he loved it and * got his tummy next to the shadow hand so the shadow could pinch at his tum. Gray then went in his room for 20 minutes then came out dragging the cord with the tinker toy rounds threaded on it. He'd recognized it as his threading cord we lost in the garden a week or 2 ago. He showed us, then went back to thread more and came out and * twirled around so the cord would whirl. He takes all the rounds off to have the pleasure (and occasional frustration) of re-threading them.

He's getting naughtier--quite wilful about doing things he knows will elicit a loud No! or even when it will cause us to take away what he's playing with. Today he broke branches and pulled leaves off my plants as I was potting them on and watering. He's getting very persistent about the plants, often digs up the dirt and throws it on the floor. He knew today that even approaching a plant would bring a No and that actually touching them would mean being taken into his bedroom and locked in for three minutes, which he hates, especially when he's outside. (We haven't shut him in his room for ages--not since the fireplace episode last fall and the stamp drawer incident at Christmas.) But still he persists, looking at me; sometimes speculatively and sometimes mischievously, and sometimes even laughing aloud--little brat. He's testing me to find out the limits. (Figure 5.11)

He verbalises a lot for requests now [?uh ?uh ?uh] and babbled [wa wa] and [di dyi], [dae dae dae] today a few times, with us and playing by himself. Still attracted to the meter outside--not interested in being in the garage anymore. He likes to be held up to shake the clothesline.

02.08.13

I always have lots to write on Sunday as I have the whole day with Gray, except the first few hours in the morning, when F kindly gets up with him.

*Yesterday he started a new variation on threading and continued it today. He got his threading cord and his rawhide and wound them around drawer handles and around the latch circle. I don't think he can undo them.

Further developments in the round about, round about, went a wee mouse; up a bit, up a bit into wee house tickle game. When I say the first line he looks at my lips and he doubles over laughing on the second line. His hand is held in mine, palm up, and I circle his palm for the first line, run my fingers up his arm for the second line into wee armpit for a tickle. *When he wanted more this afternoon, he stuck his hand in mine, palm down
and pulled my other finger. Tonight as we played he was trying to co-ordinate his palm up. I wouldn't start until he tried, and he circled my palm with his finger and also his own palm but knew it wasn't what he wanted, he just couldn't figure out how to turn his palm over and put my finger on it. When I say the first line he looks at my lips and he doubles over laughing on the second.

He imitated [di di di] and [yae yae yae] today and babbled a lot in post-bottle bedtime. *He was practicing panting with deep forced-out exhalations [h► h► h►] and [i► i►].

He's very confident about the house and yard, and if the back gates open he won't run into the lane, just stays with the compost box handle.

He played naked today because he got soaked through twice playing with the hose when it was running and had a diaper rash from a wet poo. He was playing with the running hose, he doesn't hold it as I usually, he has both hands in the same direction. He drenched himself and couldn't figure out how to get out of the way of the icy hose water. He holds it with both hands in the same direction. Then he cried, felt sorry for himself.

After watching F fix up the bike he took the wrench and applied it to the bolts on the bike in the correct manner.

Poor man has a new "don't" - don't get in the garden. Since F put the fence posts and twine up around the garden bed yesterday he's been very intrigued and today was put in his bedroom 3 times. He knows he's not allowed but it's irresistible to twang the taut twine, to shake at the posts, and to slip under the fence to the forbidden side.

He put his pegs in his pool and fished them out, put them in a container with water and put them in a straight line in the peg board. We filled his pool today but he had no desire to go in. (1.10 - 1.11) Last summer he got in voluntarily only a couple of times, although sometimes he'd stay in for a while once put there.

He was kicking in the tub, I said kick kick, then he stopped, and after a bit I said kick kick again and he kicked again. This word is sort of like jump-- in context he'll do it and seem to understand but I'm not sure he does, as he doesn't start to kick (or jump usually) at my suggestion unless he's already been doing it.

He loves to stand on the deep freeze and twiddle the window latch. Tonight I had my laundry hung up there and he grabbed a sock in each hand and shook them vigorously, laughing loudly. Then I put him on the floor with the socks and panties and with some aid he got on my panties and pulled them up, and pulled up the socks and walked with tiny steps over to show Daddy.

He's so alert to F's presence - and comings and goings - he always goes to hear a word from Daddy.

J took him for a bike ride with F and bought a yogurt cone. Gray watched F lick it down almost to the cone, then F gave it to him. *It was his first, and at first he was a little dubious (it was purple) then he stuck his finger it and tasted it, then he started to lick it. Later he filled the empty cone with water and used it as a cup.

Post-bottle, he lay snuggled up beside me and touched my nose, smiling up at me.

*Then he grabbed my finger in one hand, held his bottle with the other, and bought them to touch, nipple and finger tip. He loves to line up points like that, at eye level.

He pulled his pull-train around for a few minutes. He was outside most of the day.
Lots of hide 'n seek--quite a bit outside. We decided on no more play with the pencil drawer--he's put almost all the contents down the furnace vent.

F put him to bed but had to leave before Gray was asleep, to help me out with the hibachi on the back porch. When Gray heard F go out the back door he ran, crying loudly, to the bedroom window and pulled back the curtain and blind to see if F was leaving, or staying on the porch to cook. * He realized that this means F's not gone; the porch is part of his house now maybe. I sat with him and he was asleep in two minutes.

He likes the *pointing* game--F and I point to me, F, Gray, Lennie, and say the name, Gray laughs.

He's getting the hang of the pig vehicle (see April 2) after the third try, but he gets off as soon as I stop helping him to move it.

**Journal entries from the word spurt in comprehension**

02.09.25
Another big day for Greebo.

*He put a stick through his records to make a top and * he twirled it with the fingers of one hand. * Also more cobbler's bench banging and a new treat - F found the interior of a piano - a minus-ivories keyboard with articulated parts and Graeme moved the part to make other parts move for a long while outside.

He's laughing a lot and * whooped - I've heard it before but he's doing it more now [wu wuu] in excitement.

He likes going downstairs and jumping on Nancy's bed.

We all (D, C, F, N, Graeme and I) drove to Deep Cove to M and J's in the afternoon, stopping at Mum and Dad's for a while. Gray went happily to Grandma at her house today, wanting her to hold him, and went to a few door stops, closed a few doors, and threw some rocks down the stairs - that always makes him laugh. He ran to Milton (cat) - pulled his tail and stroked and pounded him.

At M and J's (where he's only been once or twice) he was fairly relaxed, not a "portophilac" (F's word) on the doors. He cried a bit, wanting to hold F's hand and walk around, but the three cats kept him laughing, and * the croquet mallets, as tall as him, were both a joy and an anxiety. He got frustrated because he couldn't hold four at a time, and we kept exchanging them in the game. He's not interested in balls.

He didn't shake the garden sticks overly and also was only slightly interested in a patch of fresh dirt. He liked climbing on their picnic table - ignored his toys for the cats.

His great other favourite was * watching the fish in the three aquariums - spent a long time vocalising about them to C and pointing at them. * Then he turned to her and touched her fish necklace; she thought the two events were connected.

He's mostly independent - only wanting to cuddle occasionally with Daddy. Was serene in the car, sitting on F's lap. When he laughs, he often turns to look at someone to share the joke.

Didn't go around wanting everyone's glasses and dumping stuff in their drinks for a pleasant change.
I gave him a mug of water; he drank a lot, then I put it on the floor and he poked the end of the croquet mallet in it.

He responded every time to foot, lifting his foot up.

02.10.24

Graeme climbed on to the bed first thing in the morning to wake me up as usual, with a big pile of socks he’s garnered from our drawers and his. He started touching my nose etc. for labels. I said, socks - where’s the socks? and * he turned and pointed to the pile, picking it up. New word.

Home from school to the two barnyard picture books, more socks, and the photo of Grandma, which always makes him smile. The books are so fascinating to him - he studies one page for 10 minutes, or longer if we’re involved. He points to all the animals, knows doggie for sure. Tonight Graeme was obsessed with the cover of The Jolly Barnyard, spent the better part of an hour placing his index finger on the various animals, so I would name them. I took a dog, sheep, and duck from his toy box (small 3-D figurines) and placed them over their matching drawings. * He picked up and handled each one, placing his finger on it to get me to name it, then placing his finger on (usually) the right image.

*He also transferred information about the name to animal pictures of a drastically different graphic style, e.g. photos, drawings, plastic animals.

*New words: pigs, sheep, ducks/chickens maybe. It was hard to check if he knew the new words because he was so involved in touching the plastic animals, the photos, and drawings that he was too busy to point when he heard us name. We named after he pointed, and *it's now a reward to him to hear the sound of the word, eliciting the name from us.

At the beach (80 F) he was in the water but there were waves and high tide with a little shingled drop-off so he was in and out, pulling me out and down, wanting pools dug. After seeing me empty his bucket into the pool, * he tried to fight the receding tide by filling his cups in the sea and pouring them in the pool.

* Another new and horrible trick - lying face down to sip from the sea.

He found a puppy on a lead, which led Gray to his owners and Gray lay down, delighted, to pet him, and pound on him. * He's started to hammer or hit on me too, in play.

On the beach there was an abandoned dinghy - * he got in with great joy and wanted to ride in it as it floated away. A couple of children almost cast him adrift. Very frustrated at a too-heavy-to-maneuver log.

Home from the beach to his pool - didn't stay in but seemed to enjoy the coolness. He was all over everyone - strangers, Rod, Kitty and Jeff - poking their noses.

Hardly any speech sounds - I heard none.

This past week he's realised things have names.

02.10.25
Gray off to school, reached to touch my nose as he was being strapped in. I said “yes, nose” and little Jenny beside Gray enthusiastically touched her button nose. Gray regarded her curiously.

Back with paint in his hair and down to the beach with Mum, after a nice hose and pool session. He brought the hose (see p. 98) upstairs into the kitchen. At the beach he was tireless in going to sit with other people - playing with their toes and touching their noses. It’s very hard to teach him to stay, when they are (at least initially) encouraging. He wasn’t wild to go in he water, and cried when I had to wash him off. It was cold too.

Everyday on the beach, he looks in my bag for goodies, because I’ve occasionally brought gum/candy down. More pools at the beach and * I covered him with sand - his entire legs - he loved it and helped to put sand on and pat it down (as he does in pool construction). A puppy got him right up though, then he asked for it again, * by putting sand on his leg and pulling me down.

Not as interested in the bike to spin, or the cups and bucket.

* He has a new (this week) greeting gesture - he points in the direction of the person, then jerks his hand up to the sky, looking up, then jerks it down. Silently, of course.

* He pointed to the sky when it was really windy. After I said the word windy he pointed again, to get me to say it again.

* He’s asking all day for new words by pointing, listening and turning to me and pointing again. The wind in the trees made him *point to a tree, I said tree and * he pointed to another tree. More new words.

I'm sure he knows more words now than I have any idea of, it's hard to keep track. When he’s running away he turns when I say * “Come on”; I think he also knows this to mean come with me. He responds to go up and go down in a very general way, e.g. * tonight he turned and went back upstairs.

I showed him a new book - photos of a baby and mature duck, and he touched his plastic mother and baby ducks. He studied the book, sitting down to hold it, then * remembered that “The Jolly Barnyard” with more duck pix was on the table in another room, and ran to climb up on a chair to get it.

After a dinner of yogurt, hamburger, apple juice and lots of ice cream, he was delighted to be taken out in the front yard, especially as [our neighbour] Grumpy Man had a small back and forth sprinkler going. It took a couple of surprise wettings for him to realize that it sprayed in a regular pattern. He had a bath and is very adroit at putting back the showerhead (with which he sprays relentlessly) when I call “No Graeme, put it back”.

He was interested in the labelling of light (electric) today, and ears yesterday and * confused tummy as tongue several times.

As I put him to bed sitting beside him * he clutched my arm tightly to him, and curled his leg around mine; when I moved he clung more. I realized he was remembering last week, when I was baby-sitting and shut him in his room two times because he was fooling around not going to sleep. To test this, when he rolled over and touched a strip on the wall, I moved as if to get up and he rolled back quickly, grabbing me. He blew [wә]* once, did some fancy breathing, had one sip of the bottle and was asleep. No speech sounds today.

More bear animal play, especially with dog types.
Lots of socks from every drawer for the past two days * getting us to put them on his hands like mittens.

02.10.27
Gray to school. Home to book play. He pointed to the dog picture the most, and to other pictures to get us to "make the sounds", say the words. * He pushed me a few times when I was reading my book to get me to say a word. After I'd opened the book to a dog and cat page he studied that for a while, but still prefers the cover.

He often points to something, holding the book so he can see it but I can't, and looks questioningly at me for the word, jabbing at the picture with his finger impatiently when I don't reply. Egocentric.

He learned ear(s) today (the plural inflection is not meaningful). He was interested in my ears yesterday, but today I taught him on the bears and then I generalised to mine and his. * He recognized mine, the dolls and the bears as the same, but not his own. We looked at one bear * (he chose a bear not a dog or horse when I said bear) for facial features. * He planted it firmly down beside me (I was lying on his mattress) and then got three more, one at a time, and identified mouth, eyes, ears, nose and tongue, (a bear’s red felt tongue, as well as mine and his own). He still points to his tongue for tummy. Each time he got a bear, * he shoved my head down after lining it up next to the others, leaning on me. Maybe I ruined the line.

I got down the big (3/4 his size) Eskimo doll for the first time- he pointed at my command to her foot, ear, eyes, nose (she has no mouth). The doll has a dispirited, melancholy head droop, and * he irritably pushed her head back, in the same way he gets mad if the bears don’t sit or the horses don’t stand up.

He was interested in my childhood doll, too, * especially that her eyes shut when she lay down.

Gray and I went to visit the neurologist who said Graeme’s “abnormalities” were caused by a “gross insult at birth” and were not “congenital or from any syndrome”, that he was not “retarded”, and was “not autistic” (relates too well to me). He probably isn't having seizures when he blinks in his unfocused way, it's a "self-stimulating mannerism". His tonic seizure at 3 weeks old gives a “bad prognosis, shows lots of damage to the central nervous system”. The Dr will order a CT scan – “It’s justified by the fact that it’s now clear that his handicap is severe enough to affect him for life”. There is “bilateral temporal lobe brain damage, with the left side more affected, but because the right side is also damaged it hasn’t taken over the language (not a good prognosis)”. He still has “floppy muscles and a left weakness” (left toes don’t curl down, one leg comes up higher). He isn’t as delayed in other areas, e.g. fine motor skills, as in language. His hypoxia at birth usually results in mental retardation and /or cerebral palsy rather than aphasia” but Gray has good eye movements, no tremor in his hands. So he’s unusual for this sort of abnormal birth in his “severe language delay and neurological deficits”. He reminded the Dr. of “another kid in Boston with a difficult C-section birth”.

Not good news.

Gray went to the doorknobs incessantly, opening doors like a fiend. I took him to the playground and he tried the trikes, but didn’t seem to know how to operate the pedals. He threw sand around and had a great game of hide and seek in a doll-house, looking
through the open windows at me. He went to the easel, and painted a little, and didn’t care for the swings, but wanted to go down the slide.

* He sat nicely in the seatbelt during the cab rides, fell asleep on the way home.

I tried a new way of getting him to sleep, instead of sitting with him or locking him in, I left the room after much fooling around flirtation from Mr. G., leaving the door open. He came out immediately, to stop me shutting the door, but *obeyed, suspiciously, when I told him "lie down". After about 15 times of this, * he fell asleep on his bed. Great.

02.11.18

He got up very early and started right in on the dreadful talking animals toy.

Was kind of crabby with lack of sleep - the string game makes him cranky and demanding. He can sometimes be distracted by a book though, or talking animals. Strung the spools too, and poured water in a cup from his pool all over his trousers - soaking himself in the garden again to pick flowers - he carries them around in one hand in a bunch.

Thrilled (dancing and happy pose - now very infrequent) when I was waxing my legs.

When Grandma and Grandpa came he came running out of his room where he’d been looking at *new books and the duck book and ran straight into Grandma’s arms and eagerly touched her eyes and nose, then turned to me to touch mine.

Pointed for records and to his Grandpa for Where’s Papa? Responded to music again, and very interested in picture of clothes pegs, as well as in the usual animals, birds, buttons, and bike pix. *Interested in umbrella and glasses (new words) pix too. * Said [?uh*] a couple of times in request of a name.

Played the taut string game with Grandma - really cried when I took it away. It makes him cranky and demanding. He can sometimes be distracted by a book though, or the talking animals. Likes it (very serious face) when we make the animal sound after the word - no imitation. Refused apple and granola yogi. Asks very specifically for bread. (for bread) leading us to the corner and pointing, jabbing with his finger. * Also pointed (jabbed) his finger into his cup for milk

More paintings at school this week. They had been going to keep an easel standing in every room at the beginning of the programme but that was the only thing Gray would do so they put them all away until painting time.- outdoors he went straight to the easel but investigated others areas later e.g. music boxes (stand in and step on).

Went to bed at 7 and did (also earlier) pincher fingers and pulled his bears in with him, cuddled them against his cheek like he holds his bottle, then lay on them until he went to sleep at 7:30. Got up once before that to play records. He scampers back to bed when I go in and lies down.

He cries when I say bad and the lightest finger swat to his arm makes him cry.

Lots of vocalization [owuhwei:] and [wawa] and [yiyiyi].

02.11.19

(see Preschool assessment below for this date)
I went on the Bunny Bus to observe Gray on his last day of school - he didn't realise I was there but when he finally saw me in his class he turned and ran smiling to me then put the plastic cow in my hand - he's been playing almost exclusively with the animals since he went to the animal farm - and painting too.

When Gray got off the bus, he pushed through a knot of people at the door (after a big hug from Colleen) and ran down the long, maze-like corridor straight to his classroom, all by himself.

While I watched, he was part of a singing circle - he was reluctant to sit down and didn't stay for more than 5 minutes - only one other child (who was deaf) had left before him. But (teachers) C and G said it was "a record time for Gray." *He sat in the centre while they sang Graeme got his hair cut (3X) by Breeze while Breeze imitated cutting his hair. In the circle song X loves his bear, he loves his bear, he takes it everywhere, Graeme screamed for the bear for a minute * (instead of throughout the whole song) then followed the bear around as it was passed around the circle.

He got a lot of attention, and hammered pins and used play dough and threaded animal shapes.

In the gym he rolled a light cylinder (where he got log - rolling on the beach from) and sat astride on it, then I put him on the slide (he didn't need a lot of help to climb the ladder) then just played with a knotted rope (string game) incessantly till another child took it away - then broken puppet tantruming till F came - the sight of Daddy cheered him right up.

He rode a push-car and got up on a string in the art room; and kept getting in view of the screen when slides were shown.

At home more duck book - he would touch the picture, turn to look at me, then say [? \( ? \)] (his name question) to elicit names. Because we didn't respond until he used his name question he asked verbally about 20 times each for grass, pool, water, boy, baby duck, egg, duck stand in the water/duck lie down, duck close eye. We've expanded the MLU to him but still simplify the morphemes. He read his book (Ladybird and duck) by himself - he jabs several times at a specific place, then turns the page, repeats jabbing. You can see he's hearing the words in his head, not saying them to himself of course because he doesn't say anything.

He put his bears in the drawer standing up and did spool threading.

G (speech therapist) said he's imitated (roughly) "moo" and*: today he responded [a:\(\text{\textbackslash}v\)\textbackslash a\(\text{\textbackslash}v\)] (down) to my [a:\(\text{\textbackslash}v\)] but not to baa, oink etc., although he's interested.

03.00.11

(see TAPE transcript below for this date)

He joined me in bed – cuddling with the duck book and me for half an hour, then started pulling my hand to get me up.

Wanted lots of attention all day – only played by himself for an hour today. I guess he missed me. Yesterday I stopped for him every time but I had so much work to do today including a 6-page letter for pre-school to bring them up to date on his comprehension – he knows about 30 verbs. Knows * says, roll over, (yesterday), turn around. In that list of words there are some that perhaps dont occur in the journals and vice versa.
I say The cow/pig/duck/dog/bird/chicken says? and Graeme makes his sound * [m]. I cued him with an exaggerated silent lip position [m] yesterday and today. * He squeaks [i: i: i:] for the chicken sound imitating my high pitch. Taped him playing with animals, book, colours. Why didn’t I tape him all this past year so I could have measured the great recent change that’s taken place? Discouraged by my inability to generate any sounds from him initially probably.

Gray verbalised all day but imitated [wa wa wa] and [yae yae yae] only when I whispered. He made some [brtz] raspberry-type strings – attractively fricative, i.e. spitting, then he energetically wipes his mouth, sometimes even without being asked. Was full of conversational squeaks and grunts and vowels with D and C at their house tonight. He got quite charged up being there and I crazily (pre-school tomorrow) didn’t get him to bed until 9.

I’ve been rushing around since I got home organizing sitters, rides, lessons, plans, funding, and measuring and assessing all the rapid development that took place during my 13-day absence – especially rapid compared to last year (same 2 weeks in August) when there was hardly any change discernible. He was slow then but he’s speedy now.

His facial expressions are very communicative and charming now– he can express curiosity, interest, puzzlement, slight to severe anxiety, pleasurable versus serious intensity of concentration and lots more, all just for learning words. I can tell by his face when he’s remembering and what. It’s amazing – like the book “Your Child’s Silent Language” and ethno-methodology. More subtle than I can relate alas. Many social expressions too – mischievous, showing off, giggly, inciting (for more game play) - so many more. Gets all steamed up for company.

Over half hour door/doorknob/locks play at D and C’s – just 2 minutes on the doorstop however. *Went to a book before going to the doorknobs, that’s a change. * He fit the end of a shoelace into a hole in the bottom of his cow (he loves a collage) and swung, wrapped and dragged it over rugs, grass, and carpet, made a pulley and pendulum of it, and cried in an irritated way when it worked apart but learned to jam it back in. He still gets close-up at eye-level to fully appreciate his creations.

G. fills his mouth with water from the showerhead and spews it out a foot - (since at least 3.0.0)

The usual plastic animal line-ups and sound making – consistent on cow, pig, dog – * same for duck. * Working on turtle and sloth comprehension. Must test turtle/turkey. Maybe that’s why he wants turtle named so much in pix, they’re so similar phonetically.

On the walk, he asked only 3 times right at the start to be carried. Made a broken puppet tantrum pose (down to just 2-3 times a day since at least 3.0.0) in the store when refused an ice cream but eagerly grabbed at the bread in the counter and trotted home nicely – bouncing and saying [?uh ?uh ?uh] I want it, give it to me, his food request sound] when I put the bag on our counter – ate all his peanut butter sandwich right up. Later knew that A was carrying bananas in the bag on the way home when she took him to the store. New sitter, A, 12, very sweet and relaxed with Gray - told him colours (he wanted them all day - pointing again * again to things I’d identified by colour - e.g. on walk, I said brown car and he asked [?uh-?] for every car after. A also satisfied his need for hearing animal sounds and picture books identified for an hour. On our walk * Gray didn’t stop pointing, touching, and asking for names. Non-stop all day except short intervals.
Not nearly as much bear play – they just sat in a box all day. Colours have taken over – he’s 100% right on yellow and red, 90% on green, 60-70% white, and blue and orange. Interested in purple, black, every colour except real neutrals. * Since 3.0.4 or so interested in stripes – colour distinctions – first I labelled stripes before I realized he wanted colour names.

Asked for horsie rides and roll over. In the list of words - there are some which perhaps don't occur in the journals and maybe vice versa.

Interested in (*since 3.0.9) the ankle/foot/leg distinction and today finger, hand, wrist, arm, asked 2 different times.

First correctly pointed at D and C when asked, then pointed to D for Where’s C? I said no, and C said I’m C. And he pointed at her, process of elimination but showed he knows people have names. * Ran to her for a hug.

* Working on turtle and sloth. Must test turtle/turkey. Maybe that's why he wants turtle named so much in pic.

Waved at everybody good-bye, esp. * after they'd gone out of sight.

Ate his yogi; although a new kind and he wasn't hungry really, only when spoon-fed on C's knees, but got off disgusted when he encountered a lump of strawberry. Returned to spoon-feed himself and * deliberately shake the spoon to spatter the yoghourt all over the broadloom and chesterfield. Loved whipping cream - refused it when I mixed fruit in.

* Played a bit (two minutes) with Kermits - previously afraid of it.

Kissed me on request 60% and * spontaneously 3 times. Dear little monkey.

Likes to work on a high surface - e.g. a table.

Chased Pushkin (got scratched) and Lennie unmercifully.

Learned *crayon yesterday along with *shirt, pants, hammock (picture). [See word book.] David Ingram said last night re colours that *G. is starting to learn spontaneously and it's very true – despite the fact that I lost track for two weeks word-by-word, I realize he knows so many that I haven't taught him, that I don't even think to test.

Prefers to walk on the grass, not sidewalk. Yesterday, too - since the beach summer August 80 (2.11)

Got out string - was dragged but distractible when I wouldn't hold my end. Nine pages of this diary tonight! A couple of days alone with him has made me more observant and perspective of his behaviour and also appreciate more what F’s been doing while I was away.
Berwick Preschool Assessment

THE UNIVERSITY OF BRITISH COLUMBIA
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VANCOUVER, B.C., CANADA
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SERENDIPITY ‘80 PRE-SCHOOL FOR CHILDREN

Age 02.11.19

HOME ROOM REPORT

GRAEME GIBSON

C (teacher’s name)

Played alone and wouldn’t become involved with the group at all in the beginning, by the end he became more aware of and observed the other children – also imitated their activities some – would participate to some degree in circle and music.

we had been told that he had no receptive language but he does understand some things – his parents sent us quite extensive lists of words they thought he understood – this was very helpful although we questioned whether or not he really understood all they suggested he did. He definitely understood we had expectations of him and did test us some.

-tended to throw tantrums when unable to communicate desires or (more often) unable to get his own way. He also tantrumed often when we changed activities. We ignored this behaviour (as does his mum at home) and he would eventually change activities etc. willingly.

-says ‘ah’ and began to say ‘ba’. He also became very excited about our toy cow, pig, sheep, etc., after visiting the Maplewood Animal farm with his grandparents, and the zoo with his 1 to 1 worker. He then began imitating animal sounds eg. “oin” for “onk”, ‘aa’ for ‘baa’, ‘eigh’ for ‘neigh’. His parents were very excited about this (as were we).

-he points to things for you to name often and his parents asked us to really work on this

-very interested in music and musical toys – near to the end he began to sit for most of the music sessions.

-one of our goals with Graeme was to get him to eat a variety of foods. This was very difficult as we only ate snack. He did try cheerios, raisins, cookies, apples, but bananas remained his favourite.

-watches the children and adults to see how to use toys etc. and later imitates.
Tape transcript 03.00.11
(rough transcription)

G looking at animals, lots of *name question* [request for information question], identifies animals and noises
correctly identifying *green*
G [oink oink] 3 times for *pig*
G [moo uu], lining up plastic animals in zig zag formation
Asking *name question* for colour identification (id)
G identified red and yellow with *name question*, level intonation
G said *down* word, made sheep fall down with *down* word
Asked for tape recorder to be named with *name question*
Spitting farting raspberry noise
Laughing at pulling the TR cord, loves strings
Imitated me only when I whispered [wa wa]
D – cow says
G [uu]
G’s words, elicited [moo], [bowow], [oink oink], *name question*, *down*
Animal noises in last 2 weeks *name question* last 3 to 4 weeks
*Down* –for quite a while
Pointed outside as an aeroplane went over
More *name question* and touching pic for me to id
A new noise today, [quack quack]
Asks again for colour word id
G investigating TR again, *name question*
Imitated my whispered wa wa wa
G squeaking [i] *chicken*, imitating my intonation
D Baa says the ?
G points to sheep
G [bowow] spontaneous
G Identified *orange* and *green*
G *name question* 100 times, me id-ing things in pic
G threaded string through cow’s legs
Likes non speech sounds better than speech sounds.
New verb id *push*
Appendix B   Taxonomies

1. The Word Event (WE) list of Graeme’s complete lexicon in comprehension, in the order of the age of acquisition (AoA).

2. Samples from the Word Event list of chronologically ordered entries in comprehension from the onset period, the period of slow word learning, the word spurt period, and the very rapid word learning period.

3. A sample of the Social/Cognitive Development (SCD) list for the pre-linguistic period, showing behaviours and data sources.

4. Table 4.14 reprinted for reference to codes for the above.
<table>
<thead>
<tr>
<th>word event</th>
<th>meaning</th>
<th>adult word used</th>
<th>AOA</th>
<th>notes</th>
<th>context</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Graeme</td>
<td></td>
<td>02.00.00</td>
<td></td>
<td>some recognition</td>
</tr>
<tr>
<td>2</td>
<td>no</td>
<td>don't do it, you can't have it</td>
<td>02.00.00</td>
<td>hands lightly clapped/flapped together</td>
<td>lining up milk cartons, F coming home</td>
</tr>
<tr>
<td>3</td>
<td>good boy</td>
<td>you're a good boy</td>
<td>02.00.00</td>
<td></td>
<td>smiles in response</td>
</tr>
<tr>
<td>4</td>
<td>knock knock game</td>
<td>Knock knock, come in, exaggerated intonation</td>
<td>02.00.00</td>
<td>2.6.0</td>
<td>looks at D's hand for knocking, then at her mouth for 'come in'</td>
</tr>
<tr>
<td>5</td>
<td>down</td>
<td>aD', falling tone, exaggerated intonation</td>
<td>02.05.27</td>
<td></td>
<td>parents bring it down to his level, G throws it down, G steps down, G puts something down</td>
</tr>
<tr>
<td>6</td>
<td>up</td>
<td>I'm picking you up</td>
<td>02.05.27</td>
<td>D's arm goes up</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>hide n seek game</td>
<td>I'm looking for you</td>
<td>02.06.00</td>
<td>see #33 'where's X?'</td>
<td>runs and covers his face with blanket</td>
</tr>
<tr>
<td>8</td>
<td>bye bye</td>
<td></td>
<td>02.06.05</td>
<td>turns apprehensively, afraid we're leaving</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>greeting</td>
<td>hi Graeme</td>
<td>02.06.10</td>
<td></td>
<td>waved in response</td>
</tr>
<tr>
<td>10</td>
<td>Lennie</td>
<td>our cat</td>
<td>02.06.12</td>
<td></td>
<td>turned to look at where L had been</td>
</tr>
<tr>
<td>11</td>
<td>top</td>
<td>toy top</td>
<td>02.06.25</td>
<td>recognised its photo on the box</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Daddy</td>
<td></td>
<td>02.07.14</td>
<td>turns to look when F not present</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>juice</td>
<td></td>
<td>02.07.14</td>
<td>in context</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>jump</td>
<td></td>
<td>02.07.18</td>
<td>doesn't do it on command, unless he's already been doing it</td>
<td>remembered, bounced</td>
</tr>
<tr>
<td>15</td>
<td>step</td>
<td>lift leg to put pants on</td>
<td>02.07.19</td>
<td>CVCV, CVCVCV</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>banana</td>
<td></td>
<td>02.07.19</td>
<td>recognises the word without seeing one</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>hot</td>
<td>too hot to touch</td>
<td>02.08.00</td>
<td>reacted by running away from oven</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>look</td>
<td>look</td>
<td>02.08.01</td>
<td>had his head in d's lap, looked up right away</td>
<td></td>
</tr>
<tr>
<td>word event</td>
<td>meaning</td>
<td>adult word used</td>
<td>AOA</td>
<td>notes</td>
<td>context</td>
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<tr>
<td>19</td>
<td>round/ about</td>
<td>round about game</td>
<td>I turn his palm up, circle my finger on it</td>
<td>02.08.15</td>
<td>G holds palm out on whispered verbal</td>
</tr>
<tr>
<td>20</td>
<td>more</td>
<td>more</td>
<td>02.08.19</td>
<td>D said more, held out her hand</td>
<td>brought music box to D to rewind</td>
</tr>
<tr>
<td>21</td>
<td>bottle</td>
<td>ba Gray</td>
<td>02.08.20</td>
<td>ran to get it, verbal only</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>nose</td>
<td>rubbing noses, kiss me</td>
<td>nose</td>
<td>02.08.23</td>
<td>touched his nose to toy’s nose for verbal</td>
</tr>
<tr>
<td>23</td>
<td>aeroplane</td>
<td>aeroplane</td>
<td>02.08.28</td>
<td>G pointed out window, verbal only, no sound of plane</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>foot</td>
<td>lift up your foot</td>
<td>foot</td>
<td>02.09.08</td>
<td>lifted his leg to command when being changed</td>
</tr>
<tr>
<td>25</td>
<td>run</td>
<td>run</td>
<td>02.09.10</td>
<td>started to run twice, holding hands</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>I want it, give it to me</td>
<td>give it to me Graeme, with gesture, intonation, loudness, pitch</td>
<td>02.09.13</td>
<td>maybe understood earlier, first time obeyed</td>
<td>G (his therapist) holds out her hand, he gave her the object,</td>
</tr>
<tr>
<td>27</td>
<td>this little pig game</td>
<td>this little pig went to market etc</td>
<td>02.09.13</td>
<td>recognised it verbally, held out his hand</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>here</td>
<td>here you go</td>
<td>here</td>
<td>02.09.23</td>
<td>turned around quickly expecting food he liked</td>
</tr>
<tr>
<td>29</td>
<td>Where's X?</td>
<td>Q about location /identification</td>
<td>Where’s G / Lennie</td>
<td>02.09.28</td>
<td>is it the person’s name or ‘where’?</td>
</tr>
<tr>
<td>30</td>
<td>G (his therapist)</td>
<td>where's G?</td>
<td>02.09.28</td>
<td>started language intervention with G at 2.8.22</td>
<td>looks at G when asked.</td>
</tr>
<tr>
<td>31</td>
<td>cookie</td>
<td>cookie</td>
<td>02.10.01</td>
<td>took 1 day to learn!</td>
<td>came running, verbal only</td>
</tr>
<tr>
<td>32</td>
<td>water</td>
<td>drinking, ocean, bath water, water play</td>
<td>water</td>
<td>02.10.03</td>
<td>D used ‘water’ 80 times, G turned sharply when thirsty on hearing it</td>
</tr>
<tr>
<td>33</td>
<td>kick</td>
<td>kicking in water</td>
<td>kick</td>
<td>02.10.04</td>
<td>did it on command, hadn’t already been doing it</td>
</tr>
<tr>
<td>34</td>
<td>Mummy</td>
<td>where's Mummy?</td>
<td>02.10.04</td>
<td>touched D’s nose, looked, no point</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>eye/s</td>
<td>eye/s</td>
<td>02.10.05</td>
<td>learned it quickly</td>
<td>touched Daddy’s, Mummy’s, Lennie's</td>
</tr>
<tr>
<td>word event</td>
<td>meaning</td>
<td>adult word used</td>
<td>AOA</td>
<td>notes</td>
<td>context</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
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<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>36 milk</td>
<td></td>
<td></td>
<td>02.10.05</td>
<td>see I want it, give it to me</td>
<td>responded</td>
</tr>
<tr>
<td>37 Grandma</td>
<td>That's a picture of Grandma</td>
<td></td>
<td>02.10.09</td>
<td>pointed and touched her pic in recognition</td>
<td></td>
</tr>
<tr>
<td>38 Lorna</td>
<td>where's Lorna?</td>
<td></td>
<td>02.10.09</td>
<td>pointed upstairs after her. Old family friend</td>
<td></td>
</tr>
<tr>
<td>39 baby</td>
<td>baby</td>
<td></td>
<td>02.10.12</td>
<td>turned to point at visiting baby</td>
<td></td>
</tr>
<tr>
<td>40 what's that?</td>
<td>Name question</td>
<td></td>
<td>02.10.13</td>
<td>Production, not comprehension</td>
<td>Request for information: pointing, triadic gaze</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>switching between object and speaker, initiating Joint attention</td>
<td></td>
</tr>
<tr>
<td>41 mouth</td>
<td>mouth</td>
<td></td>
<td>02.10.14</td>
<td>D labelled, and touched his and her mouth, he pointed to her mouth</td>
<td></td>
</tr>
<tr>
<td>42 sit</td>
<td>obeyed, in water</td>
<td>sit down</td>
<td>02.10.15</td>
<td>probably understood down</td>
<td></td>
</tr>
<tr>
<td>43 bear</td>
<td>bear/ growl</td>
<td></td>
<td>.</td>
<td>.</td>
<td>asks for name</td>
</tr>
<tr>
<td>44 lie down</td>
<td>lie down</td>
<td></td>
<td>02.10.19</td>
<td>responds in bed</td>
<td></td>
</tr>
<tr>
<td>45 fall</td>
<td>fall down</td>
<td>fall down</td>
<td>02.10.19</td>
<td>game</td>
<td></td>
</tr>
<tr>
<td>46 bike</td>
<td>where's bike</td>
<td></td>
<td>02.10.21</td>
<td>pointed to it when asked</td>
<td></td>
</tr>
<tr>
<td>47 sock/s</td>
<td>socks -where's the socks?</td>
<td></td>
<td>02.10.24</td>
<td>pointed to the pile he’d collected</td>
<td></td>
</tr>
<tr>
<td>48 dog</td>
<td>dog</td>
<td>doggie</td>
<td>02.10.24</td>
<td>D put a toy dog on a dog pic and G asked for name, matched them himself</td>
<td></td>
</tr>
<tr>
<td>49 put</td>
<td>put the shower head back</td>
<td>no, G, put it back reprimanding tone</td>
<td>02.10.25</td>
<td>putting shower head back on nozzle, likes to spray all over in the bath</td>
<td></td>
</tr>
<tr>
<td>50 come</td>
<td>don't run away, and come with me</td>
<td>come on, verbal only, no gesture, or name</td>
<td>02.10.25</td>
<td>turned back from running away</td>
<td></td>
</tr>
<tr>
<td>51 go</td>
<td>go up, go down</td>
<td></td>
<td>02.10.25</td>
<td>responds and obeys</td>
<td></td>
</tr>
<tr>
<td>52 tree</td>
<td></td>
<td></td>
<td>02.10.25</td>
<td>wind blowing trees</td>
<td></td>
</tr>
<tr>
<td>53 ear</td>
<td></td>
<td></td>
<td>02.10.27</td>
<td>pointed to bears', pics, D's, doll's, Lennie's, not his own</td>
<td></td>
</tr>
<tr>
<td>54 shoe</td>
<td></td>
<td></td>
<td>02.10.28</td>
<td>big day for language acquisition</td>
<td>pointed to his shoe on his foot</td>
</tr>
<tr>
<td>55 bird</td>
<td></td>
<td>bird/s</td>
<td>02.10.29</td>
<td>pointed when D said birds, chased them</td>
<td></td>
</tr>
<tr>
<td>56 duck</td>
<td></td>
<td>duck</td>
<td>02.11.00</td>
<td>favourite book 'Little Duck'</td>
<td>asked if pics of duckling, duck, wet, dry were the same</td>
</tr>
<tr>
<td>57 door</td>
<td></td>
<td>open, shut, close the door</td>
<td>02.11.01</td>
<td>probably earlier</td>
<td></td>
</tr>
<tr>
<td>58 this way</td>
<td>obeys at</td>
<td>this way</td>
<td>02.11.01</td>
<td>recorded 2.11.10</td>
<td></td>
</tr>
<tr>
<td>word event</td>
<td>meaning</td>
<td>adult word used</td>
<td>AOA</td>
<td>notes</td>
<td>context</td>
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<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>brush</td>
<td>hair brush</td>
<td>brush hair, Mummy's brushing G's hair</td>
<td>02.11.02</td>
<td>pointed to pic, imitated D stroking his hair</td>
<td>pre-school</td>
</tr>
<tr>
<td>bus</td>
<td></td>
<td></td>
<td>02.11.02</td>
<td>recognised pic even though the colour was different from his ps bus, pointed, asked, brought book right up to his eyes,</td>
<td></td>
</tr>
<tr>
<td>orange</td>
<td>fruit</td>
<td></td>
<td>02.11.02</td>
<td>pic in books</td>
<td></td>
</tr>
<tr>
<td>spoon</td>
<td></td>
<td></td>
<td>02.11.02</td>
<td>identified pic, then real thing. Many months of training on eating with a spoon</td>
<td></td>
</tr>
<tr>
<td>candy</td>
<td>candies</td>
<td></td>
<td>02.11.02</td>
<td>identified pics, great interest in real thing</td>
<td></td>
</tr>
<tr>
<td>bath</td>
<td></td>
<td></td>
<td>02.11.02</td>
<td>identified in pic, assoc with water, tap</td>
<td></td>
</tr>
<tr>
<td>leg</td>
<td></td>
<td></td>
<td>02.11.02</td>
<td>might know leg. Game of burying his leg in sand</td>
<td></td>
</tr>
<tr>
<td>cat</td>
<td>cat</td>
<td></td>
<td>02.11.02</td>
<td>pic &amp; real</td>
<td></td>
</tr>
<tr>
<td>shut/close</td>
<td>shut the drawer</td>
<td></td>
<td>02.11.02</td>
<td>ripping plaster off the wall, cried &amp; ran away</td>
<td></td>
</tr>
<tr>
<td>open</td>
<td>open the drawer</td>
<td></td>
<td>02.11.02</td>
<td>loves to fill his pool with water</td>
<td></td>
</tr>
<tr>
<td>pool</td>
<td>put it in the pool</td>
<td></td>
<td>02.11.02</td>
<td>drums on D's legs and back,</td>
<td></td>
</tr>
<tr>
<td>hit</td>
<td>hit Mum.</td>
<td></td>
<td>02.11.02</td>
<td>touches them</td>
<td></td>
</tr>
<tr>
<td>button</td>
<td>D's nipple, bellybutton, buttons on flashlight, computer</td>
<td>button</td>
<td>02.11.02</td>
<td>hadn't seen it but when D said it he ran straight to his highchair</td>
<td></td>
</tr>
<tr>
<td>Yoghourt</td>
<td>yogi</td>
<td></td>
<td>02.11.02</td>
<td>pic and real thing</td>
<td></td>
</tr>
<tr>
<td>book</td>
<td>where's the book?</td>
<td></td>
<td>02.11.02</td>
<td>pic and real thing</td>
<td></td>
</tr>
<tr>
<td>tap</td>
<td></td>
<td></td>
<td>02.11.02</td>
<td>pic</td>
<td></td>
</tr>
<tr>
<td>stairs</td>
<td></td>
<td></td>
<td>02.11.02</td>
<td>interested in pic, said up &amp; down</td>
<td></td>
</tr>
<tr>
<td>cow</td>
<td>cow</td>
<td></td>
<td>02.11.03</td>
<td>pic and toy</td>
<td></td>
</tr>
<tr>
<td>car</td>
<td></td>
<td></td>
<td>02.11.03</td>
<td>pic and real thing</td>
<td></td>
</tr>
<tr>
<td>pig</td>
<td>where's the pig?</td>
<td>pig, piggies</td>
<td>02.11.03</td>
<td>pointed in response</td>
<td></td>
</tr>
<tr>
<td>boy</td>
<td>where's the boy</td>
<td></td>
<td>02.11.03</td>
<td>identified by pointing to pic</td>
<td></td>
</tr>
<tr>
<td>house</td>
<td></td>
<td></td>
<td>02.11.03</td>
<td>pic</td>
<td></td>
</tr>
<tr>
<td>key/s</td>
<td></td>
<td></td>
<td>02.11.04</td>
<td>touched pic in book</td>
<td></td>
</tr>
<tr>
<td>pen/pencil</td>
<td></td>
<td></td>
<td>02.11.04</td>
<td>wanted label</td>
<td></td>
</tr>
<tr>
<td>word event</td>
<td>meaning</td>
<td>adult word used</td>
<td>AOA</td>
<td>notes</td>
<td>context</td>
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<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>84</td>
<td>peepee</td>
<td>pee and penis</td>
<td>02.11.04</td>
<td>touches his penis for 'peepee'</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>in</td>
<td></td>
<td>02.11.05</td>
<td>put a domino in a smarties box when asked, no</td>
<td>pointed, no demo</td>
</tr>
<tr>
<td>86</td>
<td>knee</td>
<td>where's your knee?</td>
<td>02.11.05</td>
<td>pointed, no demo</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>sheep</td>
<td>sheep</td>
<td>02.11.07</td>
<td>pic and real thing</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>teeth</td>
<td></td>
<td>02.11.07</td>
<td>points to parents' teeth</td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>tummy</td>
<td>sheep</td>
<td>02.11.07</td>
<td>no confusion</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>tongue</td>
<td></td>
<td>02.11.07</td>
<td>pic, 100%</td>
<td></td>
</tr>
<tr>
<td>91</td>
<td>egg</td>
<td></td>
<td>02.11.07</td>
<td>pic</td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>chicken</td>
<td></td>
<td>02.11.07</td>
<td>pic</td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>goat</td>
<td></td>
<td>02.11.07</td>
<td>pic</td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>string</td>
<td>action and object</td>
<td>02.11.08</td>
<td>pointed after only 10 reps</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>wait a minute</td>
<td></td>
<td>02.11.08</td>
<td>stopped whining and pulling D's hand</td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>word/s, writing</td>
<td>word/s, writing</td>
<td>02.11.08</td>
<td>maybe, no firm record</td>
<td>asks for name of printed word captions in his pic books</td>
</tr>
<tr>
<td>97</td>
<td>hand</td>
<td>body part</td>
<td>02.11.10</td>
<td>see hold hands</td>
<td>pointed to his, D's, pic</td>
</tr>
<tr>
<td>98</td>
<td>ice cream</td>
<td>ice cream</td>
<td>02.11.11</td>
<td>ran toward concession</td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>ball</td>
<td>put the ball on the thermos</td>
<td>02.11.11</td>
<td>understood 'ball'</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>cup</td>
<td>nesting cups toy</td>
<td>02.11.12</td>
<td>02.11.14 recorded</td>
<td></td>
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<tr>
<td>101</td>
<td>grass</td>
<td></td>
<td>02.11.12</td>
<td>100% for pic and real thing</td>
<td></td>
</tr>
<tr>
<td>102</td>
<td>wipe</td>
<td>wipe your mouth</td>
<td>02.11.12</td>
<td>wiped his mouth with his hand</td>
<td></td>
</tr>
<tr>
<td>103</td>
<td>David</td>
<td>where's David?</td>
<td>02.11.13</td>
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G points to all examples of one colour in a row, almost 100%
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<tr>
<td>word event</td>
<td>meaning</td>
<td>adult word used</td>
<td>AOA</td>
<td>notes</td>
<td>context</td>
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</tr>
<tr>
<td>213</td>
<td>purple</td>
<td></td>
<td>03.00.21</td>
<td>assumed date of acquisition</td>
<td></td>
</tr>
<tr>
<td>214</td>
<td>basket</td>
<td>put it in the basket</td>
<td>03.00.21</td>
<td>probably earlier</td>
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<tr>
<td>215</td>
<td>giraffe</td>
<td></td>
<td>03.00.22</td>
<td></td>
<td>knows name</td>
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<tr>
<td>216</td>
<td>loofah</td>
<td>water on the loofah</td>
<td>03.00.22</td>
<td>when D named it, he touched it and asked several times, looking at her each time she said the word</td>
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<tr>
<td>217</td>
<td>zebra</td>
<td></td>
<td>03.00.22</td>
<td>not formally recorded, probably same as giraffe</td>
<td></td>
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<tr>
<td>218</td>
<td>dinosaur</td>
<td></td>
<td>03.00.23</td>
<td>has toy</td>
<td></td>
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<tr>
<td>219</td>
<td>Joel</td>
<td></td>
<td>03.00.24</td>
<td>kids' names at preschool</td>
<td></td>
</tr>
<tr>
<td>220</td>
<td>Marla</td>
<td></td>
<td>03.00.24</td>
<td>reduplication for plurality</td>
<td>kids' names at preschool</td>
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<tr>
<td>221</td>
<td>hole</td>
<td></td>
<td>03.00.24</td>
<td></td>
<td></td>
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<tr>
<td>222</td>
<td>organ</td>
<td></td>
<td>03.00.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>223</td>
<td>lion</td>
<td></td>
<td>03.00.28</td>
<td>knows names of many exotic animals</td>
<td>washed a toy lion at p-s</td>
</tr>
<tr>
<td>224</td>
<td>bedroom</td>
<td>put it in your bedroom</td>
<td>03.00.28</td>
<td>knows his room and our room are both called bedroom</td>
<td></td>
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<tr>
<td>225</td>
<td>tattoo</td>
<td></td>
<td>03.00.28</td>
<td>learned after just 5 reps</td>
<td>loved his arm and leg tattoos</td>
</tr>
</tbody>
</table>
## Table B.2  Word Event List: Chronological Sort

Samples of chronological sorting of comprehension entries from the Word Event List in the periods of: onset, slow word learning in comprehension, word spurt in comprehension, and very rapid word learning in comprehension.

<table>
<thead>
<tr>
<th>word event</th>
<th>meaning</th>
<th>adult word used</th>
<th>age comp event</th>
<th>AoA first comp</th>
<th>sign</th>
<th>notes</th>
<th>context</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ONSET PERIOD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>down</td>
<td>falling tone, exaggerated intonation</td>
<td></td>
<td>02.05.27</td>
<td>02.05.27</td>
<td>D's arm goes down</td>
<td></td>
<td>parents bring it down to his level, G throws it down, G steps down, G puts something down</td>
</tr>
<tr>
<td>up</td>
<td>I'm picking you up</td>
<td></td>
<td>02.05.27</td>
<td>02.05.27</td>
<td>D's arm goes up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>down</td>
<td>G sits down</td>
<td></td>
<td>02.06.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>what's that?</td>
<td>request for name</td>
<td>where's X?</td>
<td>02.06.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bike</td>
<td></td>
<td></td>
<td>02.06.00</td>
<td></td>
<td></td>
<td>always riding in his bike seat on the back of parents' bikes</td>
<td></td>
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<tr>
<td>toe/s</td>
<td>pig, piggies</td>
<td></td>
<td>02.06.00</td>
<td></td>
<td></td>
<td>this little pigs game</td>
<td></td>
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<tr>
<td>table</td>
<td></td>
<td></td>
<td>02.06.00</td>
<td></td>
<td></td>
<td>much play with the coffee table, the kitchen table for eating</td>
<td></td>
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<tr>
<td>fence</td>
<td></td>
<td></td>
<td>02.06.00</td>
<td></td>
<td></td>
<td>fences an important interest, fenced yard, garden fenced with string</td>
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<tr>
<td>hide n seek</td>
<td>I'm looking for you</td>
<td>Where's Graeme? Exaggerated intonation</td>
<td>02.06.00</td>
<td>02.06.00</td>
<td>see #33 'where's X’</td>
<td>runs and covers his face with blanket</td>
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<tr>
<td>look</td>
<td>look at that, over there</td>
<td>us pointing</td>
<td>02.06.01</td>
<td></td>
<td></td>
<td>G looked at where we were pointing, not finger tip</td>
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<tr>
<td>word</td>
<td>meaning</td>
<td>adult word used</td>
<td>age comp</td>
<td>AoA first comp</td>
<td>sign</td>
<td>notes</td>
<td>context</td>
</tr>
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<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Where's X?</td>
<td>invitation to hide n seek</td>
<td>where's Graeme?</td>
<td>02.06.01</td>
<td></td>
<td></td>
<td>see #11 hide n seek game</td>
<td>responded by hiding</td>
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<td>milkshake</td>
<td></td>
<td></td>
<td></td>
<td>02.06.03</td>
<td></td>
<td>recognised container from DQ</td>
<td></td>
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<tr>
<td>throw</td>
<td></td>
<td></td>
<td></td>
<td>02.06.03</td>
<td></td>
<td>Likes to throw handfuls of stones down</td>
<td></td>
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<tr>
<td>beep beep</td>
<td>beep beep</td>
<td>02.06.04</td>
<td></td>
<td></td>
<td></td>
<td>poked his chest when he saw her game with Lorna, she pokes his chest</td>
<td></td>
</tr>
<tr>
<td>bye bye</td>
<td>bye bye</td>
<td>02.06.05</td>
<td>02.06.05</td>
<td></td>
<td></td>
<td>looks up anxiously</td>
<td></td>
</tr>
<tr>
<td>aeroplane</td>
<td>aeroplane</td>
<td>02.06.05</td>
<td></td>
<td></td>
<td></td>
<td>D teaching, one of the only things G looks up for</td>
<td></td>
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<tr>
<td>water</td>
<td></td>
<td></td>
<td>02.06.05</td>
<td></td>
<td></td>
<td>big interest in water play</td>
<td></td>
</tr>
<tr>
<td>shoe</td>
<td></td>
<td></td>
<td>02.06.05</td>
<td></td>
<td></td>
<td>D teaching</td>
<td></td>
</tr>
<tr>
<td>throw</td>
<td></td>
<td></td>
<td>02.06.05</td>
<td></td>
<td></td>
<td>watched D throw stones in water, didn't imitate.</td>
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<tr>
<td>bag</td>
<td></td>
<td></td>
<td>02.06.05</td>
<td></td>
<td></td>
<td>recognises that treats from the store come in bags</td>
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<tr>
<td>spoon</td>
<td></td>
<td></td>
<td>02.06.06</td>
<td></td>
<td></td>
<td>started to use a spoon, intensive training to 2.8</td>
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<tr>
<td>fire</td>
<td></td>
<td></td>
<td>02.06.08</td>
<td></td>
<td></td>
<td>starting to gesture, point, toward it</td>
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<tr>
<td>Graeme</td>
<td>come here</td>
<td>Graeme</td>
<td>02.06.10</td>
<td></td>
<td></td>
<td>comes when called more often if he can see parents</td>
<td></td>
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<tr>
<td>greeting</td>
<td>hi Graeme</td>
<td>02.06.10</td>
<td>02.06.10</td>
<td></td>
<td></td>
<td>Could be answering to his name</td>
<td>waved in response</td>
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<td>cat</td>
<td>see also 'Lennie' #12</td>
<td></td>
<td>02.06.10</td>
<td></td>
<td></td>
<td>recognised' pic, by looking intently at it, laughing, holding it close to his face</td>
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<tr>
<td>cup</td>
<td></td>
<td></td>
<td>02.06.10</td>
<td></td>
<td></td>
<td>from 2 on stacking cups, 2.6 on cups for water play, D teaching him to drink from cup</td>
<td>recognised' pic, looked intently at it, laughing, holding it close to his face</td>
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<tr>
<td>hammer</td>
<td></td>
<td></td>
<td>02.06.10</td>
<td></td>
<td></td>
<td>sorts them, uses them</td>
<td>distinguishes hammer and nails from wrenches and nuts, screws and screwdriver</td>
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<tr>
<td>word</td>
<td>meaning</td>
<td>adult word used</td>
<td>age comp event</td>
<td>AoA first comp</td>
<td>sign</td>
<td>notes</td>
<td>context</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td>nail</td>
<td>tool</td>
<td>02.06.10</td>
<td></td>
<td></td>
<td>sorts them, uses them</td>
<td>distinguishes hammer and nails from wrenches and nuts, screws and screwdriver</td>
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<tr>
<td>bye bye</td>
<td>bye bye</td>
<td>02.06.12</td>
<td></td>
<td></td>
<td></td>
<td>turns to look with apprehension</td>
<td></td>
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<tr>
<td>Lennie</td>
<td>our cat</td>
<td>Lennie! Where's Lennie? Exag. Intonation</td>
<td>02.06.12</td>
<td>02.06.12</td>
<td></td>
<td>turned to look at where L had been</td>
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<tr>
<td>nose</td>
<td>G's nose</td>
<td>02.06.12</td>
<td></td>
<td></td>
<td></td>
<td>D teaching for imitation, putting a red dot on his nose</td>
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<tr>
<td>record/s</td>
<td></td>
<td>02.06.13</td>
<td></td>
<td></td>
<td>see also music</td>
<td>listens with absorption to children's record</td>
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<tr>
<td>tap</td>
<td></td>
<td>02.06.14</td>
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<td>huge interest in playing in the sink, responds to hearing tap on</td>
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<td>shoelace</td>
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<td>02.06.18</td>
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<tr>
<td>pen/pencil</td>
<td></td>
<td>02.06.19</td>
<td>gestures to pen drawer</td>
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<td></td>
<td>obsessed with pen drawer on D's desk</td>
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<tr>
<td>shut/close</td>
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<td>shut the door</td>
<td>02.06.20</td>
<td></td>
<td>big interest in opening and shutting doors and gate</td>
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<tr>
<td>nose</td>
<td>identity</td>
<td>nose</td>
<td>02.06.21</td>
<td></td>
<td></td>
<td>started a new game, isolating the tips of D's and b's noses with his had</td>
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<tr>
<td>bubble/s</td>
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<td>02.06.21</td>
<td></td>
<td></td>
<td>very frightened of bubbles</td>
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<td></td>
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<tr>
<td>fire</td>
<td></td>
<td>02.06.24</td>
<td></td>
<td></td>
<td>loves to watch fireplace</td>
<td></td>
<td></td>
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<tr>
<td>top</td>
<td>toy top</td>
<td>02.06.25</td>
<td>02.06.25</td>
<td></td>
<td>recognised its photo on the box</td>
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</table>

**SLOW WORD LEARNING PERIOD**

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<th>word</th>
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<th>adult word used</th>
<th>age comp event</th>
<th>AoA first comp</th>
<th>sign</th>
<th>notes</th>
<th>context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where's X?</td>
<td>invitation to hide n seek</td>
<td>where's Mummy? Where's Graeme?</td>
<td>02.07.19</td>
<td></td>
<td></td>
<td>hide n seek game, recognises out of context</td>
<td></td>
</tr>
<tr>
<td>Mummy</td>
<td>hide n seek</td>
<td>where's Mummy?</td>
<td>02.07.19</td>
<td></td>
<td></td>
<td>hide n seek game, recognises out of context</td>
<td></td>
</tr>
<tr>
<td>eye/s</td>
<td></td>
<td></td>
<td>02.07.19</td>
<td></td>
<td></td>
<td>likes to touch D's eyes</td>
<td></td>
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<tr>
<td>come</td>
<td>come here, come on</td>
<td>come [here/on] Graeme always with gesture, tone of</td>
<td>02.07.19</td>
<td></td>
<td></td>
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<tr>
<td>word event</td>
<td>meaning</td>
<td>adult word used</td>
<td>age comp event</td>
<td>AoA first comp</td>
<td>sign</td>
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<tr>
<td>bye bye</td>
<td>F is leaving</td>
<td>Daddy bye bye, normal tone</td>
<td>02.07.20</td>
<td>first 2 word comp, first normal tone</td>
<td>ran after F, calling</td>
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<td></td>
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<tr>
<td>giraffe</td>
<td></td>
<td></td>
<td>02.07.20</td>
<td></td>
<td>lines up giraffe and other toy animals at ps</td>
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<td>colour</td>
<td>colour words</td>
<td></td>
<td>02.07.24</td>
<td></td>
<td>sorts beads by colour</td>
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<tr>
<td>orange</td>
<td>colour</td>
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<td>02.07.24</td>
<td>no comprehension</td>
<td>sorting leggo by colour as he threads it</td>
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<tr>
<td>orange</td>
<td>see # 69 orange fruit</td>
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<td>02.07.24</td>
<td></td>
<td>matching coloured lego, no comprehension</td>
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<tr>
<td>hold</td>
<td>hold on</td>
<td></td>
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<td></td>
<td>common instruction to G</td>
<td>teaching him to swing</td>
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<tr>
<td>painting</td>
<td>activity</td>
<td></td>
<td>02.07.26</td>
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<td>did his first painting at preschool</td>
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<td>fish</td>
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<td></td>
<td>likes the fish in the Dr's aquarium</td>
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<tr>
<td>Daddy</td>
<td>da da da</td>
<td></td>
<td>02.07.28</td>
<td></td>
<td>looked sharply over at F</td>
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<tr>
<td>banana</td>
<td></td>
<td></td>
<td>02.07.30</td>
<td></td>
<td>running for it, asked with vocalisation</td>
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<tr>
<td>string</td>
<td></td>
<td></td>
<td>02.07.30</td>
<td></td>
<td>interest in threading</td>
<td></td>
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<tr>
<td>on</td>
<td>get dressed</td>
<td>put you [clothing] on</td>
<td>02.08.00</td>
<td>earlier</td>
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<tr>
<td>hot</td>
<td>too hot to touch</td>
<td>hot! vehement intonation</td>
<td>02.08.00</td>
<td>02.08.00</td>
<td>reacted by running away from oven</td>
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<tr>
<td>look</td>
<td>look</td>
<td></td>
<td>02.08.01</td>
<td>02.08.01</td>
<td>had his head in d's lap, looked up right away</td>
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<td></td>
</tr>
<tr>
<td>this little pig game</td>
<td>this little pig went to market etc</td>
<td>02.08.01</td>
<td>G tenses through the game, squeals with delight at the end</td>
<td></td>
<td></td>
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<tr>
<td>wait a minute</td>
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<td></td>
<td>02.08.01</td>
<td></td>
<td>attending at p.s.</td>
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<tr>
<td>mouse</td>
<td>round about goes the wee mouse</td>
<td>02.08.01</td>
<td>favourite game</td>
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<td>sock/s</td>
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<td></td>
<td>02.08.06</td>
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<td>very interested in putting socks on his hands</td>
<td></td>
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<tr>
<td>box</td>
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<td></td>
<td>02.08.07</td>
<td></td>
<td>loves putting things in boxes, carrying, dumping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>word</td>
<td>meaning</td>
<td>adult word used</td>
<td>age comp event</td>
<td>AoA first comp sign</td>
<td>notes</td>
<td>context</td>
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<tr>
<td>window</td>
<td></td>
<td></td>
<td>02.08.08</td>
<td></td>
<td></td>
<td>loves to play with windows, banging on them, playing with latches</td>
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</tr>
<tr>
<td>aeroplane</td>
<td>aeroplane</td>
<td></td>
<td>02.08.09</td>
<td></td>
<td></td>
<td>looked up when D said word, hadn’t noticed sound</td>
<td></td>
</tr>
<tr>
<td>glasses</td>
<td>spectacles</td>
<td></td>
<td>02.08.09</td>
<td></td>
<td></td>
<td>F wears glasses, G intrigued by D’s sunglasses</td>
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<tr>
<td>hide n seek game</td>
<td>there you are, I see you</td>
<td>Oh hi! exaggerated intonation</td>
<td>02.08.11</td>
<td></td>
<td>pulls D to floor, pushes her head to floor, runs away, laughs when she looks up and says oh hi</td>
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<tr>
<td>kick</td>
<td>kick kick</td>
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<td>02.08.13</td>
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<td>like jump</td>
<td>D CA, G responds to kick only when he’s already been doing it, in context</td>
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<td>pool</td>
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<td>has been to swimming pools and has his own plastic pool</td>
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<td>house</td>
<td>up a bit up a bit, into wee house</td>
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<td>music</td>
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<td>likes a music box toy</td>
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<td>don’t</td>
<td>no! Don’t get in the garden.</td>
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<td>see ‘no’</td>
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<td>round/about game</td>
<td>round about game</td>
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<td>F leaving, G crying, stuck out his hand to D for game for comfort</td>
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<td>glass</td>
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<td>likes to put his pegs in an inch of water in a glass then drink the water</td>
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<td>up</td>
<td>get up, put your arm up, do you want to be picked up?</td>
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<td></td>
<td>game, G is flipped over D’s shoulder</td>
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<td>phone</td>
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<td>phone in unfamiliar place</td>
<td>listened to dial tone for 10 mins.</td>
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<td>bottle</td>
<td>ba, Daddy ba</td>
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<td>runs to get it</td>
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<td>car</td>
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<td>imitated a child pushing his toy car along the floor</td>
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<td>age comp event</td>
<td>AoA first comp</td>
<td>sign</td>
<td>notes</td>
<td>context</td>
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<td>I want it, give it to me</td>
<td>thanks</td>
<td>ta</td>
<td>02.08.19</td>
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<td>give and take game, I hold out my hand and say ta and he runs away.</td>
<td>I said ta for his object, he looked around for the one from before</td>
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<td>jump</td>
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<td>02.10.15</td>
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<td>over gen to all stuffed animals</td>
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<td>what's that called?</td>
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<td>pointed</td>
<td>NAME QUESTION SIGN</td>
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<td>Linda</td>
<td>that's Linda.</td>
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<td></td>
<td>learned spontaneously from books</td>
<td>liked pics of several kinds in different colours</td>
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<td>eye/s</td>
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<td>extended meaning to toy animals</td>
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<td>pointing to bear's mouth, and everyone's</td>
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<td>turned to look, verbal</td>
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<td>Lennie's foot, body part</td>
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<td>pointed to his tongue</td>
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<td>animal</td>
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<td>made another choice in matching</td>
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<td>recognised birds as part of set when labelled as bears</td>
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<td>responds in bed</td>
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<td>bird</td>
<td>D teaching bird/s</td>
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<td>saw birds for the first time on the ground, chased them, amazed when they flew away</td>
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<td>bear</td>
<td>animal</td>
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<td>dayglo plastic ball w minimal features</td>
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<td>G has been working on the word, and on getting G to imitate sticking it out</td>
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<td>might know</td>
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<td>cup</td>
<td>nesting/stacking cups, drinking cup</td>
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<td>02.10.20</td>
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<td></td>
<td>D teaching</td>
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<td>kiss</td>
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<td>spit</td>
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<td>02.10.20</td>
<td>02.10.20</td>
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<td>from this point on, a lot of spitting! imitates spitting, introduced to promote lip control</td>
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<td>bucket</td>
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<td>02.10.20</td>
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<td>D teaching bucket</td>
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<tr>
<td>Where's the X?</td>
<td>Q about location /identification</td>
<td>02.10.21</td>
<td>02.10.21</td>
<td>points</td>
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<td>points</td>
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<tr>
<td>G</td>
<td>where's G?</td>
<td>02.10.21</td>
<td>02.10.21</td>
<td></td>
<td></td>
<td>pointed at her</td>
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<td>02.10.21</td>
<td>02.10.21</td>
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<td>vocalization rather than word</td>
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<td>what's that?</td>
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<td>02.10.21</td>
<td>pointing</td>
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<td>mostly to get a label he already knows</td>
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<td>02.10.21</td>
<td>pointed</td>
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<td>pointed to it when asked</td>
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<td>come</td>
<td>come back Graeme</td>
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<td>02.10.21</td>
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<td>turned back from running away</td>
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<td>02.10.21</td>
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<td>in</td>
<td></td>
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<td>02.10.21</td>
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<td>put objects in box, but maybe automatically</td>
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<td>sit</td>
<td>sit vs fall or lie down</td>
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<td>02.10.22</td>
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<td>very amused at anything, including himself, falling down</td>
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<td>book</td>
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<td>touched eyes and noses of animal pics</td>
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<td>looked at books for pics, not as hinged toys for a long time, held it right side up</td>
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<td>Papa</td>
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<td>unsure in picking out photo</td>
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**VERY RAPID WORD LEARNING IN COMPREHENSION**

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<th>meaning</th>
<th>adult word used</th>
<th>age comp event</th>
<th>AoA first comp event</th>
<th>sign</th>
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<td>sheep/baa</td>
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<td>02.11.15</td>
<td>maybe earlier, on word list not diary</td>
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<td>02.11.15</td>
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<td>02.11.15?</td>
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<td>pointed to his foot</td>
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<td>remove drool</td>
<td>wipe your mouth</td>
<td>02.11.16</td>
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<td>realised this meant to remove drool not just swat</td>
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<td>confused chair, hair</td>
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<td>confusion</td>
<td>chair, pointing to it</td>
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<td>ran and got his bears to put in chair</td>
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<td>dog</td>
<td>dog's ear, eye, nose, foot, tail</td>
<td>dog's ear, eye, nose, foot, tail</td>
<td>02.11.16</td>
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<td>labelling tail, ear, eyes, nose, foot, tail</td>
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<td>go</td>
<td>waving him away</td>
<td>go get your book, bring me your book</td>
<td>02.11.16</td>
<td>maybe 'book' plus gesture</td>
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<td>waving him away. He responds and obeys</td>
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<td>02.11.16</td>
<td>pointed</td>
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<td>wanted label, highly accurate in identifying</td>
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<td>confusion</td>
<td>hair</td>
<td>02.11.16</td>
<td>pointed</td>
<td></td>
<td>pointed to ear</td>
<td></td>
</tr>
<tr>
<td>bath</td>
<td></td>
<td></td>
<td>02.11.16</td>
<td></td>
<td></td>
<td>asking for name</td>
<td></td>
</tr>
<tr>
<td>book</td>
<td>go get your book, bring me your book</td>
<td>02.11.16</td>
<td>looks at pic books for hours, wants lots of naming from them</td>
<td>went and got it</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tap</td>
<td></td>
<td></td>
<td>02.11.16</td>
<td>see 'water'</td>
<td></td>
<td>asking for name</td>
<td></td>
</tr>
<tr>
<td>pig/oink</td>
<td></td>
<td>oink</td>
<td>02.11.16</td>
<td>maybe earlier, on word list not diary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>boy</td>
<td>boy</td>
<td></td>
<td>02.11.16</td>
<td>confirmed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wipe</td>
<td>remove drool</td>
<td>wipe your mouth</td>
<td>02.11.16</td>
<td></td>
<td></td>
<td>realised this meant to remove drool not just swat</td>
<td></td>
</tr>
<tr>
<td>tail</td>
<td>all animal's tails</td>
<td></td>
<td>02.11.16</td>
<td>parents stopped calling G's poo a 'tail'</td>
<td></td>
<td>asked for names of dog's, monkey's, horses, all animal's tails in book</td>
<td></td>
</tr>
<tr>
<td>flower</td>
<td>includes leaves</td>
<td></td>
<td>02.11.16</td>
<td>02.11.16</td>
<td></td>
<td>v interested in real and pic</td>
<td></td>
</tr>
<tr>
<td>horse</td>
<td></td>
<td></td>
<td>02.11.16</td>
<td>02.11.16</td>
<td>before 2.11.16</td>
<td></td>
<td>also first time, for photo in mag</td>
</tr>
<tr>
<td>man</td>
<td></td>
<td>for farmer pic</td>
<td>02.11.16</td>
<td>02.11.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>spool</td>
<td></td>
<td></td>
<td>02.11.16</td>
<td>no precise record of comp acq</td>
<td></td>
<td>made spool necklace at school</td>
<td></td>
</tr>
<tr>
<td>word event</td>
<td>meaning</td>
<td>adult word used</td>
<td>age comp event</td>
<td>AoA first comp</td>
<td>sign</td>
<td>notes</td>
<td>context</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
<td>-----------------</td>
<td>---------------</td>
<td>----------------</td>
<td>------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>window</td>
<td></td>
<td></td>
<td>02.11.16</td>
<td></td>
<td></td>
<td></td>
<td>asking for name</td>
</tr>
<tr>
<td>music</td>
<td></td>
<td></td>
<td>02.11.16</td>
<td></td>
<td></td>
<td></td>
<td>pointed to speakers</td>
</tr>
<tr>
<td>bunny/ rabbit</td>
<td>bunny/rabbit</td>
<td>02.11.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pic, maybe</td>
</tr>
<tr>
<td>hair</td>
<td></td>
<td></td>
<td>02.11.16</td>
<td></td>
<td></td>
<td></td>
<td>lots of people commented on his long curls.</td>
</tr>
<tr>
<td>monkey</td>
<td></td>
<td></td>
<td>02.11.16</td>
<td></td>
<td></td>
<td></td>
<td>asking for labels of eye, ear, tail on monkeys</td>
</tr>
<tr>
<td>lion</td>
<td>differentiating from bear</td>
<td>02.11.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>asking for the name of his huge stylised stuffed lion</td>
</tr>
</tbody>
</table>
### Table B.3  
**SCD taxonomy for the prelinguistic period**

See Table B.4 (following) for Codes

<table>
<thead>
<tr>
<th>Age</th>
<th>Code</th>
<th>First instance of emerging behaviours</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td>00.06.00</td>
<td>Gm</td>
<td>Hands not coming to midline often, lags in gross motor, weak on left side</td>
<td>IDP</td>
</tr>
<tr>
<td>00.08.15</td>
<td>Fm</td>
<td>Pincer grasp</td>
<td>IDP</td>
</tr>
<tr>
<td>00.11.00</td>
<td>Smpl, Aut</td>
<td>Prefers to play with the brass question mark, the tray of his high chair and the top of the wicker laundry basket</td>
<td></td>
</tr>
<tr>
<td>01.00.00</td>
<td>Concept</td>
<td>Discovered electric plugs and sockets as items of great interest</td>
<td>Baby book</td>
</tr>
<tr>
<td>01.00.00</td>
<td>Im</td>
<td>Imitates pincer grasp well</td>
<td>IDP</td>
</tr>
<tr>
<td>01.00.00</td>
<td>Gm</td>
<td>Crawled 4-5 paces, assumes crawl position from sitting, hypotonic in crawl position, poor balance</td>
<td>IDP</td>
</tr>
<tr>
<td>01.01.00</td>
<td>Aut, Concept?</td>
<td>Discovered his shadow, and played with the shadow of his hand on the floor</td>
<td>Baby book</td>
</tr>
<tr>
<td>01.01.00</td>
<td>Fm</td>
<td>Easily grasps small and large objects, can hold 2 blocks</td>
<td>IDP</td>
</tr>
<tr>
<td>01.01.00</td>
<td>Sort, Fm</td>
<td>Attempts to build tower</td>
<td>IDP</td>
</tr>
<tr>
<td>01.01.00</td>
<td>Ss</td>
<td>Vocalises quite a bit with supraglottal consonants and glides, babbles <em>mama, dada</em>, not meaningfully</td>
<td>Baby book</td>
</tr>
<tr>
<td>01.01.00</td>
<td>Concept</td>
<td>Pats his mirror image</td>
<td>Baby book</td>
</tr>
<tr>
<td>01.02.00</td>
<td>Gm</td>
<td>Spending less time on his back</td>
<td>Baby book</td>
</tr>
<tr>
<td>01.02.00</td>
<td>Concept, Fm</td>
<td>Laughed hard watching F draw a picture, less mouthing and flinging of toys</td>
<td>Baby book</td>
</tr>
<tr>
<td>01.02.00</td>
<td>Smpl</td>
<td>Less mouthing and flinging of toys</td>
<td>Baby book</td>
</tr>
<tr>
<td>01.03.07</td>
<td>Aut</td>
<td>Short attention span, more interested in objects in room than new toys, frightened of new bright toys</td>
<td>IDP</td>
</tr>
<tr>
<td>01.03.07</td>
<td>Concept, Fm</td>
<td>Put objects in and out of container</td>
<td>Baby book</td>
</tr>
<tr>
<td>01.06.00</td>
<td>Smpl</td>
<td>Put each toy in his mouth</td>
<td>Baby book</td>
</tr>
<tr>
<td>01.06.00</td>
<td>Ss</td>
<td>Very few sounds</td>
<td>Baby book</td>
</tr>
<tr>
<td>02.02.00</td>
<td>Ss</td>
<td>No more babbling, vocal inflections of high pitched sounds and growling</td>
<td>My notes</td>
</tr>
<tr>
<td>02.02.00</td>
<td>Gm, sort, Im</td>
<td>Hammered the cobbler's bench for 4 hours without ceasing</td>
<td>My notes</td>
</tr>
<tr>
<td>02.02.00</td>
<td>Im</td>
<td>No vocal or motor imitation</td>
<td>CHDC assessment</td>
</tr>
<tr>
<td>02.02.00</td>
<td>Com</td>
<td>No evidence of comprehension of spoken language, under 1 yr SICD</td>
<td>CHDC assessment</td>
</tr>
<tr>
<td>02.02.00</td>
<td>Com</td>
<td>1.4.0 level for sound discrimination SICD</td>
<td>CHDC</td>
</tr>
<tr>
<td>Age</td>
<td>Code</td>
<td>First instance of emerging behaviours</td>
<td>Data source</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>02.02.00</td>
<td>Com, Aut</td>
<td>Responded better to environmental sounds than speech</td>
<td>CHDC assessment</td>
</tr>
<tr>
<td>02.02.00</td>
<td>Ja, social</td>
<td>No eye contact, no consistent relating behaviour, attended mostly to visual stimuli</td>
<td>CHDC assessment</td>
</tr>
<tr>
<td>02.02.02</td>
<td>Aut</td>
<td>Oppositional behaviour of collecting objects</td>
<td>CHDC assessment</td>
</tr>
<tr>
<td>02.02.00</td>
<td>Aut</td>
<td>Engaged in self stimulating behaviour with doorknobs and objects</td>
<td>CHDC assessment</td>
</tr>
<tr>
<td>02.02.00</td>
<td>Concept, Smpl</td>
<td>Symbolic understanding for use of key</td>
<td>CHDC assessment</td>
</tr>
<tr>
<td>02.02.02</td>
<td>Aut</td>
<td>Low tolerance for frustration</td>
<td>CHDC assessment</td>
</tr>
<tr>
<td>02.03.02</td>
<td>Rb, social</td>
<td>Knock knock come in</td>
<td>My notes</td>
</tr>
<tr>
<td>02.03.03</td>
<td>Ss</td>
<td>Pulls objects through teeth to make sounds, eg chains</td>
<td>My notes</td>
</tr>
<tr>
<td>02.03.03</td>
<td>Fm</td>
<td>Organising, brings thumb and index finger together, pincer</td>
<td>CHDC preschool</td>
</tr>
<tr>
<td>02.05.00</td>
<td>Smpl</td>
<td>Plays with one object at a time, non-relational</td>
<td>D. Ingram</td>
</tr>
<tr>
<td>02.05.00</td>
<td>Concept</td>
<td>Can’t figure out how to solve getting marbles out of jar</td>
<td>D. Ingram</td>
</tr>
<tr>
<td>02.05.00</td>
<td>Concept</td>
<td>Uses objects [chairs] and people to achieve goals</td>
<td>D. Ingram</td>
</tr>
<tr>
<td>02.05.00</td>
<td>Concept</td>
<td>No object permanence, couldn’t find object in single displacement</td>
<td>D. Ingram</td>
</tr>
<tr>
<td>02.05.16</td>
<td>Aut, motor</td>
<td>Eating problems, constant drooling, arm flapping</td>
<td>My notes</td>
</tr>
<tr>
<td>02.05.16</td>
<td>Ss</td>
<td>High pitched whine, scream</td>
<td>My notes</td>
</tr>
<tr>
<td>02.05.16</td>
<td>Com</td>
<td>Now responds to name as well as noise</td>
<td>CHDC preschool</td>
</tr>
<tr>
<td>02.05.16</td>
<td>Aut</td>
<td>Attraction to door knobs, continued</td>
<td>My notes</td>
</tr>
</tbody>
</table>
### Table B.4  The SCD list taxonomy (Table 4.14 reprinted)

<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Examples</th>
<th>Age dates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social/pragmatic ability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint attention</td>
<td>Ja</td>
<td>Played <em>ta</em>, giving and taking an object.</td>
<td>02.07.02</td>
</tr>
<tr>
<td>Relating behaviours</td>
<td>Rb</td>
<td>Notices and stares at other children; no vocalisation, smiles, or approaches.</td>
<td>02.06.05</td>
</tr>
<tr>
<td>Imitating</td>
<td>Im</td>
<td>Imitated D picking clovers, doing something he hadn't seen before.</td>
<td>02.07.06</td>
</tr>
<tr>
<td>Pointing</td>
<td>Point</td>
<td>Pointed to objects.</td>
<td>02.06.11</td>
</tr>
<tr>
<td><strong>Cognitive ability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorting</td>
<td>Sort</td>
<td>Sorts unstrung beads by colour and type.</td>
<td>02.07.24</td>
</tr>
<tr>
<td>Conceptual advances</td>
<td>Concept</td>
<td>Couldn't figure out how to turn jar over to get marbles out, frustrated.</td>
<td>02.05.29</td>
</tr>
<tr>
<td>Symbolic growth</td>
<td>Sg</td>
<td>Looks at drawings or photos of things he owns for a long time.</td>
<td>02.08.02</td>
</tr>
<tr>
<td><strong>Language</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of utterance</td>
<td>Mlu</td>
<td>Likes me to use longer MLU's, asks for more repetitions when I’ve used a sentence with 3 nouns, especially a preposition phrase.</td>
<td>03.00.10</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Com</td>
<td>Now responds to his name as well as to noise at preschool.</td>
<td>02.05.16</td>
</tr>
<tr>
<td>Babble</td>
<td>Babble</td>
<td>Answers praise, e.g. <em>good boy</em>, with babbling.</td>
<td>02.08.02</td>
</tr>
<tr>
<td>Semantic distinctions</td>
<td>Sem</td>
<td>Interested in distinctions within semantic fields, eg <em>leg, ankle, foot</em>.</td>
<td>03.00.10</td>
</tr>
<tr>
<td>Animal names and sounds</td>
<td>An</td>
<td>Intense and serious when parents make animal sound after the word. No imitation.</td>
<td>02.11.18</td>
</tr>
<tr>
<td>Colour</td>
<td>Col</td>
<td>Very curious when D labelled <em>orange</em>. He knows the word only as food, plus it was a new colour distinction from <em>red</em>.</td>
<td>03.00.07</td>
</tr>
<tr>
<td>Speech sound</td>
<td>Ss</td>
<td>The use of a speech sound in babble or in meaningful vocalisation.</td>
<td>00.06.19</td>
</tr>
<tr>
<td>Non-speech sound</td>
<td>Non ss</td>
<td>Likes slowing down and speeding up his animal sounds talking toy to distort the sound.</td>
<td>03.00.06</td>
</tr>
<tr>
<td>Category</td>
<td>Code</td>
<td>Examples</td>
<td>Age dates</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Asking for name</td>
<td>Ask</td>
<td>Reaches and points at objects with his asking noise, asking for object not its name.</td>
<td>02.09.26</td>
</tr>
<tr>
<td>Physical gesture, facial expression</td>
<td>Sign</td>
<td>New silent greeting gesture.</td>
<td>02.10.25</td>
</tr>
<tr>
<td>Intentional communication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Request for action</td>
<td>Ra</td>
<td>Asked me for round about game for comfort by pulling my hand over.</td>
<td>02.08.14</td>
</tr>
<tr>
<td>Protest</td>
<td>Protest</td>
<td>Flaps his arm laterally, crossly, when a child takes his items from his line up.</td>
<td>02.08.15</td>
</tr>
<tr>
<td>Avoiding behaviour</td>
<td>Avoid</td>
<td>Pulled F away to avoid me when I came home.</td>
<td>02.10.13</td>
</tr>
<tr>
<td>Request for object</td>
<td>Ro</td>
<td>Held out his hands as F was running water to give him a drink after he drank hot sauce.</td>
<td>02.09.04</td>
</tr>
<tr>
<td>Play</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensorimotor play</td>
<td>Smpl</td>
<td>Mastered stacking rings, graduated blocks, does not expand play.</td>
<td>02.05.16</td>
</tr>
<tr>
<td>Pretend play</td>
<td>Prpl</td>
<td>Puts toy animals in and out of train, links carriages.</td>
<td>02.09.26</td>
</tr>
<tr>
<td>Music</td>
<td>Music</td>
<td>Closes my mouth when I sing. I’m out of tune.</td>
<td>03.00.24</td>
</tr>
<tr>
<td>Autistic characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autistic characteristics</td>
<td>Aut</td>
<td>Responded better to environmental sounds than speech in testing.</td>
<td>02.02.02</td>
</tr>
<tr>
<td>Lining up</td>
<td>Lu</td>
<td>Lining up spice bottles.</td>
<td>02.05.26</td>
</tr>
<tr>
<td>Physical skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross motor</td>
<td>Gm</td>
<td>Crawled across the length of the flat</td>
<td>01.00.17</td>
</tr>
<tr>
<td>Fine motor</td>
<td>Fm</td>
<td>Stacked three blocks</td>
<td>01.06.00</td>
</tr>
</tbody>
</table>
Appendix C  Documentation for Research Ethics

Appendix C contains the letter of consent given to Graeme for his participation in this study, in accordance with the research ethics board of the University of British Columbia. It also contains his ethics certificate.

Informed Consent Form (Participant)

The Lexical Acquisition of an Autistic Child

Principal Investigator
Dr. Kenneth Reeder Ph.D., Professor
Language and Literacy Education Department (LLED), Faculty of Education, University of British Columbia
(phone number)

Co-investigator
Deborah Gibson, Graduate Student (Doctorate)
Language and Literacy Education Department (LLED), Faculty of Education, University of British Columbia
(phone number)
Research for the fulfilment of degree requirements for the Doctor of Philosophy degree. Ms. Gibson will use the data from this project for her dissertation (public document).

Purpose of the Study
The purpose of this case study is to show the development of your early word learning when you were a language-delayed child with autism.

The method of the data collection
Your mother who is a trained linguist recorded your language development daily for two and half years, ending when you were 5 years old, in 1982. These data were collected in a written journal, in audio-recordings, and in photographs. Letters from your pre-school educational assessments are also part of the data.
There are no foreseeable risks to you in this study. The expected benefits include increased knowledge about the vocabulary development of children with autism spectrum disorders.

**Confidentiality**
All information from this research will be kept strictly confidential. It is your right and your choice to have your first name included in the dissertation and in any subsequent publications, and to be acknowledged and credited with your participation in this study. You will not be identified by your surname or any current personal information in any reports of the completed study although it is not possible to maintain confidentiality in a study involving one person with such a close relationship to the researcher. The data will be discussed in a respectful manner and quoted verbatim, in the exact words that you used, in a doctoral dissertation, and in any future publications. You may review the dissertation and any publications and request the removal of any materials, statements, or photographs that you do not wish to have included.

All data records and videotapes will be kept on a password-protected computer disk or in a locked file cabinet and destroyed 5 years after the end of the study. Only the principal investigator and the co-investigator will have access to the data.

**Participation**
There will be no further active participation necessary from you. The unusual circumstances of this study are that the data were collected when you were a child and you are now an adult, giving consent for these data to be used in this study.

If you wish to withhold your consent to my use of these data, there will be no explanation necessary and no penalty or consequences of any kind.

**Remuneration**
There will be no remuneration or payment offered for your participation as a child and for your consent now.

**Contact**
If you have any questions or would like more information about this project, you may contact either Dr. Ken Reeder at (phone number) or Dr. Pat Mirenda (phone number). If you have any concerns about your rights as a research participant, you may contact the Director of the UBC Office of Research Services and Administration at (604) 822-8598.

**Consent**
I have read and understand the information in this letter. I have had an opportunity to ask questions about my participation and the nature of the study. I understand that my participation in this study is entirely voluntary and that I may withdraw my consent for the use of these data at any time. I agree to the use of these data, and to my participation in this study.
Please check ✓ below:

☐ I have received a copy of the consent form.

Please check ✓ one box below:

☐ I consent to my participation in this study and to the use of the data on my language.
☐ I do not consent to my participation in this study or to the use of the data on my language.

If you consent to participate in this study, please print your name and sign the appropriate section below.

__________________________________________               ________________

Your name (please print)                          Date

__________________________________________               ________________

Your signature                          Date