THE ACQUISITION OF CONSONANTS IN FIRST LANGUAGE DEVELOPMENT

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DOCTOR OF PHILOSOPHY IN LINGUISTICS

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I hereby declare that this thesis has not been and will not be submitted in whole or in part to another university for the award of any other degree.

Signature ……………………………………………………………….

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Dedication

To my mother, Joyce

UNIVERSITY OF SUSSEX

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This thesis reports on the longitudinal study of consonant production in fifteen typically-developing monolingual children living in the south-east of England acquiring non-rhotic accents of British English. The data relate to the consonant patterns found in spontaneous speech production as recorded in individual diaries kept by caregivers.

The study follows two lines of enquiry. Firstly, the speech data are analysed to chart the emergence of English consonants in relation to phonemic targets. Separate analysis of the production of initial and final singletons and cluster consonants is undertaken. This reveals word-position asymmetries in the production of consonants and consonant classes, and identifies the classes and the contexts in which consonants are most avoided.

Secondly, the speech data are analysed further for evidence of word-position bias in the use of the simplification processes identified in O'Neal (1998) as features of two discrete phonological profiles. Children who demonstrate tendencies towards either of these profiles in their patterns of consonant deletion, fronting, stopping and reduplication are identified, and their profiles compared and contrasted with those of other monolingual English-learning children.

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The acquisition of consonants in first language development

1. Introduction

This thesis reports on a longitudinal study of the phonological development of fifteen typically-developing, monolingual children living in the counties of East or West Sussex in the south-east of England acquiring non-rhotic varieties of British English as their first language. The research data are sourced from diaries kept by caregivers on children ranging in age from one year (1;0) to two years six months (2;6).

The study investigates two areas of phonological development:

i) The emergence of English consonants, considering:
   - The order in which consonants are produced
   - The place and manner of consonants produced
   - The differential rates of success of initial and final consonants

ii) The patterns of success and failure found in individual accounts of the production of English consonants, addressing the question of whether there is evidence of word-position bias in some children and how this is manifested in their speech.

The study fills several gaps in our understanding of early consonant acquisition in non-rhotic accents of English. Previous child language studies have not provided sufficient evidence to define typicality in the emergence of consonants and/or phonological patterns and processes. Moreover, many previous studies of consonant production in typically-developing children have begun too late to chart the earliest stages of speech, and hence the emergence of consonants. Some of these studies are shown in the following table.

Table 1.1: Studies of consonant acquisition in English-learning children after 2;0

British English	
Anthony, Bogle, Ingram and McIsaac (1971)	510 subjects – age 3;0-6;0
Dodd, Holm, Hua and Crosbie (2003)	684 subjects – age 3;0-6;11
Australian English:	
Kilminster and Laird (1978)	1756 subjects – age 3;0-9;0
Chirlian and Sharpley (1982)	1375 subjects – age 2;0-9;0
American English:	
Wellman, Case, Mengert and Bradbury (1931)	204 subjects – age 2;0-6;0
Poole (1934)	65 subjects – age 2;6-8;6
Templin (1957)	480 subjects – age 3;0-8;0
Petty (1973)	90 subjects – age 2;0-2;6
Prather, Hedrick and Kern (1975)	147 subjects – age 2;0-4;0
Arlt and Goodban (1976)	240 subjects – age 3;0-6;0
Stoel-Gammon (1987)	33 subjects – age 2;0
Haelsig and Madison (1986)	50 subjects – age 2;10-5;2
Dyson (1988)	20 subjects – 2;0-3;3
Smit, Hand, Frelinger, Bernthal and Bird (1990)	997 subjects – age 3;0-9;0
Watson and Scukanec (1997)	12 subjects – age 2;0-3;0
Porter and Hodson (2001)	520 subjects – age 2;6-8;0

Other high-profile studies (cited in Ferguson and Farwell, 1975; Donegan, 1979; Donegan and Stampe, 1979; Ingram, 1986; 1989; Johnson and Reimers, 2010) are unrepresentative of native, monolingual, English-learning children, in that the child received non-English input as well:

- Joan Velten (Velten, 1943) was exposed to three languages in the home: English, Norwegian and French.
- Hildegard Leopold (Leopold, 1939-1949b) was bilingual in English and German.
- Amahl Smith (Smith, 1973), whose target language was English Standard Pronunciation, spent the first twelve months of life in the United States of America. His mother spoke Standard Indian English; this was her fourth language after Hindi, Bengali and Marathi. Amahl experienced periods of total immersion in Indian language and culture during the four years of the study.

More precise data on typical language development are needed to inform the speech and language therapy community in order to establish the norms of phonological development. It is commonplace for studies on atypical linguistic development to use control groups of typically-developing children as the basis for their experiments, in the absence of any such data on normative behaviour.

There are remarkably few studies of consonant acquisition in non-rhotic accents of English. The overwhelming proportion of studies is of children learning rhotic varieties of American English. The absence of post-vocalic and final /r/ is the major difference. Of the British studies, the subjects of Anthony *et al*. (1971) were Scottish children acquiring, it is assumed, a rhotic accent of English. It is likely that some of these children had /x/ rather than /k/ as the target consonant for final unvoiced velars. Initial consonant /ʍ/ or cluster /hw/ for words beginning with ‘wh’ are also common to many speakers of American and Scottish English. The presence of /j/ in initial clusters in most

British varieties of English is a further contrast with the widespread dropping of /j/ in American English. Such differences do not allow direct comparisons in the use of consonants to be made between these accents of English and that of the present study.

Child language studies have tended to focus on the most common patterns and processes of phonological development (Wellman *et al.*, 1931; Williams, 1937; Jakobson, 1941/1968; Templin, 1957; Stampe, 1969; Olmsted, 1971; Ingram, 1986; Grunwell, 1981; 1982; 1987; Oller, 2000). O'Neal (1998), a case study of a typically-developing child (1;6-2;7) acquiring Standard Southern British English, questioned the uniformity, universality and exclusivity of consonantal preferences. The 1998 study on Richard (O'Neal) concluded that the child's phonological biases amounted to a set of contrary features, hereafter referred to as 'Strand B' features, which mirrored those of the more common 'Strand A' profile.

<u>Strand A</u>	<u>Strand B</u>
Emphasis on initial segments	Emphasis on final segments
Preferential use of alveolars	Preferential use of velars and bilabials
Use of word-initial stopping	Lack of word-initial stopping
Omission of final consonants	Omission of initial consonants
Use of reduplication	Lack of reduplication

The 1998 (O'Neal) study called for further investigation into the phonological development of other typically-developing monolingual learners of British English living in Sussex, to be based on the longitudinal data provided in diaries kept by their mothers.

In the following chapters:

Chapter 2 is presented in two parts. Section 2.1 reviews the literature on the theoretical aspects of consonant acquisition (2.1.1) and reviews primary research data on the consonant production of typically-developing monolingual learners of English up to the age of three years (2.1.2). The data from these studies are used to draw up typical inventories and timelines of the production of English consonants. The findings of key studies listed in Table 1.1 are considered at their starting points at the ages of 2;0 (Sander, 1972; Petty, 1973; Prather *et al.*, 1975; Dyson, 1988; Chirlian and Sharpley, 1982) or 3;0 (Wellman *et al.*, 1931; Poole, 1934; Templin, 1957; Anthony *et al.* 1971; Arlt and Goodban, 1976; Kilminster and Laird, 1978; Smit *et al.* 1990; Dodd *et al.* 2003). Particular consideration is given to studies that report typical patterns of consonant production at or before 2;0: Lewis (1936), Stoel-Gammon (1985) and O'Neal (1998). Where possible, word-position and cluster-consonant analysis is applied.

Section 2.2 discusses the evidence found for discrete Strand-A and Strand-B (O'Neal, 1998) features in children acquiring English as a first language. The focus is on the oppositions of word-initial and word-final bias, alveolar and velar preferences, and contrary sets of phonological processes. Strand-A processes are those that have been frequently cited as 'common processes' (Ingram 1986; Grunwell 1987; Oller 2000, *inter alia*). Since the kind of investigation required cannot easily be determined in a group setting, analysis is on a case-by-case basis. Two sets of three children are used to demonstrate the differences between Strand-A and Strand-B characteristics: Strand A: Mollie (Holmes, 1927), Philip (Adams 1972 cited in Ingram, 1974b; 1975; 1986) and

Jennika (Ingram 1974a; 1975; 1986); Strand B: Daniel (Menn, 1971; 1975), Richard (O'Neal, 1998) and Grace (Gerlach, 2010).

Chapter 3 addresses the methodological issues of conducting the present diary-based study. These include: a discussion of the merits of parental diary-keeping; criteria for the study; the recruitment process; the age and sex profiles of the seventeen subjects; accounts of the briefing of parents; the follow-up of queries; and the exclusion of the data on some subjects from the analysis. Copies of correspondence with diary-keepers, evidence of researcher follow-up of transcription queries and copies of a selection of original diary entries are attached as appendices.

The research data are presented in Chapter 4 in two sections. In Section 4.1, inventories of consonant production are presented and analysed at four points, continuing to the end of the period of study. As the diaries were subject to different starting dates, different starting ages, variable rates of parental record-keeping and variable rates of verbal output, in the first instance each child is assigned to one of three groups based on these factors. These groups are suspended at subsequent points of analysis. The production of initial, final and cluster consonants is shown for each child and for the cohort, together with a review of consonants that have not been produced. Some analysis of prosodic structure is included.

Section 4.2 analyses the data for evidence of Strand-A or Strand-B profiling (O'Neal 1998), drawing on the findings of Section 4.1 on individual consonant preferences and word-position bias, applying similar measures of comparison and contrast in the use of simplification processes as those applied to the

Strand-A and Strand-B children identified in Section 2.2 of Chapter 2. Three Strand-A and three Strand-B children are identified and their speech patterns further analysed.

Chapter 5 discusses the findings of the study, making reference to previous studies on consonant acquisition. Chapter 6 draws conclusions from the present study.

2. Literature review

This chapter reviews the literature on the phonological development of English consonants in two parts. Section 2.1 investigates theories that suggest a possible order to the acquisition of consonants (2.1.1) and examines primary research data on the consonant production of typically-developing monolingual learners of English up to the age of three years (2.1.2). Section 2.2 examines the claims of O'Neal 1998 of discrete patterns of consonant production based on word-position bias in the early stages of phonological development (Strands A and B). Key aspects of the consonant patterns identified in O'Neal 1998 as Strand A and Strand B are evaluated in the simplified speech of three Strand-A and three Strand-B children.

2.1 Phonological development in the first three years

This section reviews the literature on the process of consonant acquisition. Section 2.1.1 explores various theoretical aspects of phonological development as speech becomes more phonologically complex. In particular, I discuss the theories of Jakobson (1941/1968) and Kent (1992) on the order of consonant acquisition, and of Kirk and Demuth (2005) on the order of consonant clusters. Section 2.1.2 uses child language data to identify the trajectories in children's typical production of English consonants compared with age-matched peers. These data are used to provide evidence for any claims made in Section 2.1.1.

2.1.1 Theories of phonological development

Jakobson (1941/1968) claims that the order in which children "acquire" speech sounds of the language they are learning relates directly to the rate of occurrence of those in the languages of the world. Hence, nasal consonants exist in all languages and are therefore amongst the first that children produce, but nasal vowels are rare and appear after all other vowels (1968: 57). According to Jakobson, the order of consonant acquisition holds for all children learning the same language and for all languages with broadly similar phonological characteristics: "the relative chronological order of phonological acquisitions remains everywhere and at all times the same" (1968: 46). Moreover, Jakobson claims that once acquired, the articulation of a consonant is "stable in its fundamental characteristics" (1968: 46).

Rejecting the idea that the emergence of speech sounds is based on the principle of least physiological effort, "Schultze's law"[1] (1968: 21), Jakobson suggests that the child's phonological system develops according to "the principle of maximal contrast" (p. 68). The child begins with the basic contrast between a "minimal consonantismus" and a "minimal vocalismus" (Jakobson 1968: 47), for example between [m] and [ɑ] (p. 69), after which consonant classes become increasingly differentiated. Children progress to an oral/nasal consonant contrast such as between [p] and [m], followed by the labial/dental contrast as found between [p] and [t], and [m] and [n] (p. 48). The precise order in which other classes of consonants are acquired is less clear. However, Jakobson (1968: 53/67) claims that front consonants (labial and dental[2]) emerge earlier than velars, but that "many children" acquire velars shortly after "dentals" (p. 47).

Implicational universals apply to the acquisition of obstruents. The acquisition of fricatives presupposes the presence of plosives in the same place of articulation (p. 52), for example [t]/[d] before [s]/[z]. Similarly, affricates appear after fricatives "of the same series" (p. 55), for example [ʃ]/[ʒ] before

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[1] F. Schultze (1880) *Die Sprache des Kindes*.

[2] Jakobson's term for alveolar.

[tʃ]/[dʒ]. Consonants between or within a class remain merged until the relevant contrast is acquired. However, as Ferguson and Farwell (1975) later showed, there is a tendency for children without a contrast, for example with [b] but not [p] word initially, to lexically deselect and therefore not attempt words with initial /p/ (pp. 433–434).

Moreover, although the range of languages used by Jakobson (1968) is large, the number of subjects in the cross-linguistic studies is extremely limited and he includes data from non-monolingual children in support of his theory. For example, bilingual Hildegard (Leopold 1939) is used as an example of an English-learning child.[3] Jakobson uses the speech of one monolingual English child, 'K', in Lewis (1936) (reviewed in Section 2.1.2.1) to show the order in which some fricative classes are produced, citing K's production of "*s*-sounds" before the "corresponding" (word-initial) interdental fricatives (Jakobson 1968: 61). However, Jakobson fails to further differentiate fricatives in terms of articulatory place, particularly between word-initial labial and alveolar fricatives.

Ferguson and Farwell (1975) used 'phone trees' to illustrate the word-initial consonant production of two monolingual children in the first fifty words, in which they show that [f] is amongst the first English fricatives produced (1975: 426–427). This was also demonstrated by K, who produced [f] before [s] (Lewis 1936). Ferguson and Farwell's (1975) study further highlights Jakobson's (1968) failure to "predict" the use of [k] as well as [b] and [d] in early English speech, and his underestimation of the acquisition of [h] and the use of the semivowels particularly as consonant substitutes (1975: 435). Furthermore, it

[3] Ferguson and Farwell (1975) also use Hildegard as an example of a child learning English but, in contrast to Jakobson, they acknowledge her bilingualism.

was found that the production of plosives was not consistent and that one child (T) produced words with her favourite sounds, [s], [z] and the affricates, in preference to words with plosives (p. 436). Thus, Ferguson and Farwell's study (1975) challenges Jakobson's claim that the acquisition of consonants and consonant classes is strictly chronological by demonstrating that consonant production in early words can be subject to articulatory variation, reversal and individual preference.

Kent (1992) adopts an entirely different approach to that of Jakobson, suggesting that children's early phonological output is governed by universal constraints of a biological nature. The onset of speech typically occurs at a time when the child's articulatory system is still developing, making it unlikely that the full range of consonants can be produced in the earliest stages of speech. Kent (1992), in a theory suggestive of "Schultze's law" (Jakobson 1968: 21) claims that "ethological" factors (p. 65) act as constraints on immature articulatory systems to the extent that they affect the order of consonant output.

Kent's prediction of the order in which English consonants are "mastered" is based on Sander (1972; reviewed in 2.1.2.2). Kent relates the four age bands of "by three years", "four years" "six years" and "beyond six years" to four sets of consonants of increasing complexity. Complexity is defined in terms of the higher levels of "motoric adjustments" required for sets of consonants to be produced.

Set One: /p h m n w/

Set Two: /b d k g f j/

Set Three: /t ŋ r l/

Set Four: /s z ʃ v θ ð ʒ ʧ ʤ/

(Kent 1992: 74-75)

Sander's criteria for mastery of a consonant required consonant production in at least two word positions by at least 90 per cent of children. Notwithstanding the difficulties in articulating the most complex English consonants described by Kent (1992), it has been shown that some consonants are produced considerably earlier in some word or syllable contexts than in others.

A data-heavy study by Robb and Bleile (1994) presents several challenges to Kent's claims. Their longitudinal research into the vocalisations of seven children aged 0;8 to 2;2, based on a corpus of 8484 syllable-initial and 2707 syllable-final consonant phones, demonstrated significant differences in the ability of infants to produce initial and final consonants. Consonants were included in monthly inventories if they were produced at least twice in the same syllable position and within the same recording sample and these levels of performance applied to least 60 per cent of the children. These data therefore demonstrate consonant tendencies that occur naturally, without the phonological constraints of specific word targets.

The three infants that cooperated sufficiently to be assessed at 0;8 produced five syllable-initial consonants: [t], [d], [k], [h] and [m], and three syllable-final consonants: [t], [h] and [m], suggesting an implicational relationship between them. Moreover, the presence of [t] in both inventories does not endorse

Kent's classification of /t/ as a Set-3 consonant and the last plosive to be acquired, thus pinpointing medial [t] as the most likely source of weakness of /t/ in Sander's 1972 analysis. At 2;1, the now complete cohort of seven children produced fifteen initial consonants: [p], [b], [t], [d], [k], [g], [f], [s], [ʃ], [h], [ʤ], [m], [n], [w] and [j], and eleven final consonants: [p], [t], [d], [k], [f], [s], [h], [m], [n], [l] and [r]; at 2;0, there had been just four final consonants: [t] [k], [n] and [s], indicating the later production of many final consonants. Only nine consonants [p], [t], [d], [k], [f], [s], [h], [m] and [n] were in both inventories at 2;1, demonstrating significant asymmetry in the production of initial and final consonants (Robb and Bleile 1994: 300-301).

Some English consonants were not produced in any observation. [v], [θ], [ð], [ʒ], [ʧ], [ŋ] and [r] are absent from all syllable-initial inventories, and [b], [g], [v], [θ], [ð], [z], [ʃ], [ʒ], [ʧ], [ʤ] and [ŋ] are absent from all syllable-final inventories, further highlighting the differential rates and patterns in the production of initial and final consonants. The fact that it is predominantly fricatives and predominantly Set-4 consonants that do not appear in any monthly inventory, [v], [θ], [ð], [ʒ], [ʧ] and [ŋ], lends partial support to Kent (1992), although, in the absence of any word targets with these consonants, the children may have simply lacked the motivation to produce them. However, the Set-4 fricative [s] first appears in initial position at 1;7 and appears twelve times in syllable-final inventories, on the first occasion at 0;10 (Robb and Bleile 1994: 300-301. This demonstrates that there is no impediment to the production of [s] on purely articulatory grounds and suggests that it is more likely to be produced in word-final position than in word-initial position.

Edwards' 1978 study of six typically-developing children also found that word-final fricatives were produced before word-initial fricatives (cited in Kirk and Demuth, 2005: 725), although Stoel-Gammon (1975) suggests that [f] is an exception (p. 507). Nevertheless, on the basis of previous research by Olmsted (1971), Ferguson (1973) and Oller (1973), Kent (1981) claims that final fricatives as a class of consonants are produced more frequently in early speech than final plosives (p. 118), implying that there are not only inherent asymmetries between initial plosives and final fricatives but also between initial plosives and final plosives. Kent and Bauer (1985) also suggest that fricatives are better suited to syllable-final positions (p. 518), citing Patrick's extensive use of final [ʃ] (by 1;6) to support this (Waterson 1971). Moreover, children's ability to produce final fricatives before the age of 2;0 is well attested, not only in English but also in German (Elsen 1991: 60-67; Grijzenhout and Joppen(-Hellwig) 1998; 2002). Holmes (1927), Menn (1971) and Klein (2008: 473) show that it is not uncommon for typically-developing children acquiring English to have produced final [s] and [z] before the age of 2;0.

By contrast, some fricatives, such as /v/ and /z/ occur relatively infrequently in word-initial positions in English. Ingram (1988) claims that the late appearance of word-initial [v] in English is not a consequence of its articulatory difficulty but of its lack of phonological prominence within the language, citing the cases of children acquiring Swedish, Estonian and Bulgarian, for whom initial /v/ was phonologically significant and who produced it relatively early. The lack of opportunity of English-learning children to attempt initial [v] and initial [z] in spontaneous speech presents a problem when assessing their articulatory ability to produce them.

Jakobson (1968) and Kent (1992) do not address the production of consonants within clusters, which have been shown to operate under different phonotactic constraints from those pertaining to consonant singletons. Kirk and Demuth (2005), for example, showed that two-year-olds could produce [s] in both initial and final clusters and [z] in final clusters. Greenlee (1974) suggests a series of stages for the acquisition of clusters: Stage 1, deletion of the entire cluster; Stage 2, cluster reduction to one consonant; Stage 3, consonant substitution of one of the targets; Stage 4, realisation of cluster targets. Ohala (1999) suggests that typical patterns in the reduction of initial clusters (Greenlee's Stage 1) are those that create the greatest consonantal differences in terms of sonority.

McLeod, van Doorn and Reed (2001b) found the following general trends in the development of clusters, based on their study of Australian two- to three-year-olds: cluster development is gradual; word-final clusters appear before word-initial clusters; plosive clusters appear before fricative clusters; biconsonantal clusters are produced before triconsonantal clusters; word-initial clusters are more likely to consist of non-standard combinations, such as [fw] (Stage 3 of Greenlee, 1974), (found also in Kirk, 2008); cluster reduction is common, but the incidence of reduction diminishes over time; the most common word-final clusters are nasals, [nd], [nt] and [ŋk].

Kirk and Demuth (2005) conducted a study which compared the success rates of initial and final consonant clusters of twelve English-learning children aged from 1;5 to 2;7. The results in descending order of accuracy are as follows:-

1) word-final – Nasal + /z/

2) word-final – Plosive + /s/

3) word-final – Nasal + Plosive

4) word-initial – Plosive + /l/

5) word-initial – /s/ + Plosive

6) word-final – /s/ + Plosive

7) word-initial – /s/ + Nasal

8) word-initial – Plosive + /ɹ/

Kirk and Demuth (2005: 719)

These findings confirm that word-final clusters are produced earlier and with greater accuracy than initial clusters, with the exception of word-final /s/ + plosive cluster (6). The final cluster nasal + /z/ was produced by the most children (1), not the nasal + plosive (3) found in McLeod *et al*. (2001b), although the different elicitation techniques might account for this. The final nasal + /z/ cluster (1), at 85 per cent, contrasts sharply with the initial /s/ + nasal cluster at 33 per cent (7). However, Kirk and Demuth's claim that initial plosive + /l/ clusters (4) are generally produced before plosive + /r/ (8) is contrary to Vihman and Greenlee (1987) who found that cluster reduction of consonant+/l/ clusters persisted longer than reduction of consonant+/r/.

Prosodic structures also increase in complexity over the course of acquisition. In the early stages of phonological development, utterances are reduced to basic, manageable syllabic shapes, typically consonant-vowel (CV), CVC and CVCV. CV sequences are common in "canonical babbling" (Oller 2000: 11). Locke's (1986) study of the vocalisation patterns of infants raised in fifteen different linguistic environments demonstrates the wide use of [b], [m], [d] and

[n], and also [p] and [h] (as in Set-1/2 consonants in Kent, 1992). Redford, MacNeilage and Davis's 1997 study of 721 CVC samples produced in canonical babbling showed that whilst there was a strong tendency for the final segment to harmonise with the place of articulation of the initial consonant, particularly if the consonant was /m/, /n/, /d/ or /b/, more fricative, nasal and voiceless consonants were produced in final position (as in Robb and Bleile 1994, this section). Given the correspondence between consonants produced in babbling and in early speech found in Vihman, Ferguson and Elbert (1986: 16-17), these findings provide further evidence of asymmetries in the production of word-initial and word-final consonants (see also Edwards 1978, Olmsted 1971, Ferguson 1973, Oller 1973, and Kent and Bauer 1985).

Branigan (1976) claimed that consonants are produced first in CV syllables and that this is a universal constraint. This was based on the study of one child, whose first single words were produced at 1;4 and who did not begin to produce CVC syllables for a further three months. Demuth (1995) suggests an order to the developmental stages of rhythmic structure in English. Four stages are proposed: Stage 1, core syllables - CV with no vowel-length distinctions; Stage 2, minimal words/binary feet - CVCV; CVC; CVV; Stage 3, prosodic words - larger than a binary foot; Stage 4 prosodic words - target form (Demuth, 1995: 14-17). This owes much to Fikkert (1994), who also proposes four stages, in which Stage-1 consonants are always plosives. However, as Vihman *et al.* (1986) suggests, the order of consonants produced in early words cannot be ascertained without continuous monitoring of consonant production during the preceding period of babbling, which is beyond the remit of this study.

Furthermore, the predicted patterns of Fikkert (1994) and Demuth (1995) do not take into account the asymmetry between plosives and fricatives acknowledged by Edwards (1978) and Kent (1981), which “argues against the primacy of CV syllables for all consonants” (Kent 1981: 118). Moreover, Netsell (1981) includes VC and VCV as examples of “natural” “fundamental phonetic units” of infants’ speech capability (p. 153). In line with the finding that word-final clusters generally appear earlier and with greater frequency than word-initial clusters (McLeod *et al.* (2001a;b), Paul and Jennings (1992) and Dodd (1995) demonstrated that the CVCC syllable appears before CCVC in monosyllabic words (cited in McLeod *et al.* 2001a).

The studies reviewed have highlighted the asymmetries in the production of initial and final singletons in early speech, in which /m/ and voiced plosives are favoured in syllable-initial position and voiceless plosives and fricatives /f/ and /s/ are favoured in final position. Further asymmetries have been demonstrated in the production of consonant singletons and clusters. Final clusters are generally produced before initial clusters, but initial singletons are produced before and with greater frequency than final singletons. Given these contrary patterns, the production of singleton and cluster consonants are differentiated where possible in the remainder of this chapter and throughout Chapter 4.

2.1.2 <u>Consonant production in the first three years</u>

This section reviews primary research studies into the phonological development of English-learning children, including those acquiring rhotic accents. Where possible, word-initial, word-final and cluster consonant production is analysed separately and the development of prosodic structure considered. These data can provide evidence for or against the theoretical positions presented in Section 2.1.1 and to provide benchmarks for the new data that are introduced and analysed in Chapter 4.

Historically, two key methods have been used to chart the emergence of consonants in children learning English. One way is to monitor the phonological progress of individual or small groups of children longitudinally (e.g. in Lewis, 1936; Stoel-Gammon, 1985; Dyson, 1988; Watson and Scukanec, 1997; O'Neal, 1998). Because of the heavy workload and attention to detail that this entails, this method is best suited to case studies in which continuous assessment of spontaneous speech is feasible.

The second method is primarily synchronic, in that the successful production of consonants between groups of children is measured, generally, at a given age. However, some studies include a quasi-longitudinal element, testing different cohorts over a period of time. This method is most commonly used in large-scale, cross-sectional studies (e.g. Wellman *et al.*, 1931; Poole, 1934; Templin, 1957; Anthony *et al.*, 1971; 1973; Prather *et al.*, 1975; Arlt and Goodban, 1975; Kilminster and Laird, 1978; Chirlian and Sharpley, 1982; Smit *et al.*, 1990; Dodd *et al.*, 2003), where monitoring of individual children is impossible. The small-scale studies of Dyson (1988) and Watson and Scukanec (1997) are exceptions. Most studies on children from the age of 2;0 ask children to name pictures and/or objects, which facilitates comparisons of the articulation of specific sounds within and between age-matched cohorts.

In larger-scale studies, acquisition of a consonant is measured by the percentage of children that have produced it correctly (Wellman *et al.*, 1931; Poole, 1934; Templin, 1957; Sander, 1972; Petty, 1973; Prather *et al.*, 1975;

Kilminster and Laird, 1978; Stoel-Gammon, 1985; Dodd *et al.*, 2003). In some studies, acquisition of a consonant is qualified by the number of times (Kilminster and Laird, 1978; Watson and Scukanec, 1997) or the number of word positions in which it has been found (Wellman *et al.*, 1931; Poole, 1934; Templin, 1957; Sander, 1972; Petty, 1973).

The majority of studies reviewed here acknowledge asymmetry in the production of consonants in different word positions (Wellman *et al.*, 1931; Poole, 1934; Templin, 1957; Anthony *et al.*, 1971; Sander, 1972; Arlt and Goodban, 1976; Kilminster and Laird, 1978; Chirlian and Sharpley, 1982). Studies by Prather *et al.* (1975); Stoel-Gammon (1985); Dyson (1988); Smit *et al.* (1990); Watson and Scukanec (1997) and Dodd *et al.* (2003) specifically highlight differences in the articulation patterns of initial and final consonants. Many studies include supplementary assessment of the acquisition of consonants in relation to their place and/or manner of articulation (Lewis, 1936; Templin, 1957; Stoel-Gammon, 1985; Dodd *et al.*, 2003).

Direct comparisons between the findings of these studies are problematical owing to the array of research and assessment criteria used. Many of the studies on phonological development extend well into the school years. The following review considers only research findings on monolingual, typically-developing, English-learning children up to, or around, the age of three (3;0).

2.1.2.1 The emergence of consonants before the age of 2;0

This section assesses the findings of research begun when the subjects are at or below the age of 1;6. The studies are examined in the order of the chronological age of subjects at the commencement of the period of study: 0;9

(Lewis, 1936), 1;3 (Stoel-Gammon, 1985) and 1;6 (O'Neal, 1998). The speech data in these studies provide age-related comparisons with those of the children of the present study.

Lewis (1936)

Lewis (1936) compares the early phonological development of three children: two girls, one acquiring German and the other French, and 'K', a typically-developing boy born in 1929 (p. 3) acquiring British English. A particular focus of the study is the relationship between consonants and their place of articulation, and the dominance of "front" (bilabial and dental) consonants in the earliest inventories (0;9 to 1;1) of all three languages. K's consonant production and error patterns were observed for a two-year period, from 0;9 to 3;0.

Lewis monitored the production of K's consonants as they emerged in "conventional words" (p. 178), from which the following order was established:

1.	0;9	[m]	13.	1;8	[ʃ]
2.	0;10	[p]	14.	1;8	[l]
3.	1;0	[b][n]	15.	1;9	[s]
5.	1;1	[d]	16.	1;9	[v] (in substitution)
6.	1;4	[k]	17.	1;10	[r]
7.	1;4	[h]	18.	1;11	[w]
8.	1;5	[f]	19.	1;11	[ʒ] (in substitution)
9.	1;5	[t]	20.	2;0	[z]
10.	1;6	[g]	21.	2;0	[θ]
11.	1;7	[j]	22.	2;4	[ð]
12.	1;7	[ŋ]			

(Lewis 1936: 178)

The inventory shows that all K's consonants produced before the age of 1;4, the first five, are bilabial or alveolar, and plosive or nasal: [p], [b], [d], [m] and [n]. ([w] is missing at this point and is not produced until 1;11.) Voiceless back consonants [k] (first used in *cake* [kæke]) and [h] are followed by the first anterior fricative, [f], and the two remaining plosives, [t] and [g] by 1;6, by which age [k] has been produced in all word positions. [ŋ] first appears in a medial-/ŋk/ cluster. The data show that K produced all the consonants of Southern British English by 2;4. Despite their absence in Lewis's inventory (p. 178), K articulated both affricates successfully within the timeframe in *jar* at 1;6 and in *chip* and *picture* at 1;10 (pp. 298-299). Conversely, Lewis counted K's use of [v] and [vr] as initial substitutes in *walk* and *frock*, and [ʒ] as substitute for final /z/ in *nose*, in his order of emerging consonants. This left target fricatives /v/, /z/, /θ/ /ð/ and /ʒ/ still to be produced before K's second birthday, but as [v] and [ʒ] had been produced as substitutes, only [z], [θ] and [ð] had yet to be articulated. As indicated in the inventory, all these consonants were produced by 2;4.

K had not yet achieved mastery of the consonants assigned to his inventory, however. Although [m] > [p] > [n] > [d] > [b] > [k] had all been produced as initial consonants up to 1;4, most also as medial consonants, the first final consonant, [k], does not appear until 1;5. The next final consonant to appear is [n] at 1;8, eight months after the first production of [n] as an initial consonant. Even in the same word position, articulation of consonants could be variable. Initial [r], articulated in *rain* at 1;9, could not be produced at 2;3 in *Roger*. At 2;0, [v] was found in *stove* but not in *of*. Articulation of [s] in *six* and *sleep* [si:] at 1;9 could not be reproduced in *soap*, *pussy* or *nice* at 1;11-2;0, all [ʃ]. K was systematic in his use of [ʃ] as substitute for initial /s/ and some medial and final /s/-segments between 2;1 and 2;3 (pp. 323–325). Initial fricative deletion is reported in only one instance, in *here you are* at 1;7. Conversely, two early words are produced as consonant-only utterances in *fire* [fff] at 1;5 and *shoe-shoe* [ʃʃ] at 1;8 (p. 298).

Few clusters were produced before the age of 2;0. The first was medial, in *uncle* at 1;7. No initial clusters matched their adult targets until [θr] in *throw* at 2;0, although *three* remained [fri:]. Lewis showed that elision of approximants in initial clusters was common in all three children (English, French and German) (p. 174) and that in 89 per cent of all cases of initial-cluster reduction the child has already proved their ability to produce the consonants as singletons (p. 175). K's first final cluster to emerge was [ts] in *blankets* [bæŋkets] at 2;0. The first [z] was final, in *matches*, also at 2;0. [ŋ] did not appear word finally until 2;1. [ð] was produced at 2;4 in two words, *there* [ðær] and *with* [við] (pp. 298–301). K therefore demonstrates that, as suggested by Netsell (1981: 151), a child can produce all the consonants of English by around the age of two if measured on the basis of their production at least once.

In Section 2.1.1, it was shown that Jakobson 1941/1968 uses K in support of his claims for the universal and predetermined order of emerging English consonants. The order in which K's consonants appeared is contrary to several of Jakobson's claims, however. The example that Jakobson (1968: 61) uses is K's production of "s-sounds" (alveolar fricatives) before either of the interdentals word initially (Lewis 1936: 178). However, Jakobson failed to observe that K does not adhere to two of Jakobson's own principles: that alveolar [s]/[z] appear before postalveolar [ʃ]/[ʒ], and fricatives [ʃ]/[ʒ] appear before affricates [ʧ]/[ʤ] (1968: 52–55).

K's produces the affricate [ʤ] word initially at 1;6 in *jar*, before initial [ʃ] in *shoe* at 1;8, both of which precede initial [s] in *six* at 1;9. Word-final affricate [ʤ] in *porridge* appears simultaneously with [ʃ] and [ʒ] (both substitutes) and [s] at 1;11, but all of these final consonants precede word-final alveolar [z] at 2;0 (Lewis 1936: 298–9). The production of both affricates in the first words in which they appear as targets, *jar* and *chip*, also refutes Jakobson's claim that "before the child acquires affricates, he substitutes either corresponding stops or fricatives for them" (1968: 56). A further refuted claim is that, in a language consisting of two liquids, the production of the second liquid is considerably later than the first (1968: 57/60). This is contradicted by K's first production of both [l] in *lavatory* and [r] in *rain* at 1;10 (Lewis 1936: 299). The order in which K's consonants emerge therefore provide little support for Jakobson (1968), except possibly at the earliest points of the inventory when only initial [m], [p], [b] and [n] are produced, although K's early articulatory patterns also support the claims of Kent (1992).

Stoel-Gammon (1985)

Stoel-Gammon (1985) reports on a longitudinal study of 33 American English-learning infants living in Seattle. (The children were later subjects in Stoel-Gammon 1987, presented as a single cohort at the age of 2;0.) Speech samples were collected at three-monthly intervals and analysed according to word-initial and word-final inventorial differences. The data were further analysed according to the age of "onset of meaningful speech", defined as "production of at least 10 identifiable word types (i.e. different words) during the hourlong recording session" (Stoel-Gammon 1985: 506). Children were placed in groups according to this criterion. Seven children formed Group A, having reached this stage by the age of 1;3, and were tested at 1;6, 1;9 and 2;0. For the twelve children in Group B and the thirteen in Group C, testing began at 1;6 and 1;9 respectively.

The data demonstrate that Group A continued to outperform their age-matched peers throughout the period of investigation, particularly in the production of initial [k] and [g] and of final consonants. No final consonants were reported at 1;3 for Group A or for Group C at 1;9 (the earliest sampling for either group) because none met the minimum requirement of production by 50 per cent of subjects. The following tables of initial and final consonants (Tables 2.1 and 2.2) chart the emergence of phones that meet this criterion, sounds produced by 90 per cent are marked *:

Table 2.1 Initial consonant production by Groups A, B and C from 1;3 to 2;0

Group	A	A	B	A	B	C	A	B	C
Age	1;3	1;6	1;6	1;9	1;9	1;9	2;0	2;0	2;0
p				✓					
b	✓*	✓*	✓*	✓*	✓*	✓	✓	✓*	✓
t		✓		✓	✓		✓	✓*	✓
d	✓*	✓*	✓*	✓*	✓*	✓	✓*	✓*	✓*
k		✓		✓			✓*	✓	
g		✓		✓			✓		✓
f				✓			✓	✓	
v									
θ									
ð									
s							✓	✓	✓
z									
ʃ									
h	✓	✓	✓	✓	✓*		✓	✓*	✓
ʧ									
ʤ									
m		✓	✓	✓*	✓		✓*	✓	✓
n		✓	✓	✓	✓		✓	✓	✓
w		✓		✓	✓		✓	✓	
l									
r									
j							✓		
	3	9	5	11	7	2	12	10	8

There is a high degree of conformity in the order in which initial phones emerge, particularly in the case of [b], [d], [h], [m], [n] and [t] and to a lesser extent, [k], [g] and [w], [f] and [s]. These eleven sounds plus [j] are the only consonants produced with sufficient frequency to appear in the initial inventories of any of the groups over the period of study from 1;3 to 2;0.

[h] is found in all initial inventories with the exception of Group C's debut session at 1;9, which features only [b] and [d]. But [b] and [d] predominate, as they are found in all the inventories of every group and in at least 90 per cent of subjects in Groups A and B, except for [b] in Group A's last inventory which has twelve consonants. Initial nasals [m] and [n] were produced by all the groups. They appear together in the inventories of Groups A and B for the first time at 1;6 and were produced in every subsequent session. They appear in Group C's inventory at 2;0. [m] reached the 90 per cent threshold in Group A at 1;9 and 2;0.

Initial [t] is not found in the first inventory of any group but is present in every inventory thereafter. Its presence is weaker than for [b], [d], [h], [m] or [n], and it appears above the 90 per cent threshold only for Group B at 2;0. The velar plosives and [w] appear as second-wave initial consonants because they are not as well represented in the initial inventories as are [b], [d], [t], [h], [m] and [n]. Initial [k] and [g] are shown at the minimum level in Group A in the three later sessions, and initial [g] in Group C's final session. Curiously, [g] is not found in any of inventories for Group B, although [k] emerges at 2;0. Group A is the only cohort to have both velar plosives in their initial inventories, [k], at 2;0, reaching the higher threshold of 90 per cent participation. [w] is produced by at least 50 per cent of subjects in Groups A and B in the two later sessions. Neither of the glides appears in Group C's initial inventories. Initial [j] is added only to the inventory of the most phonologically-advanced cohort (Group A) at 2;0.

The full complement of initial bilabials is found only in Group A's inventory at 1;9, which is also the only inventory in which [p] is present, thus identifying [p] not only as the weakest consonant of this class but also of plosives, word initially. [w] does not achieve the levels of production of either [b] or [m]: [m] and [w] are added to Group A's inventory at 1;6 but [m] outperforms [w] at 1;9 and 2;0, at the higher (90 per cent) rate. Furthermore, [m] precedes [w] in Group B. Group C produces [m] but not [w]. (Note that [w] emerged late in K's (Lewis, 1936) inventory at the age of 1;11.)

Initial [d] is produced by at least 90 per cent of children in every group except for Group C at 1;9. [t] appears in Group A at 1;6, in Group B at 1;9 and in Group C at 2;0. A similar sequence is seen in the production of the other alveolars, [n] and [s], in which the nasal takes priority. [n] appears at 1;6 in Group, at 1;9 in Group B and at 2;0 in Group C, but [s] does not emerge until 2;0, when it is produced by all the groups.

The findings suggest that [f] and/or [s] are the most likely candidates to enter the inventory of initial fricatives after [h]. For Group A, [h] at 1;3 and 1;6 is followed by [h] and [f] at 1;9, and [h], [f] and [s] at 2;0. For Group B, the process is less gradual: [h] at 1;6 and 1;9 and [h], [f] and [s] at 2;0. In Group C, [h] and [s] are both added at 2;0. Initial [s] was therefore added to the inventories of all three groups at 2;0, but all three fricatives were produced only by Groups A and B, the groups with [h] already in their inventories. Robb and Bleile (1994) observed the simultaneous entries of initial [f] and [s] in the inventory at 1;7. However, using elicitation techniques to test the production of initial fricatives (excluding /h/) and affricates in children from 1;6, Ingram, Christensen, Veach and Webster (1980) found that initial [f] was “the earliest acquired sound by far” (p. 188).

Table 2.2: Final consonant production by Groups A, B and C from 1;3 to 2;0

Group	–	A	B	A	B	A	B	C
Age	1;3	1;6	1;6	1;9	1;9	2;0	2;0	2;0
p				✓	✓	✓	✓	✓
b								
t		✓	✓	✓*	✓	✓*	✓*	✓*
d								
k		✓		✓	✓	✓*	✓	✓
g								
f								
v								
θ								
ð								
s						✓	✓	
z								
ʃ								
ʒ								
ʧ								
ʤ								
m							✓	
n				✓*	✓	✓	✓*	✓
ŋ						✓		
l								
r				✓		✓*	✓	
	0	2	1	5	4	7	7	4

Stoel-Gammon 1985: 507)

The inventories of final consonants are smaller and start later than those of initial consonants for all groups. Table 2.2 shows that no final consonant was produced by at least 50 per cent of any group at 1;3. Furthermore, there are significant differences in the individual levels of final consonant production within the groups. No final consonants are produced by some children in Groups A and B at 1;6 or in Group C at 1;9. Inventory size at 2;0 ranges from one consonant in Group C to eleven in Group A.

All final plosives in the inventories are voiceless, in order of frequency these are: [t] > [k] > [p]. Final [t] is present in all the inventories, and reaches the 90 per cent threshold in Group A at 1;9 and 2;0, and in Groups B and C at 2;0. [k] is found in all inventories except Group B at 1;6, where [t] is the only final consonant. Final [k] is produced by 90 per cent of Group A at 2;0. Final [p] does not achieve the higher level of participation in any inventory and does not appear before 1;9. (In Vihman *et al.* 1986, [p] is the most common final consonant at the 15-point stage, produced in words by five of the seven children.) Final voiced plosives /b/ and /d/ are absent from all the inventories of the 33 children (Stoel-Gammon 1985: 511).

Nasals are second to plosives in frequency. [n] is the only final consonant to appear in all groups, and the only non-plosive consonant in Group C's only inventory of final consonants at 2;0. For groups A and B, [n] is the first nasal to be added at 1;9, remaining in the inventories of both groups at 2;0. Table 2.2 shows that [n] reaches 90 per cent in Group A's inventory at 1;9 and Group B's at 2;0. Group A favours [ŋ] and Group B [m] to join [n] in the inventories at 2;0.

[s] is the only final fricative produced above the 50 per cent threshold; it is found only in the inventories of Groups A and B at 2;0. The final rhotic is found in Group A's inventories at 1;9 and 2;0 and in Group B's inventory at 2;0. It reaches the higher threshold of 90 per cent in Group A's final session. Analysis of the antecedence patterns of the 21 children that produced initial and final /r/ during this period shows that the articulation of final /r/ preceded that of initial /r/ in the ratio 20:1 (p. 511).

O’Neal (1998)

O’Neal (1998) is the case study of Richard, a monolingual English child, whose speech data are analysed in seven stages from 1;6 to 2;7. The first set of data from the study consists of the 37 words that were present in his working vocabulary at that time. There had been no earlier attempts to record his articulations, although it had been noted by the author that Richard’s first entirely spontaneous word was *up* [ʌp], produced at the age of 0;10. A spurt in the production of previously unarticulated consonants and consonant combinations occurred in Stage 4, around the time of his second birthday, coinciding with a lexical spurt and the onset of continuous speech production. After this, monitoring focussed on the articulation of outstanding consonants and clusters, mispronunciations, and the pronunciation of words that had previously been subject to error.

In Stage 1, at 1;6, fourteen consonants were produced. This included all the plosives, fricatives [f], [s], [ʃ] and [ʒ], nasals [m] and [n], and glides [w] and [j]. Two clusters were produced, [st] in *pasta*, and [kj] in the reduction of *thank you* to [kju:]. [p] was the only consonant found in all word positions, but [t], [k], [g], [m] and [n] were in use in both initial and final positions. [k] was articulated the most, followed by [p]. All utterances were monosyllables, except *pasta*.

The nine initial and nine final consonants were produced in the following orders of frequency:

Initial [k] > [p b m] > [g] > [t d n w]

Final [k] > [p t n] > [s] > [g f ʃ m]

Initial /f ð h ʧ ʤ j/ were avoided. Initial /v θ s z ʃ ʒ l ɹ/ were not targets. Final /θ z l/ were avoided. Final /b d v ð ʒ ʧ ʤ ŋ/ were not targets.

By the end of the final stage at 2;7, all consonant singleton targets had been articulated, with the exception of /θ/, and medial /ð/ and /ʒ/; but some clusters had yet to appear. Twenty-two initial and 29 final clusters had been produced, but initial /pl/, /bl/, /kl/, /gl/, /fl/ and /θɹ/, and final /ðz/ remained unattained. Tables 2.3 and 2.4 provide longitudinal analyses of ages and stages at which Richard first produced initial consonants, final consonants and consonant clusters.

Table 2.3: Richard's initial and final consonant inventories (O'Neal 1998)

Stage	Age	Initial consonants produced/added
1	1;6	[p] [b] [t] [d] [k] [g] [m] [n] [w]
2	1;7–1;8	[f]
3	1;9–1;10	[ɹ]
4	1;11–2;0	[ð] [s] [h] [ʧ] [ʤ] [l] [j]
5	2;1–2;2	–
6	2;3–2;5	[v] [ʃ]
7	2;6–2;7	[z]

Stage	Age	Final consonants produced/added
1	1;6	[p] [t] [k] [g] [f] [s] [ʃ] [m] [n]
2	1;7–1;8	[d] [z] [ʧ]
3	1;9–1;10	[l]
4	1;11–2;0	[b] [ʤ] [ŋ]
5	2;1–2;2	[v]
6	2;3–2;5	–
7	2;6–2;7	–

Table 2.4: Richard's initial and final consonant cluster inventories (O'Neal 1998)

Stage	Age	Initial clusters produced (22)
1	1;6	–
2	1;7–1;8	–
3	1;9–1;10	–
4	1;11–2;0	[pɹ] [bɹ] [tɹ] [dɹ]
5	2;1–2;2	[sk]
6	2;3–2;5	[kw] [fɹ] [hj] [nj] [sp] [st] [sm] [sn] [skɹ]
7	2;6–2;7	[tw] [tj] [kɹ] [gɹ] [sl] [stɹ] [stj] [skw]

Stage	Age	Final clusters produced (29)
1	1;6	–
2	1;7–1;8	[ps] [ts] [ks] [nd] [nʧ] [ld]
3	1;9–1;10	[ns] [ŋk]
4	1;11–2;0	[pt] [dz] [gz] [vz] [sp] [st] [ʃt] [mp] [mz] [nt] [nʒ] [nʤ] [lk] [lz] [nts] [ŋks]
5	2;1–2;2	[ŋz]
6	2;3–2;5	[ft]
7	2;6–2;7	[lp] [lt] [lv]

These data further suggest that most consonant singletons and some clusters appear in the phonologies of typically-developing learners of English by the age of 2;2, the age at which the diary on Amahl (Smith 1973) and several of the studies listed in Table 1.1 begin. The findings also demonstrate that the order in which Richard's consonants were produced corresponds with the data of other studies into the early stages of phonological development in English in the following key respects: 1. The order in which initial consonants appear favours bilabials, nasals and plosives, although from the outset velar plosives are more secure and more versatile than alveolar plosives in Richard's case. Initial [ɹ] is not amongst the first, and [v] and [z] are amongst the last initial consonants to be produced. 2. The order in which final consonants appear favours voiceless plosives and fricatives, with the exception of /θ/. [b] is typically the last voiced plosive to be produced (Richard's Stage 4). 3. The interdentals and [ʤ] are amongst the last consonants to be produced in any word position. Richard achieves limited success with initial /ð/ from Stage 4, but he avoids /θ/ in all contexts. /θ/ is the only consonant that he does not produce. 4. Final clusters appear before initial clusters. (Richard begins to produce final clusters in Stage 2, but initial clusters not until Stage 4.) 5. The liquids in initial obstruent-liquid clusters are prone to deletion; Richard's initial C+/ɹ/ clusters are more accessible than C+/l/ clusters. 6. The velar cluster [ŋk] is often one of the first clusters to be produced medially and/or finally.

Richard uses a range of syllabic structures in his Stage-1 utterances at 1;6: CVV, CVC, CVVC, CVCCV; VV, VC and VVC, but neither CV nor CVCV. None of the CVV syllables is the result of final compensatory lengthening of the previous vowel, and two vowel-initial words, *erm* and *up,* are realised correctly as [ɜːm] and [ʌp]. This pronunciation of *up* is the same as was noted at 0;10 (see above), thus undermining the claims of Fikkert (1994) and Demuth (1995), also disputed by Grijzenhout and Joppen (1998), that a child's earliest words are necessarily produced within the constraints of consonant-initial "core syllables", and that CV will always appear before VC. Patrick (Waterson 1978) also produced VC words, *up* [ʌp] and *Anne* [æn], as well as CV and CVC, in the earliest stage of observation, 0;10.14 to 1;2.21 (p. 420). By 2;7, Richard's words were maximally quadrisyllabic and utterances were generally faithful to their target rhythmic structures, apart from the occasional use of weak syllable deletion.

2.1.2.2 The emergence of consonants between the ages of 2;0 and 3;0

Several of the medium- or large-scale studies begin at or after 2;0, some extending well into the school years. These are largely cross-sectional studies with different cohorts across the various designated ages, which are presented in terms of the percentage of children achieving phonological targets. The data from these studies are examined with a view to drawing up consonant inventories typically produced at 2;0, between 2;0 and (in the studies reviewed in this section) 3;3, and at 3;0 (2.1.2.3), which incorporate any incremental progression of consonant production achieved in earlier stages of speech. The studies are reviewed in chronological order of publication: Sander (1972); Petty (1973); Prather *et al.* (1975); Chirlian and Sharpley (1982); Dyson (1988) and Watson and Scukanec (1997).

Sander (1972) does not provide any primary research evidence, but is reviewed here because of its influence over subsequent studies into consonant acquisition. Sander reassessed the research of Wellman *et al.* (1931), Poole (1934) and Templin (1957) (see Section 2.1.2.3) in a critique that focussed on the youngest age at which consonants are consistently produced in the acquisition of American English. He suggested that the process of consonant acquisition can be assumed to be underway if the child achieves a measure of 'customary production', the age at which the sound is produced more often than it is deleted or substituted (1972: 56) in two of three possible word positions. Applying these measures to the findings of the earlier studies, and incorporating Wellman *et al.*'s (1931) data on fifteen two-year-old children, Sander designed a bar chart, novel at the time, to represent the temporal period of acquisition of 24 English consonants (Sander 1972: 62).[4] Sander suggested that the bar chart was a “tentative” (1972: 60) guide to consonant acquisition. The starting-point for the continuum of each consonant was calculated by applying Sander’s criteria to the combined test averages of Wellman *et al.* (1931), Poole (1934) and Templin (1957), whose youngest subjects were aged 2;0, 2;6 and 3;0, respectively. The bar for each consonant extends to the age at which 90 per cent of children were found to be successful. This constitutes Sander’s redefinition of the age at which ‘mastery’ of a consonant is achieved (1972: 57).

Six consonants with a combined average of more than 70 per cent accuracy at the age of 2;0 were considered to have been customarily produced before the age of 2;0. These are /p/, /b/, /h/, /m/, /n/ and /w/. This chimes broadly with the data on the later stages of Stoel-Gammon (1985), and Robb and Bleile (1994) in the production of word/syllable-initial [b], [h], [m], [n], [w] and word/syllable-final [p]. Sander further analysed the data to show the children’s rate of production of word-initial consonants (word-final [ŋ]; word-medial [ʒ]). The results are shown in descending order up to the age of 3;0.

Before 2;0: [n] 100% > [b] 93% > [p h m] 87% > [w] 79%

At 2;0: [d] 87% > [t] 80% > [k] 66% > [ŋ] 60% > [g] 57%

At 3;0: [f] 88% >[s j] 70% > [l] 67% > [r] 58%

(Sander 1972: 61)

On Sander’s chart, the age of production of /b/ by 90 per cent of children (shown as the upper limit on the continuum) is 4;0, a year later than for /p/,

[4] Only ten of Wellman *et al.*’s two-year-olds were tested on all consonants in three positions (Stoel-Gammon, 1987: 323) however, and only six children on all sounds (Prather *et al.*, 1975: 179).

/h/, /m/, /n/ or /w/, the five consonants on the first of Kent's (1992) four levels of complexity (Set 1). Sander indicates a two-year period for the acquisition of /k/, /g/ and /d/ from 2;0 to 4;0, and a four-year period for /t/ and /ŋ/ from 2;0 to 6;0. As shown above, initial [d] and [t] achieve high rates of production at 2;0, but /d/ and /t/ are excluded from the first wave of consonants mastered. It is assumed that this is because the two-of-three word-position criterion is breached. Certainly, low articulation rates of medial /t/ in American children has been reported in Templin (1957), and the low rates of production of final voiced plosives shown to be typical in Stoel-Gammon (1985) would account for Sander's downgrading of both /d/ and /b/.

Sander (1972) shows /f/ and /j/ as having a later, but shorter, period of development from 2;6 to 4;0, which brings forward the lower limit shown above as 3;0, after the data have been adjusted for progress made between 2;0 and 3;0. The average age of customary production (at least 51 per cent of subjects) for /s/, /l/ and /r/ remains at 3;0, with the upper limit for /l/ and /r/ set at 6;0. A period of five years, from 3;0 to 8;0, is suggested between the 51- and 90- per-cent levels for /s/. According to Sander, /v/, /ð/ and /z/ are also not mastered until 8;0, and /ʒ/ beyond this age. The average age of customary production of: /ʃ/, /ʧ/ and/z/ is 3;6; /v/ and /ʤ/ is 4;0; /θ/ is 4;6; /ð/ is 5;0 and /ʒ/ is 6;0. Consonants not reaching minimum levels of production before 3;0 are:

/v θ ð z ʃ ʧ ʤ/

Petty (1973)

Petty used Sander's (1972) 51 and 90 per cent measures of consonant production in her cross-sectional study of 90 Texan children aged 2;0 and 2;6 acquiring American English. The subjects were all monolingual, Caucasian, only children, living with both parents. Two aspects of Petty's remit were to find any differences in consonant production between the sexes, and between children from different socio-economic backgrounds. Phonological targets consisted of 24 consonants, excluding /ʒ/ but including /ʍ/, and eleven initial consonant clusters elicited from pictures. All the plosives, both affricates, both liquids, /m/ and /n/, and all fricatives except /h/ and /ð/ were tested in initial, medial and final word positions. (Final /ð/ was not included.) Eleven initial clusters were also tested: /bl/, /br/, /dr/, /fl/, /kl/, /kr/, /pl/, /skw/, /sl/, /st/ and /tr/.

As in Sander, assignment of a consonant to an age level was judged on the basis of the correct articulation in two of three possible word positions. Fifteen girls and 15 boys were tested within one month of their second birthday; 30 girls and 30 boys were tested within one month of 2;6.

At 2;0, the following eleven consonants are produced by at least 51 per cent of the children (in descending order): [h], [w], [p k g], [t], [f m], [b n] [d]. [ʃ] is produced above the minimum level only by boys, at 60 per cent. [h] and [w] are produced by all the girls, 93 per cent of whom also produce [p]. All the boys produce [h] and 97 per cent produce [w]. At 2;0, [h] is therefore the only consonant found in the inventory of all subjects. [d] is the weakest plosive overall, produced by less than 51 per cent of girls, and its appearance in the inventory is therefore based entirely on its production by 73 per cent of boys.

(Compare Prather *et al.*'s (1975) inventory at 2;0 in which [d] at 58 per cent is absent from the inventory because of the 75 per cent criterion.) Velar [k] and [g] are produced by more children than either of the alveolars or [b]. The production of initial [f] at a rate of over 50 per cent confirms the findings of Stoel-Gammon (1985), and supports the findings of Ferguson and Farwell (1975) and Ingram *et al.* (1980).

The consonant inventory at 2;6 shows that fourteen consonants and one cluster are produced by at least 51 per cent of children. In descending order, these are: [h], [p], [b t], [m w], [k], [n], [g f], [d], [ʧ], [ʃ], [ʤ] and initial [st].

At 2;6, the four bilabials are amongst the six sounds produced by the most children. The girls use [s], [l] and [r] at rates of 67, 60 and 53 per cent, respectively. Fewer than half the boys produced any of these consonants. [d] and [ʃ], above the 51 per cent threshold only for boys at 2;0, are now above this level for both sexes. There is consolidation after 2;0 in the production of plosives. By 2;6, [p], [b] and [t] are above the 90 per cent level for girls and boys, and [k] is above this rate for girls. [g] has maintained the same average, but with the sex differentials reversed; girls are now at 87 per cent to boys' 80 per cent. Overall, production remains lower for [n] than [m]. Both affricates have been added to the inventory, in both cases at higher rates for girls. The initial cluster [st] is included in the inventory because it is produced by 57 per cent of girls.

Consonants not reaching minimum level of production at 2;0 or at 2;6 are:

/v θ ð z ŋ j/

Prather, Hedrick and Kern (1975)

Prather *et al*. (1975) studied 147 Seattle children acquiring American English between 2;0 and 4;0. Testing of initial and final consonants was conducted. The subjects were placed into seven age groups of 21 children at four-monthly intervals from 2;0 to 4;0. The children's ages were within one month on either side of the age group to which they had been assigned. The groups were controlled for social factors, race, sex and monolingualism, although Prather *et al*.'s methodology has been criticised for elicitation procedures that failed to generate data on more than half the children in the youngest age group at 2;0. (Stoel-Gammon 1987: 323-324).

The research criteria stipulated the correct articulation of both initial and final consonants, where possible, by a minimum of 75 per cent of the cohort responding to the stimuli. The results of this analysis show that [p], [h], [m], [n] and [ŋ] meet the criteria at 2;0 (Prather *et al*. 1975: 184). However, the study differentiates the production of initial and final consonants (p. 183). Shown below are the inventories for all initial and final consonants tested at 2;0, 2;4, 2;8 and 3;0 that achieved a minimum level of 75 per cent production. Percentages are based on the number of responding subjects (Prather *et al*., 1975: 183). Sounds produced in at least 90 per cent of cases are marked *

Inventory of initial consonants at 2;0 (10): [p b* t k g] [h] [m n*] [w* j].
Initial [b] and [w] are produced by all respondents. All the bilabials are present in the inventory. [b] is by far the strongest initial plosive, but it is also the plosive with the largest margin between its 100 per cent rate of production and the 33 per cent rate of its final counterpart by the same number of respondents (9). Initial [d] is produced by only 58 per cent of respondents and

falls far short of the 75 per cent criterion (cf. Petty 1973). Initial [k] and [g] are produced in similar numbers (cf. Petty 1973). [s] and [ʃ] are produced by 50 per cent of respondents, the lower threshold of some studies, but [f] is produced by 67 per cent. [j] is confirmed as the second initial approximant (Stoel-Gammon, 1985), but note that Sander (1972) suggests 2;6 as the starting point for the development of [j], although Prather *et al.*'s (1975) response rate for initial [j] is extremely low (4/21). Initial [l] stands at 38 per cent, [r] at 9 per cent, the lowest production rate of any initial sound. Initial [m] and [n] achieve similar percentages (cf. Petty, 1973; Stoel-Gammon, 1985): [n] at 91 per cent and [m] at 89 per cent.

Inventory of initial consonants at 2;4 (11): [p* b* t d k* g*] [f h*] [m* n*] [j].
At 2;4, initial [g], [h] and [m] reach a 100 per cent rate of production, making [g] the strongest initial plosive. [d] and [f] have been added to the inventory since 2;0, after a dramatic rise in their levels of production from 58 per cent to 86 per cent for [d] and 67 per cent to 80 per cent for [f]. There has been a rapid rate of increase for initial [s], now at 71 per cent, and for [z], which at 2;0 could be articulated by only 25 per cent of children, produced by 58 per cent. The velar plosives and the nasals remain closely matched. All are now above the 90 per cent threshold. The bilabial plosives are on 93 per cent, as is [k], and the alveolar plosives trail at 86 per cent. Initial [w] has fallen from 100 per cent to just below the lower threshold, and now stands at 73 per cent. [j] remains in the inventory.

Inventory of initial consonants at 2;8 (12): [p* b* t* d k* g*] [f h*] [m* n*] [w j*].
At 2;8, there has been little change in the inventory of initial consonants, but nine of its twelve consonants are now used by over 90 per cent of respondents.

[d] and [f] (which were added at 2;4) and [w] (reinstated by the 2;8 cohort) are the only consonants below this level. [h] is the only consonant with 100 per cent production. [d] remains the weakest initial plosive at 84 per cent. [k] and [g] remain closely matched. [m] and [n] reclaim their parity at 94 per cent.

Inventory of initial consonants at 3;0 (13): [p* b* t* d* k* g*] [f s* h*] [m* n*] [w j*]. By 3;0, there has been further consolidation of production. The nine initial consonants produced by at least 90 per cent of respondents in the 2;8 cohort are produced by the 3;0 cohort with the addition of [d] now in the upper range at 94 per cent. Initial [s] appears in the inventory for the first time at 90 per cent. Eight initial consonants achieve 100 per cent: [p], [t], [k], [g], [h], [m], [n] and [j]. Note that [b] and [d], identified by Stoel-Gammon (1985) as being the first initial consonants produced, are not included in this group, but that [j] is firmly established a year earlier than suggested by Sander (1972).

For all consonants, the number of children responding to the stimuli has increased steadily since the age of 2;0. At 3;0, initial [s] has the most respondents, 20 of the 21 in the cohort. The number of children responding has doubled since 2;0. Initial [ʃ] and [l] are close to meeting the minimum requirement, at 72 per cent. Both initial affricates are on the rise, [ʧ] is produced by 69 per cent, and [ʤ] by 59 per cent, of respondents.

The following consonants did not reach the minimum requirement for inclusion in any inventory of initial singletons between 2;0 and 3;0:

/v θ ð z ʃ ʧ ʤ l r/

Inventory of final consonants at 2;0 (5): [p]* [f] [m n* ŋ*]. At 2;0, the number of final consonants is half that of initial consonants, although [p] and [ŋ] are produced by all respondents. [p] is the only plosive in the inventory. This does not concur with Stoel-Gammon (1985) who suggests the primacy of [t] and [k] in the emergence of final consonants. Nasals outperform every other class: [ŋ] 100% > [n] 90% > [m] 75%. [f] is the first final fricative to appear (as in Stoel-Gammon, 1985).

Inventory of final consonants at 2;4 (9): [p* d* k g] [f s] [m n* ŋ]. By 2;4, the inventory of final consonants has almost doubled in size since 2;0 (cf. Robb and Bleile, 1994), although [n] is now the only consonant to achieve 100 per cent, replacing [ŋ] as the most produced final nasal. [p] is joined by the first voiced plosives, [d] and [g], both with 50 per cent more respondents than at 2;0, and in the case of [g] with a production rate that has doubled. Final [k] is also added to the inventory with 86 per cent; [t] remains just below the threshold at 73 per cent.

Inventory of final consonants at 2;8 (11): [p* b t* k*] [f v s] [m* n* ŋ] [r].
At 2;8, final [m] and [n] achieve 100 per cent, although [n] has more respondents. [b] has made the final inventory with production at 75 per cent, but reversals on the 2;4 rates for [d] and [g] are found in the 2;8 cohort. All voiceless plosives are present in the inventory and are produced by at least 90 per cent of respondents. Final [t] is still behind [k] and [p], which stand at 94 per cent. Final [v] is the first voiced fricative to be included, reaching the minimum level of 75 per cent. Final [r] enters the inventory with a rate of 84 per cent, preceding final [l] and outperforming initial [r] (as in Stoel-Gammon,

1985; Sander, 1972; Petty, 1973; Arlt and Goodban, 1976; Smit *et al.*, 1990), currently with a rate of 39 per cent.

Inventory of final consonants at 3;0 (13): [p* b* t d* k* g] [f* s] [m* n* ŋ*] [l r]. The inventory of final consonants is dominated by plosives and nasals, with [p], [k], [m] and [n] achieving 100 per cent although both liquids are now also present. Final [l] has been added to the inventory having been produced by 77 per cent of respondents, but still lags behind final [r] at 89 per cent. The differential has increased still further between the rates for initial and final [r], as in initial position it remains at the 2;8 level of 39 per cent. The nasals are still the strongest consonant class of manner; [ŋ] is the weakest final nasal at 94 per cent. Final [b] and [d] also have a response rate of 94 per cent, which represents significant progress since the age of 2;0, especially for [b]. Alveolar [t] is the weakest final plosive, produced by 82 per cent of respondents. Velar [g] is the weakest voiced plosive produced by 89 per cent. [f] is the first final fricative to exceed the higher threshold of 90 per cent. Meanwhile, [v] has reverted to its 2;4 rate of 50 per cent and is no longer in the inventory.

The following consonants did not meet the minimum requirement for inclusion in any inventory of final singletons between 2;0 and 3;0:

/θ ð z ʃ ʧ ʤ/

At 3;0, the inventories consist of an equal number of initial and final consonants. There is parity between initial and final positions of: [ʧ] at 69 per cent, [b] at 94 per cent, [d] at 95 per cent, and [p], [k], [m] and [n] at 100 per cent. Conversely, /θ/, /ð/, /z/, /ʃ/, /ʧ/ and /ʤ/ are not found in any initial or final inventory between 2;0 and 3;0.

Chirlian and Sharpley (1982)

This Australian study used a total of 1375 subjects, a small number of whom were Aboriginal. It replicated Kilminster and Laird (1978) (cited in Section 2.1.2.3) in every respect, except for the lower age limit of 2;0.

The age range of the study is 2;0 to 9;0, of which only the findings of the children tested at 2;0, 2;6 and 3;0 are considered here. There is no indication of how many children were allocated to each age group, but male and female results are differentiated. As in Prather *et al.* (1975) and Kilminster and Laird (1978), the criteria required that 75 per cent of children produce the correct sound in all possible word positions, although Chirlian and Sharpley do not provide detailed word-position analysis. Unlike Prather *et al.* (1975) however, Chirlian and Sharpley (1982) do not apply the 75-per-cent measure only to children responding to the elicitation procedures; instead they include all subjects in the analyses, as in Templin (1957), Arlt and Goodban (1976) and Kilminster and Laird (1978) who all studied children with a minimum age of 3;0. The two inventories shown are the result of two different methods of data analysis.

At 2;0, [m] and [n] are the only consonants to be produced in all word positions by at least 75 per cent of all subjects. [g] and [h] are produced by 75 per cent of girls. However, the inventory of consonants produced by at least 75 per cent of subjects when production is averaged out across all word positions is as follows: [b g] [h] [m n ŋ]. Therefore, the inventory at 2;0 is minimal when the 75 per cent requirement applies to all possible word positions. When the criterion is applied to the average percentage in all word positions, the inventory starts to resemble those found in Sander (1972), Petty (1973) and Prather *et al.* (1975). This demonstrates the dominance of nasals, and the presence of [h] and voiced plosives [b] and [g], but not of [d] (as in Petty, 1973; Prather *et al.*, 1975), sounds that indicate a high proportion of initial consonants (see Prather *et al.*, 1975; Stoel-Gammon, 1985). However, as /ŋ/ is included in the inventory, some non-initial phones are represented.

At 2;6, [d] and [ŋ] are produced by at least 75 per cent of subjects in all word positions. Consonants [p], [t], [k] and [w] are only produced by a minimum of 75 per cent of girls. Consonants produced by at least 75 per cent of subjects, with production in all word positions averaged and including previous acquisitions at age 2;0 are: [p b t d k g] [h] [m n ŋ] [w].

The study's remit was to find the earliest age at which children reached the criteria, similar to the starting point of Sander's (1972) continuum. Assuming the continued use of consonants that met the criteria at 2;0, the data show that by 2;6 at least 75 per cent of the children use all the plosives, all the nasals, all the bilabials and [h]. Four of the five consonants added are plosives, [p], [t], [d] and [k]; the fifth consonant is [w].

At 3;0, [f], [ʃ] and [j] are produced by at least 75 per cent of all subjects in all possible word positions, but [p], [b], [k], [g], [h] and [w] applies only to boys. Consonants produced by at least 75 per cent of subjects at 3;0, with production in all word positions averaged (including previous acquisitions) are: [p b t d k g] [f ʃ h] [m n ŋ] [w j] (Chirlian and Sharpley 1982: 26-28). By 3;0, the inventory consists of fourteen consonants: all the plosives, nasals and bilabials, both glides and three voiceless fricatives. (As before, continued use of consonants is assumed.) A second approximant, [j], has been added, and fricatives [f] and [ʃ] have joined [h], although the inventory does not include [s].

Chirlian and Sharpley's data are not differentiated for word position, and therefore any asymmetrical patterns of consonant production can only be gleaned from Chirlian and Sharpley's explanatory notes on their tables. From these, disparities in the production of [b], at least, can be identified. It is clear that the delay in meeting the required standard for inclusion of [b] in the first inventories at 2;0 and 2;6 (above) is due to its low rates of production in final position, a pattern that is well documented in this review. The tables show that the minimum requirement is met by boys at 3;0 and by girls at 3;6 in the use of [b] in all three word positions, but the notes explain that the sound reaches the 75 per cent criterion by the age of 2;0 for both sexes if initial and medial [b] only are taken into account (p. 26). However, [b] meets the 75 per cent criterion when production in all three positions is averaged (p. 28), as shown in the inventories from 2;0 (above), suggesting that high levels of production in other word positions compensate for low use of final [b].

The following consonants did not meet Chirlian and Sharpley's criteria for inclusion in any inventory between 2;0 and 3;0:

/v θ ð s z ʧ ʤ l r/

Dyson (1988)

Dyson's data are the product of semi-longitudinal research on two groups of ten children acquiring American English. Spontaneous speech samples were collected during play sessions in which 36 key words were the primary focus, although each session generated an average of 134 words per child.

Consonants were assigned to an inventory on the basis of the correct articulation in at least two lexical items by at least half the group. An intermediate 'transitional' stage was introduced that applied using less stringent measures. Consonants were assigned to an inventory if the phone was used twice by 4/10 children or once by 6/10 or more.

The younger group was tested at average ages of 2;0 and 2;5, the older group at 2;9 and 3;3. The inventory of fourteen initial consonants produced at 2;0 and 2;5 by the younger group and by the older group at 2;9 is the same for all three groups:

[p b t d k g] [f s h] [m n] [w l j]

The inventories show that the full complement of plosives and bilabials, both initial nasals, both glides, fricatives [f], [s] and [h], and the lateral are present in the initial inventories of both groups in both sessions. Initial [ʧ] is transitional for the younger group at both observations. The non-standard affricate [ʦ], and [ʃ] are transitional for the younger group at 2;0. The inclusion of the non-standard initial cluster [fw] at 2;0 is the only difference in the inventories of initial consonants of the younger group.

Initial consonants that are not found in the inventories of either group are: /v θ ð z ʃ ʧ ʤ/, although [ʧ] is transitional in the younger group, and [ʃ] is transitional at 2;0, 2;9 and 3;3. At 3;3, the older group adds initial [r] to complete the production of approximants; [r] is transitional from 2;5.

The inventories of final consonants are subject to greater change and expansion throughout the year than those of initial consonants. The inventory of final consonants of the younger group at 2;0 consists of ten consonants:

[p t d k] [f s ʃ] [ʧ] [m n]

At 2;5, the inventory is the same except for the addition of [ŋ] and the cluster [ts]. Final [b] is absent from all inventories and does not appear as a transitional consonant at any observation. [ts] is the only final cluster to meet the full requirements of production by at least five children in at least two words. Many final clusters are in transition between 2;0 and 3;0, but they are more evenly distributed between the groups and across the sessions than initial clusters, although the older group produces more. [ŋk] is found at all ages; [ps] at 2;5, 2;9, 3;3; [nʧ] at 2;5, 3;3; [nts] at 2;9; [ns] at 3;3.

Final consonants /b/, /g/, /θ/, /ð/, /ʤ/ and /l/ are not found in the inventories of either group, although [g] is a transitional consonant in both sessions of both groups.

Considering Dyson's data overall, it has been shown that the relatively low requirements of the study's criteria in the assignment of consonants is reflected in the enhanced size of the inventories. At 2;0, these are the same as, and in some cases larger than, those found at 3;0 in other studies. [p], [f], [s], [m] and [n] appear in the initial and final inventories of both groups in both sessions. However, /θ/, /ð/ and /ʤ/ are not found in the inventories of either group.

Watson and Scukanec (1997)

Watson and Scukanec (1997) report on a longitudinal study of eleven girls and one boy acquiring American English between the ages of 2;0 and 3;0. They investigated not only the production, accuracy and error patterns of consonants including those in clusters, but also syllable shapes and mean lengths of utterances. Speech data consist of 450 words for each child, taken at three-monthly intervals and extracted from recordings of their spontaneous utterances during play sessions with parents. The lexical items analysed were the first 50 different words appearing in the first recording session at 2;0, and the first 100 different words in the four subsequent sessions at 2;3, 2;6, 2;9 and 3;0. Compilation of the phonetic inventories at each of these stages was made on the basis of a consonant being produced by at least seven of the children in two different lexical items, and by at least six of the children in two different words for consonant clusters, although it was not a requirement that the sound should match the target phoneme.

The inventory of initial consonants at 2;0 consists of eleven consonants: [p b t d k] [s h] [m n] [w j]. This includes all bilabials, both initial nasals and both glides. All plosives are present except /g/. [s] and [h] are the only fricatives. By 2;3, the inventory of initial consonants has risen to fourteen: [p b t d k g] [f s h] [m n] [w l j]. [g] has been added to the inventory to complete the plosives. [l] is the first initial liquid. [f] joins [h] and [s] to become the third fricative. The combination of initial [f], [s] and [h] has also been observed in Stoel-Gammon (1985) at 2;0 and in Dyson (1988) from 2;0.

At 2;6, only one consonant singleton is added to the previous inventory, the first affricate, [tʃ]. At 2;9, the inventory of initial consonant singletons is the same as at 2;6, so that the inventories at 2;6 and 2;9 consist of fifteen consonants: [p b t d k g] [f s h] [ʧ] [m n] [w l j]. At 2;6, the first initial clusters appear, [pw] and [bw], which are substitutions for /pl/ and /bl/ (cf. [fw] and [bw] in Dyson, 1988). Initial clusters [pw] and [bw] are repeated at 2;9, but [pl] now reaches criteria.

At 3;0, two more consonants enter the inventory, bringing the total of initial consonants to seventeen: [p b t d k g] [f ð s h] [ʧ] [m n] [w l r j]. [ð] has been added, the first voiced fricative for this cohort, and the first dental fricative recorded in any of the studies under review, except in the case studies of Lewis (1936) and O'Neal (1998). All approximants are present with the addition of [r] (as in Dyson, 1988 at 3;3). All initial alveolars are present except /z/. At 3;0, all initial clusters are legal: [pl] is repeated; [st] and [sp] are added to the inventory.

The following consonants are absent from all the inventories of initial singletons: /v θ z ʃ ʤ/.

There are seven consonants in the inventory of final consonants at 2;0: [p t k] [s z] [m n]. All plosives are voiceless, as found in Stoel-Gammon (1985) and as for Dyson's (1988) older group at 2;9. The only fricatives are alveolar. The velar nasal is absent. At 2;3, the number of consonants in the inventory remains at seven. [d] has taken the place of [k], leaving no velars. Five of the seven consonants are alveolar; two are bilabial. The fricatives and nasals are unchanged.

At 2;6, there are ten final consonant singletons in the inventory: [p t d k] [s z] [m n] [l r]. [k] has returned so that all voiceless plosives are present, but [d] remains the only voiced plosive. Both liquids are added, increasing the dominance of alveolar consonants. The fricatives and nasals are unchanged from those found at 2;0. Final clusters [nd] and [ts] appear. (Recall that [nd] and [ts] are in the first batch of Richard's (O'Neal 1998) final clusters, and that [ts] is K's (Lewis 1936) first final cluster, as also found in Dyson (1988).)

At 2;9, the velar nasal is added, bringing the total of final consonants to eleven: [p t d k] [s z] [m n ŋ] [l r]. The 3;0 inventory is the same as the 2;9 inventory for final consonant singletons. However, the number of final clusters increases at 2;9 and at 3;0, in both cases repeating the success of [ts] and [nd]. There are four final clusters in the inventory at 2;9: [nd] [ts] [nt] [nz]. At 3;0, this is increased to six: [nd] [ts] [nt] [nz] [st] [ŋk]. Therefore, all final clusters include a nasal, [t] or [s], and all except [ŋk] are alveolar.

The following consonants are absent from all the inventories of final singletons: /b g f v θ ð ʃ ʧ ʤ/. The fricatives, /v/, /θ/ and /ʃ/, and the affricate /ʤ/ are not included in any of the inventories.

The data show that accuracy in the production of consonants increases with age. At 2;0, the percentage of consonants produced correctly ranges from 53 to 91. There is a significant improvement in the rate of accuracy after 2;3 (51–91); at 2;6 ranging from 61 to 94 per cent, at 2;9 from 63 to 96 per cent, and by 3;0 from 73 to 99 per cent (Watson and Scukanec 1997: 7).

Watson and Scukanec's (1997) additional survey of the syllabic structures used by the children (pp. 11–12) showed that at 2;0 the most common word shapes were CVC followed by CV. Together, these two represented over half of all word shapes. Only 12 per cent of word shapes were CVCV. There were twice as many CVCC as CCVC syllables, demonstrating the higher incidence of final cluster production, although the number of both CVCC and CCVC was small. By the age of 3;0, the number of CVC syllables had risen to 35 per cent, having reached a peak at 2;9. The greatest difference found was in the decline of the CV syllable between 2;0 and 3;0, from 27 to 14 per cent.

Summary of the emergence of consonants between 2;0 and 3;0

The studies reviewed here used a variety of methods and criteria in order to assess consonant development between 2;0 and 3;0. The number of subjects ranges from twelve in Watson and Scukanec (1997) to 1375 in Chirlian and Sharpley (1982). In Prather *et al.* (1975), Dyson (1988) and Watson and Scukanec (1997) the size of the sample was consistent across all age groups, but the distribution in Chirlian and Sharpley is unknown. Girls and boys are differentiated in Petty (1973) and Chirlian and Sharpley (1982). Prather *et al.*'s (1975) data is based only on the children that responded to the elicitation tasks. The number of responses to each consonant and the number of respondents at each age level varies widely. A criterion of production in all word positions is imposed in Chirlian and Sharpley (1982); in Sander (1972) and Petty (1973) it is two of three. Prather *et al.*'s (1975: 184) criterion was production in both initial and final positions in their comparisons with Wellman *et al.* (1931), Poole (1934) and Templin (1957) (Section 2.1.2.3). The criterion for the minimum rate of production is 50 per cent in Dyson (1988), 51 per cent in Sander (1972) and Petty (1973), and 75 per cent in Prather *et al.* (1975) and

Chirlian and Sharpley (1982). In Watson and Scukanec (1997), the minimum rate of consonants produced correctly ranges from 51 at 2;3 to 73 per cent at 3;0. Sander (1972), Petty (1973) and Prather *et al*. (1975) identify initial and final consonants that reach an upper threshold of 90 per cent production. Petty (1973), Dyson (1988) and Watson and Scukanec (1997) provide additional analysis of the production of consonant clusters.

Despite the challenges in attempting to find common ground between the studies, a number of patterns and configurations in the development of consonants emerge from the data that signify some consensus. All the studies have a point of testing at 2;0, although the number of children contributing to the data is smaller than in later or older age groups.

Tables 2.5, 2.6 and 2.7 show the progress of children between the age of 2;0 and the final stage of testing around the age of 3;0, according to the original studies' individual remits and criteria. Petty's (1973) final age of testing is 2;6, Dyson's is 3;3. (/ʒ/ is not included in the tables because it was excluded from testing in some studies and is absent from the inventories of all others.) Table 2.5 provides an overall assessment of consonant acquisition, across all word positions in studies where there is no differentiation of initial and final consonants: Sander (1972); Petty (1973); Chirlian and Sharpley (1982).

Table 2.5: Consonant production assessed across all word positions

Overall	Sander	Petty	Ch & Sh	Sander	Petty	Ch & Sh	Sander	Ch & Sh
	2;0	2;0	2;0	2;6	2;6	2;6	3;0	3;0
p	✓	✓		✓	✓*	✓	✓*	✓
b	✓*	✓	✓	✓	✓*	✓	✓	✓
t	✓	✓		✓	✓*	✓	✓	✓
d	✓	✓ M		✓	✓	✓	✓	✓
k	✓	✓		✓	✓	✓	✓	✓
g	✓	✓	✓	✓	✓	✓	✓	✓
f		✓		✓	✓		✓	✓
s					✓ F		✓	
ʃ		✓ M			✓			✓
h	✓	✓*	✓	✓	✓*	✓	✓*	✓
ʧ					✓			
ʤ					✓			
m	✓	✓	✓	✓	✓	✓	✓*	✓
n	✓*	✓	✓	✓	✓	✓	✓*	✓
ŋ	✓		✓	✓		✓	✓	✓
w	✓	✓*		✓	✓*	✓	✓*	✓
l					✓ F		✓	
r					✓ F		✓	
j				✓			✓	✓

* – denotes production at higher level

F – female subject M – male subject

Of the three studies that do not differentiate initial and final consonants (Table 2.5), Chirlian and Sharpley (1982) has the smallest inventory at 2;0, [b], [g], [h], [m], [n] and [ŋ], reflecting its higher, 75-per-cent criterion. The later inventories of Chirlian and Sharpley are similar in many respects to those of Sander (1972), and Petty (1973) at 2;6 and 3;0. All three studies at their final age points have twelve consonants in common, all the plosives, [f], [h], all the nasals and [w]. Petty's (1973) inventory at the latest point, 2;6, has [ʃ] and both affricates for both sexes, and [s] and both liquids for girls. Sander (1972) at 3;0 has [s] in common with Petty (1973), Chirlian and Sharpley (1982) at 3;0 has [ʃ] in common with Petty. [j] is found in all three.

Sander's (1972) analysis of customary production at 2;0 suggests that the process of acquisition begins before this age for [p], [b], [m], [n], [h] and [w].

This is borne out in the studies reviewed in Section 2.1.2.2 and also in the high rates of production, exceeding 90 per cent in many cases, found at 2;0 in the studies reviewed in this section.

Tables 2.6 and 2.7 summarise the findings of studies where initial and final consonants have been analysed separately: Prather *et al.*, (1975); Dyson (1988); Watson and Scukanec (1997). Differentiation of initial and final singletons highlights extremes in the production of some consonants, for example /b/, which has high rates for word-initial segments, but rates so low for word-final segments that only Prather *et al.*'s (1975) respondents at 2;8 and 3;0 include final [b] in their inventories. These disparities are also demonstrated in Stoel-Gammon (1985).

Tables 2.6 and 2.7 show that, at 2;0, initial consonants are more established than final consonants. Fewer inventorial changes occur in the acquisition of initial singletons during the following year, but production levels are consolidated, although [p], [f], [s], [m] and [n] figure prominently in the inventories of both initial and final consonants between 2;0 and 3;0.

Table 2.6: Initial consonant production between 2;0 and 3;3

Initial	Prather	Dyson	W&Sc	W&Sc	Prather	Dyson	W & Sc	Prather	Dyson	Prather	W&Sc	Dyson
	2;0	2;0	2;0	2;3	2;4	2;5	2;6/2;9	2;8	2;9	3;0	3;0	3;3
p	✓	✓	✓	✓	✓*	✓	✓	✓*	✓	✓*	✓	✓
b	✓*	✓	✓	✓	✓*	✓	✓	✓*	✓	✓*	✓	✓
t	✓	✓	✓	✓	✓	✓	✓	✓*	✓	✓*	✓	✓
d		✓	✓	✓	✓	✓	✓	✓	✓	✓*	✓	✓
k	✓	✓	✓	✓	✓*	✓	✓	✓*	✓	✓*	✓	✓
g	✓	✓		✓	✓*	✓	✓	✓*	✓	✓*	✓	✓
f		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
v												
θ												
ð											✓	
s		✓	✓	✓		✓	✓		✓	✓*	✓	✓
z												
ʃ												
h	✓	✓	✓	✓	✓*	✓	✓	✓*	✓	✓*	✓	✓
tʃ							✓				✓	
dʒ												
m	✓	✓	✓	✓	✓*	✓	✓	✓*	✓	✓*	✓	✓
n	✓*	✓	✓	✓	✓*	✓	✓	✓*	✓	✓*	✓	✓
w	✓*	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
l		✓		✓		✓	✓		✓		✓	✓
r											✓	✓
j	✓	✓	✓	✓	✓	✓	✓	✓*	✓	✓*	✓	✓
	10	14	11	14	11	14	15	12	14	13	17	15

* – Denotes consonant production above a higher threshold

Table 2.7: Final consonant production between 2;0 and 3;3

Final	Prather	Dyson	W & Sc	W & Sc	Prather	Dyson	W & Sc	Prather	Dyson	W & Sc	Prather	Dyson
	2;0	2;0	2;0	2;3	2;4	2;5	2;6	2;8	2;9	2;9/3;0	3;0	3;3
p	✓*	✓	✓	✓	✓*	✓	✓	✓*	✓	✓	✓*	✓
b								✓			✓*	
t		✓	✓	✓		✓	✓	✓*	✓	✓	✓	✓
d		✓		✓	✓*	✓	✓			✓	✓*	✓
k		✓	✓		✓	✓	✓	✓*	✓	✓	✓*	✓
g					✓						✓	
f	✓	✓			✓	✓		✓	✓		✓*	✓
v								✓				✓
θ												
ð												
s		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
z			✓	✓			✓		✓	✓		✓
ʃ		✓				✓						✓
tʃ		✓				✓						
dʒ												
m	✓	✓	✓	✓	✓	✓	✓	✓*	✓	✓	✓*	✓
n	✓*	✓	✓	✓	✓*	✓	✓	✓*	✓	✓	✓*	✓
ŋ	✓*				✓	✓		✓		✓	✓*	✓
l							✓			✓	✓	
r							✓	✓		✓	✓	✓
	5	10	7	7	9	11	10	11	8	11	13	13

* – Denotes consonant production above a higher threshold

Sources: Prather *et al*. (1975); Dyson (1988); Watson and Scukanec (1997).

At 2;0, the consonants in all three initial inventories are: [p b t k] [h] [m n] [w j]. Initial [b], [n] and [w] achieve over 90 per cent in Prather *et al.* (1975), although the proportion of respondents ranged from less than one-third to just over one-half of the children in the cohort for all initial consonants. [d] is missing from Prather *et al.*'s (1975) inventory, representing a dip in the production of [d] in relation to [b]. Petty (1973) also reported a lower rate for initial [d] than [b] at 2;0. Prather *et al.*'s (1975) inventory also lacks initial [f], [s] and [l], all present under the more relaxed conditions of Dyson (1988), and in Stoel-Gammon's (1985) Group A at 2;0 for [f] and [s]. Watson and Scukanec's (1997) inventory does not have initial [g] (found in Prather *et al.*, 1975), [f] or [l] (in Dyson, 1988) at 2;0, but all three initial consonants are added to Watson and Scukanec's inventory at 2;3.

Prather *et al.* (1975) and Watson and Scukanec (1997) tested at 3;0. Eleven of the thirteen initial consonants in Prather *et al.*'s inventory are produced by over 90 per cent of respondents; this includes [s]. [ð] and [r] are added in Watson and Scukanec bringing the total of initial consonants to seventeen. The consonants present in all three initial inventories at 2;0 (Table 2.6) are still present in the inventories at 3;0 or 3;3. Apart from a blip for [w] at one observation, [p b t k] [h] [m n] [w j] appear in every inventory.

Initial consonants were added to the inventories in the following order:

Prather *et al.*	[p b t k g h m n w j] + [d f] + [s]
Watson and Scukanec	[p b t d k s h m n w j] + [g f l] + [tʃ] + [ð r]
Dyson – younger group	[p b t d k g f s h m n w l j]
Dyson – older group	[p b t d k g f s h m n w l j] + [r]

The transitional stage built into Dyson's (1988) study has proved useful in identifying the emergence of consonants that are generally associated with later stages of phonological development. Initial consonants [ʃ], [ʧ] and [r] were all found to be transitional at some point, [r] in the older group proceeding to the inventory at the next observation.

There is some degree of correspondence between Dyson's (1988) initial transitional consonants and those found in Watson and Scukanec's (1997) initial inventories, and in Prather *et al*. (1975) to a lesser extent. /ʧ/, transitional in Dyson at 2;0 and 2;5, is in Watson and Scukanec's inventory from 2;6, and is produced by 69 per cent of Prather *et al*.'s respondents at 3;0. /ʃ/, transitional in Dyson at 2;0, 2;5 and 2;9, is produced by 72 per cent of respondents in Prather *et al*. at 3;0. Initial /r/, assigned to Dyson's inventory at 3;3, is found in Watson and Scukanec's at 3;0.

There are further similarities in the production of initial clusters. Of the eight produced in Dyson (1988) at 3;3, which are all transitional, [bw] is found at 2;6 and 2;9, and [st] and [sp] at 3;0 in Watson and Scukanec (1997). Of the eleven initial clusters tested by Petty (1973), [st] is the only cluster in the inventory at 2;6 on the strength of its production by 57 per cent of girls.

Table 2.7 highlights the considerable differences in the size and range of final singletons present in the inventories at 2;0. As for initial consonants, Dyson's (1988) ten subjects produced the most final consonants, a total of ten including three fricatives and an affricate. Watson and Scukanec's (1997) subjects produced seven consonants to Prather *et al*.'s (1975) five, reflecting the different methodologies, but in all three cohorts differentials are maintained between initial and final consonants. Three final consonants are common to all three studies at 2;0: [p], [m] and [n]. [t] and [k] are found in Dyson (1988) and Watson and Scukanec (1997). All these consonants are found in Stoel-Gammon (1985), which also reported the absence of final voiced plosives. This remains the case for /b/ and /g/ in all three studies under review. Final [d] appears in Dyson (1988) and [g] is transitional.

Final consonants were added to the inventories in the following order:

Prather *et al.*	[p f m n ŋ] + [d k g s] + [b v r] + [l]
Watson and Scukanec	[p t k s z m n] + [d] + [l r] +[ŋ]
Dyson – younger group	[p t d k f s ʃ ʧ m n] + [ŋ]
Dyson – older group	[p t k f s z m n] + [d v ʃ ŋ r]

Several final clusters are common to both Dyson (1988) and Watson and Scukanec (1997). [ts] is the only cluster in the inventories of Dyson at 2;5 and 3;3, having been produced by both groups first in transition. In Watson and Scukanec, [ts] appears at 2;6 and remains in the inventory at 3;0. [ps] is found only in Dyson, and [st] only in Watson and Scukanec. Transitional [ŋk], found at all observations in Dyson, is in Watson and Scukanec at 3;0. The presence of [n] in final clusters is also evident in Dyson's transitional [ns], [nts] and [nʧ], and in Watson and Scukanec's [nd], [nt] and [nz].

2.1.2.3 Consonant production at and beyond the age of 3;0

All the studies reviewed in this section are of medium or large scale, requiring procedures to elicit specific consonant targets within carefully selected lexical items. Details of the eight studies are shown in Table 2.8.

Poole (1934) has the most stringent conditions: production of the consonant by all subjects in all word positions. In most of the studies there is a threshold of 75 per cent in all word positions. A 90-per-cent criterion applies to Anthony *et al.*'s (1971) corpus, as the test is on single elements; this is the same percentage used by Smit *et al.* (1990) except for /s/, /z/ and /ŋ/.

Table 2.9 provides an inventory of consonants acquired around the age of 3;0 according to the individual assessment criteria of the studies outlined in Table 2.8. Consonants that have not been tested are indicated and differential consonant production by girls and boys is shown where applicable. The data shown in Table 2.9 do not demonstrate the degree of correlation found in the analyses of studies conducted between the ages of 2;0 and 3;0 (Section 2.1.2.2). Moreover, a common consonantal base does not exist at 3;0 of the kind found at 2;0. Table 2.9 shows that no consonant tested met Poole's (1934) exacting criteria at 3;0. [m], [n] and [w] are the only consonants found in all seven of the remaining inventories. Wellman *et al.* (1931) has the smallest inventory of these, consisting of six consonants: [b], [f], [h], [m], [n] and [w]. Dodd *et al.* (2003) is the only study in which production of [v], [z], [j], initial [l], and [s] for both sexes is reported. The voiceless postalveolars do not meet the criteria of any study, and /r/ is not found in any of the inventories of children acquiring a rhotic accent.

Table 2.8: Large- and medium-scale studies of consonant production in children acquiring English

Study	No.	Rhotic	Language	Age tested	Positions	Production level required
Wellman *et al*. (1931)	204	Yes	American English (Iowa)	2;0-6;0	3 - I M F	By 75% of subjects
Poole (1934)	140	Yes	American English (Michigan)	2;6-7;6	3 - I M F	By 100% of subjects in all word positions
Templin (1957)	480	Yes	American English (Minnesota)	3;0-8;0	3 - I M F	By 75% of subjects in all word positions
Arlt & Goodban (1976)	240	Yes	American English (Illinois)	3;0-6;0	3 - I M F I clusters - 5	By 75% of subjects in all word positions
Anthony *et al*. (1971)	510	Yes	Scottish English (Edinburgh)	3;0-6;0	3 - I M F I M F clusters	All targets included in analysis Scoring according to maturity of sound
Kilminster & Laird (1978)	1756	No	Australian English (Brisbane)	3;0-9;0	3 - I M F	By 75% of subjects in all word positions
Chirlian & Sharpley (1982) (2;0-3;0 data in 2.1)	1375	No	Australian English (New South Wales)	2;0-9;0	3 - I M F	By 75% of subjects in all word positions
Smit *et al*. (1990)	997	Yes	American English (Iowa/Nebraska)	3;0-9;0	2 - I F I clusters	By 90% of subjects except for /s z ŋ/
Dodd *et al*. (2003)	684	No	British English (8 UK regions)	3;0-6;11	2 - I F	By 90% of subjects

Table 2.9: Consonant production at 3;0 in large-scale studies

Cons.	Wellman	Poole	Templin	A & G	Anthony	K & Ld	Smit	Dodd
p	✗	✗	✓	✓	✓	✓	✓	✓
b	✓	✗	✗	✓	✓	✓	✓	✓
t	✗	✗	✗	✓	✓	F	✓	✓
d	✗	✗	✗	✓	✓	✓	✓	✓
k	✗	✗	✗	✓	✗	F	✓	✓
g	✗	✗	✗	✓	✗	M	✓	✓
f	✓	✗	✓	✓	✗	F	F	✓
v	✗	✗	✗	M	✗	✗	✗	✓
θ	✗	✗	✗	✗	✗	✗	✗	✗
ð	o	✗	✗	✗	✗	✗	✗	✗
s	✗	✗	✗	F	✗	✗	F	✓
z	✗	✗	✗	F	✗	✗	✗	✓
ʃ	✗	✗	✗	✗	✗	✗	✗	✗
ʒ	✗	✗	✗	✗	✗	✓	o	✗
h	✓	✗	✓	✓	✗	✓	✓	✓
tʃ	✗	o	✗	✗	✗	✗	✗	✗
dʒ	✗	o	✗	✗	✗	✗	✗	✗
m	✓	✗	✓	✓	✓	✓	✓	✓
n	✓	✗	✓	✓	✓	✓	✓	✓
ŋ	✗	✗	✓	✓	✗	✓	✗	✓
w	✓	✗	✓	✓	✓	✓	✓	✓
l	✗	✗	✗	✗	✗	✗	✗	/l-/
r	✗	✗	✗	✗	✗	✗	✗	✗
j	✗	✗	✗	o	✗	M	✗	✓

Sources: Wellman *et al.* (1931); Poole (1934); Templin 1957; Arlt and Goodban (1976); Anthony *et al.* (1971); Kilminster and Laird (1978); Smit *et al.* (1990); Dodd *et al.* (2003)

✓ – denotes consonant production to minimum criteria (shown in Table 2.8)
✗ – denotes failure to reach criteria
o – consonant not tested
F/M – only female/male subjects achieved criteria
/l-/ – initial /l/ only

2.1.2.4 Summary

The high standards for acquisition required in some of the early studies on phonological acquisition have resulted in unrealistic expectations of children's ability to achieve adult-like articulations of consonants across a range of contexts. The insistence, in studies such as Wellman *et al.* (1931), Poole (1934), Templin (1957), Arlt and Goodban (1976), Kilminster and Laird (1978) and Chirlian and Sharpley (1982), that children achieve a high or perfect percentage score in all possible word positions has impacted considerably on the age at which consonants are said to be acquired. This has not only affected the norms suggested in the literature of certain consonants, for example the interdental fricatives and /v/, the affricates, the liquids and /j/, but also the ages assigned to the acquisition of plosives, especially /t/, and of fricatives /s/, /z/ and /ʃ/.

Increasingly, studies have analysed the production of syllable-/word-initial and -final consonants and consonant clusters separately, and in some cases have considered the differential patterns of acquisition between the sexes. Templin (1957) is one of the few studies to have incorporated all these measures. Data showing the discrete, and in some cases polarised, patterns in the articulation of initial and final segments are of particular interest here, given the focus on the dichotomies of Strand-A and Strand-B features explored in the second section of this chapter.

Studies which do not begin until the age of 3;0 leave many unanswered questions about the earlier ages and stages of phonological development, therefore. Several of the studies of consonant production in children under the age of 3;0 reviewed here (Sander, 1972; Petty, 1973; Prather *et al.*, 1975;

Chirlian and Sharpley, 1982) were prompted by previous research unable to distinguish between consonants produced at 3;0 and those likely to have been acquired before this age.

Studies of phonological development between 2;0 and 3;0 have identified consonants that are in common use by the majority of children and have highlighted those that are not produced by most children of this age. Testing at 2;0 and at or around the age of 3;0, and at various stages inbetween, has demonstrated the incremental process of consonant acquisition. However, the inventories compiled on the basis of these tests in many cases show remarkably little change from one intermediate age/stage to another, particularly for initial consonant singletons, suggesting that many consonants are acquired before 2;0 and after 3;0.

Initial /d/, /f/, /s/, /l/, and later /r/, have been identified as typically emerging between 2;0 and 3;0, on a base of /p/, /b/, /t/, /k/, /h/, /m/, /n/ /w/ and /j/. Final /d/, /f/, /s/, /ŋ/, and later /g/, /z/, /v/, /l/, and /r/ where applicable, have been identified as typically emerging between 2;0 and 3;0, building on a base of /p/, /m/ and /n/. Consonants with a strong presence in both initial and final positions are /p/, /f/, /s/, /m/ and /n/.

Given that some consonants are already established at 2;0, the studies of Lewis (1936), O'Neal (1998) and Stoel-Gammon (1985) have provided some answers to the questions that remain about the order in which the earliest phones typically emerge. These studies suggest that /p/, /b/, /d/, /k/, /g/, /h/, /m/, /n/ and /w/ are amongst the first initial singletons to emerge and that the first final singletons, typically /p/, /t/, /k/ and /n/, appear later. Furthermore, from all the studies that have investigated consonant production around the age of 2;0 (Sections 2.1.2.1 and 2.1.2.2), it is possible to build some consensus about the consonants that are likely to be amongst the last to be acquired. The studies reviewed suggest that these are most likely to be Kent's (1992) Set-4 consonants /v/, the interdentals and /ʤ/, and final-position /b/ and /g/. In the few studies that have registered the spontaneous production of initial and final consonant clusters (Lewis, 1936; O'Neal, 1998; Dyson, 1988), it has been shown that final clusters generally appear before initial clusters and are produced with greater accuracy.

2.2 Examples of Strand-A/B word-position bias and simplification processes

Ingram (1986: 224: 231), Grunwell (1987: 212-226) and Oller (2000: 54) list common "processes" that are used by children to simplify their early speech. These include reduplication, the fronting of velars, the stopping of fricatives and the deletion of final consonants. Grunwell's (1982) Profile of Phonological Development (endorsed in Vihman, 1996) presents a broad outline of seven age-related stages indicating the age at which these simplification processes are commonly in use. This suggests that between 0;9 and 1;6 (Stage 1) the full range of processes are used, but in Stage 2 (1;6 to 2;0) consonant harmony and reduplication are used less than cluster reduction, final consonant deletion, velar fronting and stopping. In Stage 3 (2;0 to 2;6), reduplication is absent, final consonant deletion is in decline and velar fronting is uncommon, whilst the other processes continue.

Grunwell (1987) suggests that two or more processes may "operate on" the articulation of the same target segment or cluster (pp. 226-227). For example, the case of *sky* → [daɪ] involves initial cluster reduction, velar fronting and voicing; in *thread* → [dɛt] there is initial cluster reduction, stopping and voicing; and in *Shreddies* → [dwɛdit] there is palatal fronting, stopping and voicing, liquid gliding and final stopping. In most cases, the use of these processes results in the production of initial [d], which demonstrates a preference for alveolar plosives over other consonants of place or manner.

In O'Neal 1998 (see also Section 2.1.2.1), the child (Richard) demonstrated velar and bilabial preference over alveolars and greater focus on the production of final consonants. Richard did not front velars and avoided alveolars using the counter-process of backing and occasional bilabial fronting. Furthermore, he did not use stopping processes or reduplication and was systematic in his use of initial consonant deletion rather than final consonant deletion. Richard's word-final bias, preference for velars and bilabials, lack of stopping or reduplication, and word-initial deletion were included in a set of features labelled "Strand-B" (1998: 35), which were shown in opposition to the common "Strand-A" processes of Ingram, Grunwell and Oller.

In this section, the links are examined between the common features of Strand-A and Strand-B profiles, and examples are provided of Strand-A and Strand-B characteristics in the speech of three Strand-A and three Strand-B children. The case studies on Mollie (Holmes, 1927), Philip (Adams 1972 cited in Ingram, 1974b; 1975; 1986) and Jennika (Ingram 1974a; 1975; 1986) demonstrate the phonological patterns of Strand-A children; the case studies on Richard (O'Neal 1998), Daniel (Menn, 1971; 1975) and Grace (Gerlach 2010) illustrate children who demonstrate Strand-B tendencies.

A defining feature of Richard's speech from 1;6 is the complete absence of reduplication, contrary to Moravcsik (1978) which claims that reduplication is a universal of child language. Schwartz, Leonard, Wilcox and Folger 1980 and Fee and Ingram 1982 conducted studies that compared the patterns of final consonant production in "reduplicators" and "nonreduplicators". Schwartz *et al.* (1980) studied the structural simplification processes of twelve children, six of whom were identified as "reduplicators" (1;3 to 1;9) and six as "nonreduplicators" (1;5 to 2;0). They found a correlation between the use of reduplication (in at least 20 per cent of utterances) and the use of syllable reduction processes and final consonant deletion. Although final consonant deletion was also found to be widely used by the non-reduplicators, the difference between the two groups was sufficiently convincing for them to suggest that "reduplication may serve as a means to avoid final consonants" (1980: 76). Similarly, Kent and Bauer 1985 observed that children who tend to reduplicate (e.g. Ted, Dave and Bob) produce relatively few CVC syllables compared to children who are not inclined to reduplicate and who produce a higher proportion of CVC syllables (e.g. Susan) (p. 510).

Fee and Ingram (1982) identify two further groups of "reduplicators" and "nonreduplicators" from previous child language studies. Using the same measure of 20 per cent used by Schwartz *et al.* (1980), Fee and Ingram (1982) confirms Schwartz *et al.*'s finding that non-reduplicators are considerably more likely to produce final consonants than reduplicators. One reduplicator, Padmint (Ross 1937), whose proportion of reduplicated forms at 1;10 was 72 per cent (reduplicators' mean = 31 per cent), produced no final consonants and no monosyllables at all (1982: 46/50).

Fee and Ingram (1982) identify Mollie (Holmes, 1927), Philip (Adams 1972) and Jennika (Ingram 1974a) as reduplicators. These American English-learning children fit the Strand-A profile, since they all demonstrate the tendency to front and stop initial consonants and to omit final consonants. Despite these common tendencies and some similar pronunciations of specific words, the phonological development of the three children proceeds in quite different ways.

Holmes (1927) shows that most of Mollie's reduplicative utterances are produced at 1;6.[5] These include *apple* [bæbæ], *bib* [bɪbi], *cracker* [kækæ] and *dinner* [nænæ], which demonstrate (following Schwartz *et al.* 1980, Fee and Ingram 1982 and Kent and Bauer 1985) that reduplication inhibits the production of final consonants. Mollie's deletion of final consonants is evident throughout the period of the diary (see Table 2.10). Mollie also deletes final alveolar clusters in *want* [wɑ] (1;6), *bird* [bo] (1;8) and *girl* [gœi] (2;0). Conversely, there is a high rate of success in the production of initial targets, particularly of alveolar plosives; *duck* is [dʌ.k:] (1;6). Initial velar fronting is found in *kitty* [tɪ.i] (1;10), *going away* [doɪn əwe] (1;11) and *golliwog* [dågiwɔg] (2;0) although, as these examples show, she does not delete all final velar consonants.

Furthermore, Mollie is systematic in the use of the alveolar plosives as substitutes in initial stopping processes, as shown in *that* [dæ] (1;1), *there* [dɛə], *soap* [to.k:] (1;6), *sleep* [ti.k:] (1;8) and *see* [ti] (1;6/1;10). Also, there is word-initial stopping of labiodental /f/ in *fish* [pɪʃ], *Felix* [piks] (1;10) and *fox* [bɑk] (1;11). Final bilabial plosives are avoided, however, with final /b/ targets realised as alveolar [d] in *bib* [bɪd.] (1;11) and *cab* [kæd:] (2;0), and final /p/ is

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[5] The transcriptions of Mollie's speech are those used by Holmes.

[t] or [k] until 2;0.14 in *get up* [gɛt. ʌp.]. (Stoel-Gammon (1985) found that [p] was the last word-final voiceless plosive to be acquired by Group A.)

Philip's reduplications at 1;9 include [mimi] for *Anne-Marie*, [didi] for *TV* and [wawa] for *water* (Ingram 1986: 230). He produces few final consonants and, like Mollie, uses extensive final consonant deletion; in addition syllabic /m/, /n/, /l/ and /r/ are lost through vocalisation. (See Table 2.10.) At 1;9, Philip generally avoids initial velars by using fronting processes. In several cases, this is achieved through metathesis so that initial substitutes are bilabial [b] or [m], or alveolar [d] or [n] (Ingram 1974b: 236). Vowel-initial words are realised as CV or CVCV, for example *arm* [ma] (Ingram 1975: 290) and *alligator* [dæge] (Ingram 1974b: 236). Few examples are provided by Ingram of words with target fricatives, but initial stopping is found in the metathesised versions of *coffee* [baki] and *hammer* [mænu] (Ingram 1974b: 236) and in the deaffrication, fronting and voicing of the initial affricate /ʧ/ in *chin* [din] (Ingram 1975: 290).

Fee and Ingram (1982) found that Jennika (Ingram 1974a) used reduplication less than Mollie or Philip, and that at 1;5 the proportion of her "reduplicated forms" were 0.21, only just above the qualifying threshold of 20 per cent (p. 46). Nevertheless, she demonstrates the same phonological tendencies of word-initial and alveolar bias, fronting, initial stopping, and in particular the deletion and avoidance of final consonants (see Table 2.10).

Ingram (1974a: 54) shows that at 1;3 Jennika produces her first fricatives in *hi* [hai] and *see* [si]. Her word shapes are CV, CVCV or CVC, but CVC production is limited to the free variant of *dot* [dat]. Final /t/ is otherwise avoided in *dot* as [dati], in *blanket* as [ba]/[babi] and in *that* as [da]. At 1;4, Jennika extends the use of diminutive forms to avoid final consonants, so that final targets become medial in *out* [auti]/[auwi] and *up* [api] (Ingram 1974a: 55).

Beltzung and Yamaguchi (2008) suggest that compensatory lengthening (de Chene and Anderson 1979; Hayes 1989) is a common strategy of final consonant avoidance in early speech. Ota (2003) shows that the typical pattern of word-final compensatory lengthening in CVC targets (e.g. /pɪg/→[pi:]) occurs in words in which the initial consonant is produced. Therefore, compensatory lengthening is more likely to be used by Strand-A than by Strand-B children, although there are no clear examples of the phenomenon in the speech of Mollie, Philip or Jennika from the available literature.

Table 2.10: Final consonant omission in Mollie, Philip and Jennika

Consonant	Word/s	Mollie	Philip	Jennika
b	*bib*	1;5	–	–
t	*that*	1;1–1;6	–	1;3
	blanket	–	–	1;3
	out	–	–	1;4
	coat / pocket	1;6	–	–
	hat / hot / plate	–	1;7	–
k	*book*	–	1;7	1;5
	bike	–	–	1;5
g	*dog*	1;3	–	–
θ	*bath*	1;6	–	–
s	*juice*	1;6	–	–
m	*come*	1;6	–	–
	bottom	–	1;9	–
n	*down / spoon / pin*	1;6	–	–
	button	–	1;9	–
	man	–	1;11	–
l	*apple / doll / squirrel*	1;6	–	–
	animal / apple / bottle	–	1;9	–
	pull / sand pile	1;10	–	–
	fall	1;11	–	–
r	*more*	–	–	1;5
	cracker	1;6	–	–
	dinner	1;10	1;9	–
	hammer	–	1;9	–
	bear / deer / where / letter	1;10	–	–

Sources: Holmes (1927); Ingram (1974a; b; 1975; 1986: 226)

Table 2.10 (above) lists the final singleton and syllabic consonants that were omitted by the three children, either through deletion or vocalisation. Samples of these are included in Table 2.11, which summarises Mollie, Philip and Jennika's simplification processes in the early stages of speech production.

Table 2.11: Simplification processes used by Mollie, Philip and Jennika

Process	Mollie	Philip	Jennika
Reduplication	e.g. *apple* [bæbæ]	e.g. TV [didi]	e.g. *dot* [dati]
Final omission	/t g θ s m n l r/ e.g. *that* [dæ] *bath* [bæ] *dog* [dœ]	/t k m n l r/ e.g. *hat* [æ] *book* [bʊ]	/b t k r/ e.g. *out* [aɷ] *bike* [bai]
Velar fronting	/g/→[d] /k/→[t] e.g. *going away* [doɪn əwe]	/g/→[d] e.g. *alligator* [dæge]	final /ŋ/→[n] e.g. *tongue* [gʌn]
Initial stopping	/ð/→[d] *there* [dɛə] /s/→[t] *see* [ti] /f/→[p] *fish* [pɪʃ]	/f/→[b] (metathesised) *coffee* [baki]	/ð/→[d] *that* [da] /s/→[t] *see* [ti] /s/→[g] *sock* [gʌk]
Final cluster deletion	/nt/ in *want* /rd//rl/ in *bird*/*girl*		

Sources: Holmes (1927); Adams (1972 cited in Ingram 1974b; 1975); Ingram (1974a; 1975; 1986)

Strand-B Richard (O'Neal 1998) demonstrated converse patterns of phonological development from the commencement of the study at 1;6. Word-final bias was shown in the greater accuracy of final consonants and clusters (see Section 2.1.2.1), and was manifested in the use of simplification processes that served to constrain the production of initial segments. These included systematic initial consonant deletion (at 1;6 of all initial fricatives, /j/ and /ʧ/) and the backing of initial alveolar plosives regardless of any alveolar presence within the word, for example in *down* [gaʊn] (1;6) and later in *downstairs* [gaʊntɛəs] (1;11). Secondary labial bias was demonstrated in the articulation of the homorganic alveolar word *derailed* as [biːɹeɪld] (2;3-2;5).

Menn (1971) found similar phonological patterns in Daniel. Menn 1975 suggests that the likely co-occurrence of some "less-common patterns of child phonology", such as initial alveolar backing, might form a 'syndrome'", a collection of characteristics of a "general final-segment-oriented strategy" (p. 293). Menn 1975 further suggests that Daniel's use of counter-fronting (backing) processes was linked to the velar→labial→alveolar direction of his strength hierarchy. (Richard's strength hierarchy from 1;6 to 1;10 was also velar → labial → alveolar, with alveolar consonants remaining the weakest to 2;7 (O'Neal 1998: 36).)

Menn's principal claims for Daniel's strength hierarchy were based on the fact that his "velars never assimilated" to other consonants and that "dentals assimilated to velars or labials" (1975: 294). Daniel and Richard's velar assimilation patterns are strikingly similar. Both children use regressive velar harmony in *dog* [gVg], *duck* [gʌk], *stuck* [gʌk], *drink* [gɪnk] and *milk* [gʌlk], although *dog* [gɔg] is one of Grunwell's examples of the "common process" of velar assimilation (1987: 215), and both Mollie (Holmes 1927) and Jennika (Ingram 1986) are reported as having articulated *duck* as [gʌk] at some stage. But Daniel also uses the velar nasal word finally to achieve harmony in *tongue* [gʌŋ] (Menn 1971: 243) (*contra* Jennika's version of *tongue*, [gʌn] (Ingram 1986: 226)), and in /m/-initial words: *mug* [ŋʌŋ], *Mike* [ŋjajk] (Menn 1971:

240), and *milk* [ŋjʌk] (p. 244) which is also [gʌ(l)k] (p. 248). The use of [ŋ] in regressive velar harmony, as in *milk* [ŋjʌk], is not found in Richard, however.

Daniel additionally uses regressive velar assimilation that results in the backing of initial bilabial plosives. First seen in *bug* [gʌg] (Menn 1971: 232), velar harmony is extended to *big*/*pig* [gig], *book* [gʊk], *back* [gæk] and *park* [gark]. These harmonies are not found in Strand-A children. Daniel also uses bilabial harmony of plosives and nasals to avoid both initial and final alveolars. Regressive assimilation is found in tub [bʌb], *tape* [bejp], *top*/*stop* [bap], *steps* [bɛps] and *drum* [mʌm]; progressive assimilation in *boot* [bu:p] and *boat* [bowp] (previously [du:t] and [dowt]) and *moon* [mum], a homophone of *broom* (Menn 1971; 1975).

Daniel's use of consonant harmony far exceeds that of Richard, who from 1;6 achieved all initial /b/ and /p/ targets and whose articulation of all initial and final plosives was reasonably secure by 2;1. O'Neal's (1998) assessment of Richard's strength hierarchy was therefore based a higher proportion of correctly-produced consonants than was the case for Daniel (Menn 1975), particularly in words with bilabial targets or substitutes. But note the similarity between Daniel's *table* [bʌbu:] (Menn 1975: 295) and Richard's *table* [beɪbəl] (1;8-1;10), and Richard's use of bilabial assimilation in *dummy* [bʌmi] (1;11) and in some words with initial /f/: *fireworks* [waɪəwɜks], *flowers* [waʊwəz] and *forwards* [wɔ:wədz] (1;11), which is not "pseudo-harmony" (Vihman (1978: 289) because he does not use the initial /f/→[w] gliding process in all initial-/f/ words at 1;11. Note also that both children subject initial affricates to regressive velar or bilabial assimilation in some words as alternative processes to alveolar stopping. For example, at 1;11 Richard produces velar harmony in *chicken* [kɪkɪn] and *chocolate* [gɒktet], and labial harmony in *Jim* [bɪm]. Daniel uses velar harmony in *chalk* [gɔk] (Menn 1971: 237) and labial harmony in *chop* [bap], *jeep* [bi:p] and *jump* [mʌmp] (pp. 239/242). These data confirm that bilabials are secondary to velar consonants in Richard and Daniel's developing phonologies. However, Richard's examples of bilabial assimilation in *ice cream* [aɪsbi:m], *Christmas* [bɪsməs], *Clarabel* [bæəbel] and *Kipper* [pɪpə] (1;11) (O'Neal 1998) show that he did not adhere strictly to the "velars never assimilated" rule found in Daniel (Menn 1975: 294).

In a more recent study (Gerlach 2010), Grace demonstrates similar phonological tendencies to those of Richard and Daniel, in that she does not reduplicate systematically and has a bias towards the production of word-final segments and velar consonants. Grace is more limited in her use of assimilatory processes because she has a high level of accuracy in production, and a concentrated period of initial consonant deletion between 1;5 and 1;9 during which consonant harmony is minimised. For example, her first attempt at *duck* is [ʌk], rather than Daniel and Richard's [gʌk]. However, the few examples of Grace's place harmony that exist reveal only velar and labial assimilation, of which the majority are velar.

All examples of regressive bilabial assimilation demonstrate bilabial-over-velar preference, as in Richard's *Kipper* [pɪpə]. These are found in *grandma* [mæma], *grandpa* [bæpa] (1;7) and *cup* [pʌp] (in free variation with metathesised [pʌk]) at 1;8. Progressive bilabial assimilation is found only for a brief period in *boat* [boʊp] (cf. Daniel's *boat* [bowp] (Menn 1971)) in free variation with [boʊ] at 1;6. Regressive velar assimilation is demonstrated in *doggie* [gagi] (1;6), *bad guy* [gæg:aɪ] and *truck* [kʌk] (1;8) (cf. Daniel's *truck* [gʌk] and Richard's *trucks* [gʌks] both at 1;11). Grace uses progressive velar assimilation in *cut* [kʌk], *coat* [kɔk] (1;6), *cold* [koʊk] and *game* [gɪŋ] (1;8). Her use of the [kVk] process in *cut* and *coat* represents a direct challenge to Jakobson (1968), which states that "the English child (says) *tut* for "*cut*"" (p. 47) because it is a "universal fact" (p. 47) that word-initial /k/→ [t] "fronting" (Ingram 1974b) occurs at a certain stage in the development of any language with the "dental/velar contrast" (Jakobson 1968: 47). Vihman and Vihman (2011: 121) argue that the consonant harmony, as in [tVt] for *cut*, is not a universal feature of phonological development.

A further measure of Grace, Daniel and Richard's velar preference is their ability to achieve /k/, /g/ and /ŋ/ targets in early words. Three of Grace's seven words recorded at 1;3 are realised with initial [k] or [g], *kitty* [kɪi], *cracker* [kækə] and *go* [goʊ]. [ŋ] appears medially in *thank you* [ʌŋku] at 1;6 and *blankie* [ʌŋki], and word finally at 1;10 in *doing* [duɪŋ].[6] Daniel's (Menn 1971) first two stages cover the period 1;4 to 2;0. During this time, except for systematic initial /k/→[g] voicing, like Grace he produces all velar targets. This includes the production of final [g] in *hug* [ʌg] and *bug* [gʌg], and final [ŋ] in *swing* [ɪŋ] and *going* [goɪŋ].[7] Similarly, Richard produces all velar targets in the 37 words reported in his opening list at 1;6. The final cluster [ks] is produced in three words between 1;7 and 1;8 and a fourth between 1;9 and 1;10 (as shown in Section 2.1.2.1). The velar nasal is produced first in the final [ŋk] cluster between 1;9 and 1;10, in the final triple cluster in *thanks* [æŋks]/[væŋks]/[ðæŋks] at 1;11, and as a word-final singleton at 1;11, for

[6] Note that K (Lewis 1936) also produced [ŋ] in the medial cluster /ŋk/ before final /ŋ/; see Section 2.1.2.1.
[7] Olmsted (1971: 204) does not provide an age-norm for the acquisition of final /g/ and calculates the age norm for /-ŋ/ as 4;0+.

example in *bang* [bæŋ] and *coming* [kʌmɪŋ]. Therefore, all three children consistently achieve velar targets in their early speech.

Moreover, contrary to the patterns found in Strand-A children, velars do not feature in the mispronunciations of Daniel, Richard or Grace. However, Dyson's (1986) study of forty "normal two-year-olds" shows that initial velar fronting, as in Grunwell's examples of *car* [da], *glue* [du] and *sky* [daɪ] (1987: 227), is not a universal process in English. Thirty per cent of the children showed no evidence of any "velar deviations" at 1;11; by 3;1, this had risen to 91 per cent (Dyson 1986: 495). This is consistent with the speech data in Vihman and Greenlee (1987), which suggest that initial velar→alveolar fronting is one of the first common processes to be eliminated (p. 507), confirming Grunwell (1982).

Strand-B children adopt strategies for dealing with initial and final fricatives that are different to those adopted by Strand-A children. At 1;6-1;7, Richard's initial fricatives are deleted in *fish* [ɪʃ] (cf. Daniel's [ɪʃ] (1;10); Grace's [ɪs] (1;6)) *that* [æt], *there* [ɛə] and *socks* [ɒks]. These are alternatives to the initial stopping processes used by Strand-A Mollie in *there* [dɛə] and *fish* [pɪʃ] (Holmes 1927) and by Jennika in *that* [da] and *sock* [gʌk] (Ingram 1974a). (See Table 2.11.)

Conversely, Richard's final fricatives are not deleted, and are either articulated, for example in *juice* [ʒu:s] and *woof* [wʊf], or are substituted by other fricatives, for example by [f] in *bath* [bɑ:f]. This is consistent with Williams (1937), who found the final /θ/→[f] substitution to be typical, along with /θ/→[s]. Daniel also uses the /θ/→[f] process word finally, as shown in *mouth* [mæwf] at 1;10, but he produces target /θ/ in *bath* by 2;0.15 in free variance with [bæf] and [bæs] (Menn 1971). Recall that in Strand-A Mollie's *bath*, the final consonant is deleted (Table 2.10). In addition, at 1;10, Daniel uses the counter-stopping process of final spirantisation in *up* [ʌf] (Menn 1971), one of Oller's "common processes" (2000: 54). Grace (Gerlach 2010) is unable to produce /f/ in any word context but final /f/ is realised as voiceless bilabial fricative [ɸ] at 1;8 in *bath* and *mouth*, also [maʊs]. Preisser, Hodson and Paden (1988) challenge the view that stopping, as in Grunwell's examples *thread* → [dɛt] and *Shreddies* → [dwɛdit] (1987: 227), is a universal, or even a common process. Preisser *et al.* found that "stopping was a relatively infrequent process" (1988: 128) and that only 46 of the 60 subjects used a stopping process at least once.

Systematic initial consonant deletion is a central plank of the Strand-B profile. Grace's (Gerlach 2010) systematic use of initial consonant deletion began at 1;5 and ended at 1;9, therefore lasting for a total period of four months. Richard's (O'Neal 1998) use of initial consonant deletion was already in evidence at 1;6 and lasted for a further seven months. It was at its most intense around the time of his second birthday, but was not systematic after 2;1. Daniel's first examples of initial consonant deletion appear in Stage 2 at 22½-24 months. Table 2.12 shows the patterns of their deleted initial consonants.

Table 2.12: Initial consonant deletion in Daniel, Richard and Grace

Cons	Word/s	Daniel	Richard	Grace
/b/	*book*	–	–	1;6
/t/	*together*	–	2;3-2;5	–
	tomato	–	2;6	–
/d/	*duck*	–	–	1;7
/f/	*fish*	Stage 2	1;6	1;6
	farm / feathers / fence / finished / fork / found	–	1;11	–
	fast / faster	–	2;1-2;2	–
	fallen	–	2;4	–

Cons	Word/s	Daniel	Richard	Grace
/θ/	*thank you*	–	1;6	1;6
	thanks / thunder	–	1;11	–
/ð/	*this*	–	1;6	–
	that	–	1;6–1;11	–
	there	–	2;3–2;5	–
/s/	*six / soap / socks*	–	1;7–1;8	–
	seaside	–	1;9–1;10	–
	sandwich / sorry / soup	–	1;11	–
	sand / seat	Stage 2	–	–
	seven	–	2;1–2;2	–
/z/	*zip*	–	1;11	–
/ʃ/	*shoes*	Stage 2	1;7–2;0	1;8
	shampoo / sheep / shop	–	1;11	–
/h/	*hat / help*	–	–	1;6
	hello / hot	–	1;6	–
	hair / hand / hard	–	1;7–1;8	–
	hill	–	1;9–1;10	–
	ham / home / Humpty Dumpty / who's	–	1;11	–
	horse / hug	Stage 2	–	–
	hose	Stage 5	–	–
/ʧ/	*change*	Stage 2	1;6	–
	cheese	–	1;7–1;8	–
	chips	Stage 2	–	1;6
/ʤ/	*juice*	–	–	1;5
/m/	*milk*	–	1;11	–
	Mary	1;8	–	–
/n/	*nose*	–	1;11	–
	nappy / Noddy	–	1;11	–
/w/	*wall*	–	1;7–1;8	–
	wake / wheats	–	–	1;8
	wash	–	–	1;9
	watch / water	Stage 2/2–3	–	–
	walk	Stage 5	–	–
/l/	*light(s)*	1;9–2;1	1;7–1;8	1;6
	lunch / Luke	–	1;7–1;8/1;8	–
	lamp / letter	–	1;11	–
	look	Stage 3	–	–
	lap	Stage 4	–	–
	lock	Stage 5	–	–
/r/	*read*	Stage 5	–	1;6
	rice / Richard	–	1;7–1;8	–
	rain / reach / run	–	–	1;8
	ride	Stages 2/3	–	1;8
	rabbit / radio / robin	–	1;11	–
	rake / radish	Stage 2	–	–
	running / wrench	Stages 4/5	–	–
	wrench	Stage 5	–	–
/j/	*yes / yellow*	–	1;6/1;7–1;8	–
	yoghurt / yours	–	1;11/2;1–2;2	–

Table 2.12 shows that eighteen initial consonants were deleted ranging from plosives to approximants: /b t d f θ ð s z ʃ h ʧ ʤ m n w l r j/, but /k/ and /g/ are not included. All three children deleted /f ʃ h w l r/ at least once, and all three deleted /f/, /ʃ/ and /l/ in *fish*, *shoes* and *light* or *lights*. In terms of frequency, initial fricatives and approximants proved the most vulnerable consonant classes to deletion.

Daniel deleted initial /f s ʃ h ʧ ʤ n w l r/; in his final stage at 2;1, the deletion of both liquids still being the rule, although the deletion of initial /f/, /s/, /ʃ/ and the affricates occurs only in single words. Daniel's main focus is on the deletion of the liquids, with secondary focus on the deletion of /w/ and /h/. He produces two words without initial or final consonants: *nose* [o] (1;8) and *read* [i:] (2;0.15), the same pronunciation as Grace's *read* at 1;6. At 2;1, he uses metathesis to avoid initial /z/ in *zebra* [ɪ:z].

Over the thirteen months, Richard deleted initial /t f θ ð s z ʃ h ʧ m n w l r j/, but most deletions took place between 1;6 and 2;1. He has by far the largest range and number of deleted initial consonants (15), but also the longest period of study and the most protracted period of initial deletion, extending to 2;6 in the trisyllabic version of *tomato* [əwɑ:təʊ]. In Table 2.12, all the deletions of initial /t/, /ð/, /j/ and the only /z/ are Richard's, as are most of the deletions of initial /f/ and /s/. Richard also deletes both initial nasals; Daniel and Grace delete initial /m/ or /n/ in at least one word. This pattern is not found in the Strand-A children. Mollie and Philip delete both /m/ and /n/ word finally (see Table 2.10), contrary to the patterns of the Strand-B children who do not delete any final nasals (see Table 2.13).

Grace has the shortest period of initial consonant deletion of the three children, from 1;5 to 1;9, during which time she deletes /b d f θ ʃ h ʤ m w l r/. Of these, only the three approximants and /h/ are deleted in more than one word. /h/-deletion, which is used extensively by Daniel and Richard, is found only in *hat* [æt] and *help* [ʌʊp]. Grace first produces [h] in [haɪ] at 1;3, but at 1;6 initial /h/ is sacrificed in words in which the final consonant is articulated (the "trade-off phenomenon" described in Edwards and Garnica 1977). The breakthrough comes later in the month in *hop* [hap]. Grace deletes two initial voiced plosives, /b/ and /d/. /d/ in *duck* [ʌk] is not subject to velar assimilation as in the case of Daniel and Richard. But Grace deletes initial /b/ in *book* [oʊk] at 1;6, in a counter-process to the deletion of final /k/ in *book* by Jennika [ba] at 1;5.10 and Philip [bʊ] at 1;7.17 (Ingram 1974b: 239).

Daniel, Richard and Grace delete the following initial clusters:

Daniel:	/pl/ in *plane* (2;0.15)	/st/ in *Stevie* (1;10)
	/sl/ in *slide* (Stage 2) / *slippers* (2;1.15)	
	/sw/ in *swim* / *swing* (Stage 5)	
Richard:	/fl/ in *floor* (1;11)	/sp/ in *spaghetti* (2;3-2;7)
	/nj/ in *nuisance* (2;3-2;5)	
Grace:	/pl/ in *please* (1;6)	/bl/ in *blankie* (1;6)
	/sn/ in *snake* (1;6)	

None of the deleted clusters consists of a velar consonant. Conversely, all the deleted clusters consist of at least one alveolar. The consonantal patterns of deletion therefore reflect the difficulties experienced in the production of initial singletons, with the exception of /r/. Although all three children found initial /r/ challenging as a singleton, it seems to have been more accessible in clusters. This suggests that the first stage of Greenlee's (1974) stages of cluster acquisition, cluster deletion (see 2.1.1), is more likely to be skipped in the case of plosive+/r/ clusters, particularly when compared with the rates of deletion and reduction of initial clusters with /l/. The development of Richard's initial clusters supports this view. As shown in Section 2.1.2.1, [pɹ] [bɹ] [tɹ] [dɹ] were the first initial clusters to appear in his phonology and the only initial clusters produced by 2;0, whilst /pl/, /bl/, /kl/, /gl/ and /fl/ remained unattainable at 2;7. Vihman and Greenlee (1987) also found that cluster reduction in consonant+/l/ clusters persisted longer than reduction in consonant+/r/ clusters (p. 521).

Initial /s/ proved problematic for all three children in clusters, which reflects their velar and bilabial bias. Five of Daniel's six deleted initial clusters consist of alveolar /s/. Richard's /s/-clusters only start to appear at 2;0, following a period of systematic reduction to a single consonant in *splash* [pæʃ], *sponge* [pʌnʤ], *slug* [lʌg], *smoke* [məʊk], *snake* [neɪk] and *skin* [kɪn] (1;11). Grace demonstrates a similar pattern of /s/-cluster reduction at 1;10 to 1;11 for example in *sleep* [sip], *snake* [seɪk] and *spicy* [paɪsi] (Greenlee's Stage 2), at a time when bilabial and velar plosive biconsonantal clusters are produced (Greenlee's Stage 3) in *please* [pwis], *broccoli* [bwaki], *crash* [kwæʃ] and *Grace* [gweɪs] (1;11). Daniel enters a stage at 2;0.15 when reduced initial /s/-clusters harmonise with the final consonant, even in the case of the homorganic cluster /st/: *stop* [bap] (homophone of *chop*), *stick* [gɪk] and *stone* [non], and in *spoon* [mum] (Menn 1971: 239-240). This strategy is also used by Daniel to avoid the alveolar cluster /dr/ in *drum* [mʌm].

Schwartz *et al.* (1980) found that non-reduplicating children deleted final consonants, although not to the same extent as reduplicators. Daniel, Richard and Grace also delete final consonants but this occurs less than their deletion of initial consonants. Their final deletions are only of alveolar and mainly non-fricative consonants. Grace uses final consonant deletion the most, but more than half of all her final omissions are of /r/, which Daniel produces in one of his earliest words at 1;10 in *car* [gar] (Menn 1971). Table 2.13 shows the final consonants omitted by Daniel, Richard and Grace. The table excludes /r/.

Table 2.13: Final consonant omission in Daniel, Richard and Grace

Consonant	Word	Daniel	Richard	Grace
/t/	*boat*	–	–	1;6
	boot	1;9	–	–
	gate	1;10	–	–
/d/	*bread*	1;10	–	1;2
	read /ri:d/	Stages 4–5	–	1;6
	slide	Stage 2	–	–
	ride	Stages 2–3	–	–
/s/	*nice*	1;9	–	–
	geese	–	1;11	–
/z/	*noise*	1;8–1;10	–	–
	nose	–	–	1;8
	who's	–	1;11	–
/l/	*ball*	–	1;6	–
	apple/ *bowl*/ *pool*	–	–	1;7
	circle	–	–	1;9
	wall	–	1;9–1;10	–
	bagel/ *cereal*/ *doll*/ *triangle*	–	–	1;10
	all	–	1;11	–
	fall/ *pencil*/ *spill*/ *towel*	–	–	1;11
	stool	Stage 2	–	–
	owl	–	2;1–2;2	–
	well	–	2;3–2;5	–

(Menn 1971; O'Neal 1998; Gerlach 2010)

Table 2.13 confirms that all omitted final consonants over the period of observation of each child were alveolar. The earliest example is Grace's deletion of /d/in *bread* [bɛ] at 1;2, an age at which the speech of Daniel and Richard is unreported. No deletion of final alveolar plosives is found in Richard. Daniel deletes final alveolar plosives, particularly /d/, the most, but his deletion of final /l/ is minimal. Menn (1971) suggests that there was some compensatory gliding of final-/l/ segments. Richard and Grace omit final /l/ extensively, however. This is a reflection of their general avoidance of /l/ in all word contexts. The deletion of the final fricatives is limited to single-word examples.

There are no examples of final cluster deletion by Daniel, Richard or Grace, a fact that not only provides further evidence of their word-final bias but also illustrates the antithetical nature of Strand-A and Strand-B profiles. This is exemplified in Daniel's use of metathesis in *brush* [bʌrʃ] (2;1) (Menn 1971: 243) and in the production of final clusters in *horse* [ars] (p. 231), *beard* [bird], *park* [gark] and *cards* [kardz] (Menn 1975: 295), contrary to Mollie's (Holmes 1927) deletion of the final cluster in *bird* [bo] (1;8) and *girl* [gœi] (2;0) (see Table 2.11). Moreover, production of final clusters is more advanced in the Strand-B children. Richard's extensive repertoire of 24 final bi- and tri-consonantal clusters at 2;0 is shown in Section 2.1.2.1. Grace's final clusters start to appear at 1;7 in *boots* [buts]. She produces final /ts/ consistently thereafter, with [nʤ] appearing in *orange* [ʌnʤ] at 1;9 (cf. Richard's *lunch* [ʌnʧ] at 1;7-1;8). By contrast, Mollie's first final cluster /ts/ does not appear until 1;11 in *carrots* [kæ.ʌts] (Holmes 1927: 224).

Strand-A Mollie (Holmes 1927) and Jennika (Ingram 1986: 227) use regressive velar assimilation in CVC words, resulting in the backing of initial alveolar consonants, particularly in conjunction with the production of final [k]. This process has been shown to be present also in Strand-B children, for example in /d/→[g] in *duck*. However, Strand-A backing of velars is limited to cases of velar harmony. Velar preference in Strand-B children is demonstrated in the backing of alveolar consonants and postalveolar affricates in words without velar targets, of which there are no examples in the Strand-A children. Strand-B examples of this are shown below. Daniel and Richard also back and reduce initial homorganic alveolar clusters at some stage. [g] is the main substitute in these backing processes:

Daniel: /tr/→[g] /tr/→[ŋ] /str/→[g] /ʧ/→[g] /ʤ/→[g] /n/→[ŋ]

tree [gi:] *train* [ŋjajn] (both in Stage 3)

street [gi:t] (Stage 5) (previously [di:t])

cheese [gi:z] (Stage 5) (initial consonant previously deleted)

juice [gu:s] (Stage 5) (initial consonant previously deleted)

nice [ŋjaj] (1;9)

Richard: /d/→[g] /t/→[k] /st/→[g]

do [gu:] *door* [gɔ:] (1;11)

down [gaʊn] (1;6) *downstairs* [gaʊntɛəs] (1;11)

toys [kɔɪz] (1;11)

stories [gɔ:ɹi:z] (1;11)

Grace: /d/→[g] /ʧ/→[k]

deer [gi] (1;7)

cheese [kis] (1;7)

Strand-A stopping of initial fricatives is shown in Table 2.11 and in the commentary on Mollie, Philip and Jennika. This takes several forms: /s/→[t], /s/→[g] (in velar assimilation), /f/→[p/b] and /ð/→[d], of which only simple alveolar-to-alveolar stopping of /s/→[t] does not involve another phonological process. Strand-B children employ an alternative strategy in their early words, that of deleting initial fricatives /f/, /s/ and /ʃ/, although initial /s/ is acquired early by Grace (see Table 2.12). This table also shows that Richard deletes the initial fricative /ð/ in the deictic words *that*, *there* and *this* when otherwise he produces [ð] or substitutes it with [v]. However, in the closing stage of the study on Richard (2;4-2;7), he adopts the /ð/→[d] stopping process in free variants of *this* and *that*, so that *this* is [ɪs], [vɪs] or [dɪs] and *that* is [ðæt], [væt] or [dæt]. These are the only examples of his initial stopping of fricatives. There is no indication of how Daniel coped with initial /ð/; possibly he avoided /ð/-words. However, Grace also uses the initial /ð/→[d] process, in *that* [dæt] (1;6) and *those* [doʊs] (1;8). This shows that, unlike other fricative-stopping processes, the use of the initial /ð/→[d] process is not confined to Strand-A children.

The speech data from Strand-A and Strand-B children suggest that several other of the "common" processes listed by Grunwell (1987: 212-226) and endorsed by Oller (2000: 54) are not employed exclusively by one group or the other. This is demonstrated in the common use of initial cluster reduction (typically /pl/→[p];/sp/→[p]), weak syllable deletion (see also Fee and Ingram 1982), final consonant devoicing, and gliding, typically /r/→[w].

A number of processes are demonstrated in both sets of children but are more typical of Strand-A or Strand-B profiling. Consonant harmony, in particular regressive velar assimilation to final /k/, as in [gʌk] for *duck*, is found in both Strand-A and Strand-B children. This is consistent with Vihman's (1978: 302) finding that most consonant harmony is regressive and with Stoel-Gammon (1985) that one of the first final consonants produced is [k]. (See also Vihman and Hochberg (1986).) Ingram (1974a) reports that "back assimilation" (previously observed at 1;7) is still found in Jennika from 2;0 to 2;2, for example in *talk* [kɔk], *dog* [gɔk] and *duck* [gək] (p. 60). However, the use of velar harmony is more extensive and systematic in Strand-B children who also favour bilabial harmonies of place, although the strength and the direction of the harmony vary from child to child.

It has been shown that Strand B-children use initial consonant deletion more than final consonant omission (see Tables 2.12 and 2.13), and that they use initial cluster deletion exclusively. Conversely, Strand-A children use final deletion more because this is linked to their higher rates of reduplication (see Table 2.11). However, initial deletion of /h/ is found in all Strand-A and Strand-B children. In Mollie this is demonstrated at 1;6 in *hat* [æ]/[æ.t] and *Henry* [ɛ.wi] (Holmes 1927), in Philip in *hat* [æ] and *hot* [a] at 1;7 (cited in Ingram 1975: 291), and in Jennika at 1;6 also in *hat* [ak] and *hot* [at] at 1;6 (Ingram 1975: 291). Holmes (1927) reports that from 1;10 to 2;0 Mollie deletes initial /w/ in *where* and initial /l/ in *letter*, both realised as [ɛə], whilst /l/ is vocalised in all /l/-final words. This suggests similar difficulty in producing [l] as those encountered by the Strand-B children (see Tables 2.12 and 2.13). Also at 1;11, Mollie's production of initial [ð] is unreliable and is deleted in *that* [æt] and *that's* [æs] (cf. Richard's *that* [æt] 1;6-1;11). Table 2.14 summarises the phonological processes used by Strand-A and Strand-B children.

Table 2.14: Comparisons of Strand-A and Strand-B use of simplification processes

Process	Strand A			Strand B		
	Mollie	Philip	Jennika	Daniel	Richard	Grace
Reduplication	24%*	30%*	21%*	4%*	None	Minimal
Final consonant omission	/t g θ s m n l r/	/t k m n l r/	/b t k r/	/t z n/	/l/	/d l/
Final cluster deletion	Yes	–	–	No	No	No
Fronting of initial /g k/ (n/a)	Yes	–	–	No	No	No
Stopping of initial /ð/	Yes	–	Yes	–	Some	Yes
Stopping of other initial fricatives	Yes	Yes	Yes	No	No	No
Initial affricate reduction to [t d]	Yes	–	Yes	Some	Some	Yes
Initial consonant deletion	/ð h w l/	/h/	/h/	/f s ʃ h ʧ ʤ n w l r/	/t f θ ð s z ʃ h ʧ m n w l ɹ j/	/b d f θ ʃ h ʤ m w l r/
Initial cluster deletion	No	No	No	Yes	Yes	Yes
Backing of initial /d t n/ (n/a)	No	No	No	Yes	Yes	Yes
Gliding of initial liquids	Yes	Yes	Yes	Yes	Yes	Yes
Weak syllable deletion	Yes	Yes	Yes	Yes	Yes	Yes

(n/a) – non-assimilatory

– Not found in the available data

* Measurement found in Fee and Ingram (1982: 46)

Therefore, the most common Strand-A features, word-initial bias, alveolar-over-velar preference, word-initial stopping, the use of reduplication and the omission of final consonants, have been shown to co-occur in Strand-A children. As suggested in O'Neal 1998, children with Strand-B profiles produce final and velar consonants with greater accuracy than initial and alveolar consonants. This reduces the likelihood of reduplication and final consonant deletion but increases the likelihood of initial consonant deletion and the velar backing and, to a lesser extent, the bilabial fronting of alveolar consonants. Strand-A and Strand-B features are not mutually exclusive, however. Initial consonant deletion particularly of articulated fricatives, final consonant deletion particularly of plosives and liquids, and /ð/→[d] word-initial stopping have been shown to be common in, although not used equally by, Strand-A and Strand-B children. However, the gliding of liquids, word-final devoicing, the substitution of initial voiceless consonants by voiced counterparts, initial cluster reduction and initial deletion of /h/ are common to both sets of children in the early stages of speech.

In the second section of Chapter 4, the incidence of systematic fronting, backing, word-initial deletion, word-final deletion, stopping and reduplication will be examined. Together with the findings of Section 4.1 showing the differential patterns of consonant use and avoidance according to word position, the use of these processes will indicate whether there is any evidence of word-initial or word-final bias by the children in the present study. The next chapter discusses the methodological issues concerned with the setting up and monitoring of the study.

3. Methodology

The main objective of the research was to collect primary data on the phonological patterns of an infant cohort learning a non-rhotic variety of British English, using the same method employed in the case study of Richard (O'Neal 1998). It was intended that parental diaries should document the spontaneous utterances of children from the earliest stages of intended speech for a period of up to one year. As in the previous study, the focus of the analysis would be on the order of emerging consonants, and on the deletion processes and selected substitution processes, utilised by young children to overcome their inability to articulate target sounds.

The eligibility criteria for the study were as follows:

a) English was the first language of the child;
b) English was the native language of the principal caregiver;
c) The principal caregiver was a parent of the child;
d) The parent was prepared to commit to a minimum period of diary keeping of six months.

Diary-keeping

Diary-keeping has been the traditional way of collecting longitudinal speech data on infants (see Chapter 1). Although the advent of recording equipment has provided an alternative, the diary method remains the quickest, easiest and most immediate way of reporting child speech. Full-time parents are in an ideal position to closely monitor their children's speech and, as such, represent a significant and largely untapped resource. Parental observations can be recorded in a diary, providing an additional resource of information as to the context and the intention of utterances.

There are limitations to the use of diary-keeping for this purpose, however. Constant monitoring of an infant's articulations using the diary method is only practicable in the earliest stages of speech. (The target length of the study period, from six months to one year, was intended to keep the task of diary-keeping within manageable proportions.) But diary studies alone cannot address issues of voicing, aspiration or glottalisation in infant speech. Ideally, diary transcriptions should be supplemented by regular recordings of the children's speech. This was an original intention, but it proved unfeasible in the present study.

Recruitment of subjects

Permission was obtained for a pilot study to be conducted. The mother of a 15-month-old girl who was personally known to the author was recruited. The data on this child were later incorporated into the main study. Colleagues from the Infant Study Unit in the Psychology Department at the University of Sussex provided contact details of parents who had previously responded to advertisements for infant subjects. A selection process took place to identify equal numbers of girls and boys that would fit into the experimental timeframe. The target age range at the commencement of the study was 12 to 15 months for girls and 15 to 18 months for boys.[8] (Previous studies suggested that first words appeared earlier in girls than in boys. Ota's (2003) recordings started at 1;0;22 for the female subject, and at 1;5;19 and 1;4;24, respectively, for the male subjects, because the first word produced by the girl

[8] These represented a downward revision of the ages for both sexes proposed in the original research plan.

appeared an average of two months earlier than the first words of the boys. See also Huttenlocher *et al.* (1991) on the link between gender and vocabulary growth, and Hobman (1997: 92-3) on the differential rates of phonological acquisition for English-speaking girls and boys.)

Subsequently, correspondence was sent to the mothers of a further twenty-six infants, fourteen boys and twelve girls, outlining the research and inviting them to take part (see Appendix 1). This was followed up by telephone calls to arrange home visits. The mothers of ten girls and ten boys agreed to participate in the study. Two of the girls were dizygotic twins. All the families were resident in Sussex, although spread over a wide area. An administrative delay in obtaining permission for the pilot study, which had resulted in the loss of an original one-year-old female subject, created an overlap between the pilot and the main study. Therefore, the pilot study was not used, as intended, to inform the guidance given to parents at the commencement of the period of data collection. The research project was granted approval by the University of Sussex School of Humanities Research Governance Committee.

Procedure

Interviews were set up in the homes of the twenty infants whose mothers had agreed to take part in the study. These confirmed the eligibility status of all the participants. Further information on the linguistic influences on the child was obtained using a questionnaire (Appendix 2). This was completed by the researcher in conversation with the mother. Diaries were handed out, together with a sheet explaining the study in more detail (Appendix 3). Some instruction was provided in order to anticipate any problems arising from differences between the orthographic and phonetic form of a word, and between the "word intended" and "word produced". A consent form (Appendix 4) for each child was signed at the conclusion of the initial interview.

One boy was withdrawn from the study after six weeks at the request of the mother without the collection of any speech data. During the course of the study period, contact was lost with three more of the families, and despite numerous attempts the diaries could not be recovered. The reasons for this could not be ascertained, as the mothers had all been contacted since the initial interview and were assumed to be maintaining records. The mother of the pilot study subject agreed to continue to keep the diary beyond the original period of six months. Code names were given to the remaining children according to the date of birth (A–Q) and the sex of the infant (G or B), so that the pilot study child, who was the oldest, was coded 'AG'.

Occasional home visits were arranged to collect the diaries in order to photocopy the entries for data analysis. (Appendix 5 includes copies of the first entries for BB, KB and LB.) Pronunciation queries were answered when returning the diaries, or by telephone or post. (Appendix 6 includes the best copies available of three of these exchanges, for FG/GG, NB and QB.)

Clarification was sought on the transcription of homographs, the number of syllable targets (e.g. was *medicine* a disyllabic or trisyllabic target), possible variation in phonological targets (e.g. final /ʤ/ or /ʒ/) and unclear handwriting. Lexical items were excluded if there was no evidence that the mother had witnessed the utterance, for example LB's *milk*, which was "heard by Granny" (see Appendix 5c). QB's mother produced electronic word lists of his pronunciations at certain dates from 1;5, which provided supplementary data to the diary entries.

In some cases, the length of the study became self-limiting. Five of the sixteen mothers had subsequent pregnancies and did not wish to continue the diary-keeping beyond the period of their next confinement, although updates were obtained on two of these children, BB and CB.

Computer records were set up to analyse the diachronic and synchronic use of consonants of the seventeen children in the cohort. To protect the anonymity of participants, an identification code was allocated to each child, according to the system described above. An electronic log detailing all contact with the parents has been kept. All the diaries were returned to, and have been retained by, the mothers.

The first entries for BB, DB, LB, NB and PG were retrospective diary entries. These were either transferred from notes taken out of interest by the mothers before being contacted about the study, or from recollection, and were registered in the diaries with approximations of age or date. All retrospective entries were excluded from further analysis. Once PG's retrospective entries had been removed, there were insufficient entries left in the diary for analysis; updates had not been provided on many of the retrospective entries, presumably because they were still in use. (PG's retrospective entries are shown in Appendix 7). PG was therefore excluded from the study. MG was later excluded also from the study because, after a short time, the mother abandoned the suggested scheme of reporting words as they appeared, and instead provided monthly summaries of words produced.

Personal details of the participants

The interviews and questionnaires of the remaining fifteen participants revealed the following details:

The children

All the children were born in Sussex. Three of the girls had been born prematurely, one month before term: the twins FG and GG, and OG. The fifteen children who eventually formed the cohort were born between 3rd April 2004 and 18th January 2005. At the beginning of the study period, all the infants had passed health-screening checks, including routine hearing tests. On interview, JG's mother admitted to 40 per cent hearing loss, but JG's own hearing had undergone more rigorous checks and had been declared normal.

Six of the children were the first-born of the family: BB, CB, EB, KB, LB and QB.[9] Five were second-born children: HB, IG and NB with an older sibling of pre-school age. AG and DB had an older sibling of school age. Twins FG and GG were the third and fourth children of the family. JG and OG were third in birth order; both had teenage siblings.

The mothers

The principal caregiver was the mother in every case, although several mothers worked part-time throughout the period of diary-keeping. All the mothers were native speakers of English, and all were born and raised in London and the Home Counties of England, except the mothers of FG and GG (from Bristol), CB (born in Ireland), JG (born in Wales) and KB (born in Devon). These origins could

[9] Hoff-Ginsberg (1998) showed the relationship between birth order and vocabulary size.

not be detected in the accents of the latter three, but the twins' mother had retained a slight post-vocalic burr. The mother of KB was the only caregiver considered to have a Received Pronunciation accent. None of the mothers had non-standard use of the interdentals.

Linguistic influences

Outside the relationship of mother and child, the children were subject to various linguistic influences of fathers, grandparents, childminders and siblings, particularly if they were close in age. Native accents of English had been retained by JG's father who was from Rhodesia (now Zimbabwe), LB's father from Yorkshire, and NB's father from Liverpool, and by a regular childminder of FG and GG who, like their mother, was from the Bristol area of England. QB, by far the most verbally precocious of the cohort, was exposed to Spanish in the home from his mother's fluent use of the language and also from Argentinian friends of the family. This seems to have had little effect on QB's lexical acquisition of English, however, as the only two Spanish words in his extensive vocabulary were recorded after 180 words, at 1;4;18. During the course of the study, FG, GG and HB encountered French at nursery or playgroup, but no French words were reported in the diaries of these children.

The logistical aspects of diary-keeping

The mothers varied greatly in their application to the task, which required a degree of dedication to record the fine detail of pronunciation and to maintain regular notes. The success of the study was wholly dependent upon the time that parents were prepared to devote to maintaining the diaries. Some mothers had returned to part-time working, whilst others experienced bereavement or personal health problems. JG's mother, for example, spent a considerable time in hospital during the study period, which resulted in a total of only 43 lexical items in JG's known vocabulary (see Appendix 8). Such factors presented key obstacles to the continuous monitoring of the children's use of consonants, although the most diligent correspondents were not necessarily the stay-at-home mothers of only children.

The delivery of the diaries prompted immediate registering of block lexical entries by the mothers of the following children:

AG – the first 13 words (1;3;10)

CB – the first 12 words (1;4;2)

HB – the first 38 words (1;3;28)

QB – the first 43 words (1;2;19)

Conversely, there are significant gaps in the diary entries of several children. IG and JG were not monitored for two and a half months between diary entries 8 and 9, and 11 and 12, respectively. There is a time lapse for KB between entries 6 and 7. OG's diary shows two time lapses, each of two months' duration, between words 5 and 6, and words 16 and 17.

Terms of reference

The following chapter (Chapter 4) details the patterns of phonological development of the fifteen children at three points of analysis. This is based on all entries made after delivery of the diaries. The list of entries is shown as Appendix 8.

4. Results and analyses

This chapter is presented in two parts. Section 4.1 examines the longitudinal data on the appearance of consonants in the fifteen monolingual children acquiring British English. Inventories show each child's production of initial and final consonants and consonant clusters. Section 4.2 analyses the corpus of each child for evidence of Strand A or Strand B features, as defined by O'Neal (1998), incorporating the findings of Section 4.1 on their word-initial/final bias and consonantal preferences.

4.1 Consonant inventories

The longitudinal data presented in this section are based on the appearance of consonants in spontaneous utterances reported in the parental diaries on fifteen children. Consonants are included in each child's inventory from the day its articulation was first reported, the same method used by Lewis (1936) to create K's inventory (p. 178). However, unlike Lewis, the inventories here only report on the children's patterns of success in achieving consonant targets, except in the case of the earliest clusters. Word position is analysed and the progress of both singleton and cluster consonants charted. An indication is also provided of the consonants that were not produced or that did not appear as targets in the child's lexicon. Issues of voicing are not addressed, as they cannot be verified.

The age at first entry in the corpus, after retrospective entries and lexical items consisting only of vowels have been removed, ranges from 1;0.26 (JG) to 1;4.23 (BB). This reflects the later delivery of boys' diaries and rules out the possibility of applying age-matched criteria across the cohort at the first point of analysis. Significant variation is also found in the number of entries made on the first day of recording, and in the growth of vocabulary and parental monitoring of it. To circumvent these methodological issues, the first consonant inventories of each child (shown in sub-sections 4.1.1.1, 4.1.1.2 or 4.1.1.3) are compiled on the basis of consonant production in a minimum of five lexical items in the earliest diary entries to a maximum of 43 diary entries reported for one child in a single day. Utterances are further analysed to identify the syllabic structures used by each child in their earliest diary entries. Sections 4.1.2 and 4.1.3 take into account the remaining parts of the corpus. Section 4.1.2 analyses consonant production up to the age of 1;6 and Section 4.1.3 incorporates consonant production to the last diary entries. In all sections, the most commonly-used consonants are identified and also those that have not been produced, differentiated on the basis of word position.

4.1.1 The first consonant inventories

In order to provide baseline consonant inventories for each child, the children have been assessed individually and placed into one of three groups, according to the number and length of period covered by the first entries in the diary. The first group consists of eleven children: JG, whose first six entries were recorded on the first day, and BB, DB, EB, FG, GG, IG, KB, LB, NB and OG, whose first five, six or seven diary entries were documented over a period ranging from eleven days to three months. The sixth and seventh diary entry is included if reported on the same day as the fifth. The exception is KB, whose sixth word is incorporated because it precedes a lengthy gap in the diary. The second group is a pairing of AG and CB, whose first diary entries items exceeded these numbers on the first day of reporting. Analysis has been conducted at the 15- or 16-word point of their diaries respectively, which represents monitoring over two days for AG and over five days for CB. The third group is a further pair, HB and QB, whose earliest diary recordings are in blocks of 38 lexical items for HB and 43 for QB. Consonant inventories are shown according to manner and place of articulation. These data are analysed to show comparisons of consonant success and failure within and between the groups, which are presented in subsections 4.1.1.1, 4.1.1.2 and 4.1.1.3.

4.1.1.1 <u>The first inventories of BB, DB, EB, FG, GG, IG, JG, KB, LB, NB and OG</u>

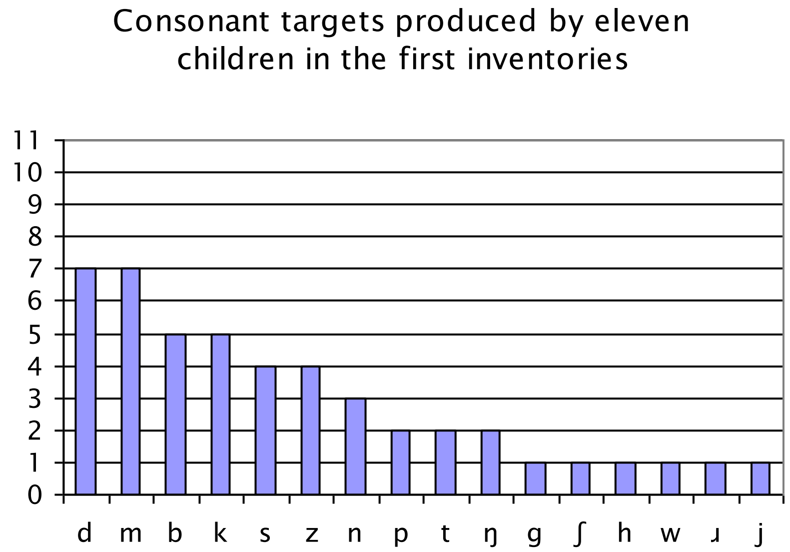
Table 4.1 shows the target consonants produced by the eleven children in the first set of diary entries (five, six or seven words). This includes the articulation of consonant targets in all word positions and in clusters. (Column 3 shows the number of diary entries analysed for each child. Column 4 shows the total number of different consonants produced by each child.)

Table 4.1: Consonants produced by eleven children in the first inventories

Child	Age	Entries	Cons	p	b	t	d	k	g	s	z	ʃ	h	m	n	ŋ	w	ɹ	j
BB	1;4.23–1;5.10	5	4		✓			✓		✓				✓					
DB	1;3.27–1;4.7	6	2			✓	✓												
EB	1;3.18–1;4.15	5	2				✓			✓									
FG	1;1.19–1;4.17	6	4				✓			✓				✓	✓				
GG	1;1.24–1;3.19	5	1		✓														
IG	1;1.21–1;3.13	5	4				✓	✓		✓				✓					
JG	1;0.26–1;0.26	6	6		✓		✓				✓		✓	✓	✓				
KB	1;3.10–1;3.23	6	6	✓			✓	✓	✓		✓			✓					
LB	1;1.27–1;5.10	6	7		✓		✓	✓						✓	✓	✓			✓
NB	1;3–1;4	7	6	✓	✓			✓			✓	✓				✓			
OG	1;1.5–1;1.16	5	5			✓					✓			✓			✓	✓	

As Table 4.1 indicates, there was considerable variation in the number of different consonants produced in the first diary entries of the eleven children, ranging from one to seven consonants, with an average inventory size of 4.4. However, fricatives /f v θ ð ʒ/, both affricates, and the lateral are absent from the inventories of all eleven children, although /v/, /ʒ/, /ʧ/ and /ʤ/ were not phonemic targets. The eleven children produced a total of 47 targets from a collective inventory consisting of sixteen consonants. Fig. 4.1 illustrates their distribution.

Fig. 4.1



The graph shows that /d/ and /m/ are the only consonants to appear in more than half the inventories, although all the plosives, nasals, bilabials and velars and both alveolar fricatives are represented. The single case of /ɹ/ is word-medial in the name *Aaron*, and the single case of /ʃ/ is medial in the phrase *there she is*. Consonant classes produced by the group are found in the following orders of frequency:

alveolar > bilabial > velar; plosive > nasal > fricative

However, consonants and consonant classes were subject to different patterns of production depending on their context. Table 4.2 shows the differential rates of initial and final consonant singletons found in the inventories of BB, DB, EB, FG, GG, IG, JG, KB, LB, NB and OG.

Table 4.2: Initial and final singleton targets produced by eleven children in the first inventories

Child	Initial consonants									No.	Final consonants							No.
	b	t	d	k	h	m	n	w	j		p	t	k	g	s	z	m	
BB	✓					✓				2								0
DB		✓	✓							2		✓						1
EB			✓							1					✓			1
FG			✓			✓	✓			3					✓			1
GG	✓									1								0
IG			✓	✓		✓				3			✓		✓			2
JG	✓		✓		✓	✓	✓			5						✓		1
KB			✓	✓		✓				3	✓			✓		✓		3
LB	✓		✓			✓			✓	4								0
NB										0						✓		1
OG						✓		✓		2		✓					✓	2
	4	1	7	2	1	7	2	1	1	26	1	2	1	1	3	3	1	12

The consonants in the collective inventory of initial singletons are found in the following orders of frequency:

bilabial > alveolar > velar; plosive > nasal > glide > fricative (/h/)

By contrast, most consonants in the collective inventory of final consonants are alveolar, and fricatives just outnumber plosives. Final bilabials and velars share second place, but their incidence is low.

Table 4.2 also shows that the ratio of initial to final consonants in inventories is more than 2:1, in part reflecting the sizeable proportion of words in this data set without codas. However, the number of different initial consonants produced by the group exceeds the number of final consonants only if the glides are counted. Plosives /b/ and /d/ are exclusively word-initial, whereas /p/, /s/ and /z/, are exclusively word-final. With one exception, /m/ is word-initial. Five children have only one consonant in their final inventory, and four of these are /s/ or /z/. The only final voiced plosive in the inventory is /g/, produced by KB, who was the only child to achieve all his consonant targets; all his targets were singletons. BB, GG and LB did not produce any of their final singleton targets, although LB achieved a final cluster and BB produced the fricative of the final /st/ cluster in *toast*. GG had only one final target, /n/, which appears in the fifth diary entry, *Eryn*, and which she produced in *Eryn* four days after the first attempt.

JG was the only child to produce /h/, in *hello*. Six other children deleted /h/ in their attempts at *hello*. NB avoided initial /f θ ð ɹ/ in addition to /h/, but produced /p/ and /b/ in the reduction of initial clusters /pl/ and /bl/. His success in the production of medial targets, including /ʃ/, also contributes to the differences between his inventory in Table 4.1, with six consonants, and his inventories in Table 4.2 with only one. LB and JG deleted initial clusters /dɹ/ and /fɹ/ respectively, and FG deleted initial /kl/ and /kɹ/.

All of BB's words were monosyllabic, and his is the only case of 3>1 syllable reduction of *banana* in the entire corpus. Furthermore, BB's articulation of *clock*, with extended vowel length and deleted final consonant, suggests final compensatory lengthening. The vowel was shortened in *moon*, however. Although BB was the oldest child at the beginning of the study, he was the only child whose earliest-reported patterns were limited to basic consonant-initial structures.

Table 4.3 shows the range of syllable structures found in the first set of diary entries of the eleven children. Few of the children had vowel-initial targets, indicating that most vowel-initial utterances resulted from initial consonant or cluster deletion. Since some of the entries were recorded over a period of weeks or months, the table shows them in the order in which they first appear in the diary. Phrases are represented within brackets. (R) indicates forms that are reduplicative.

Table 4.3: Syllable structures of eleven children in their first diary entries

BB	CVC CV CVV
DB	(CVV VC) CVCVC VVVV(R) CVV
EB	VCVV CVCV(R) CVVCV CVC V
FG	(VV VV VV) VVV CVCV(R) CVV
GG	CVV VVV V CVVV
IG	CV CVCV(R) CVC VC
JG	CVCVV CVC (CVV CVV) CVCCVC(R) CVVCVV(R) VVV
KB	CVC CVCV(R) CVCCVC(R)
LB	VCC CVCVC(R) CVCVCV(R) CVC CVCVCVCVC(R) CVCVCV(R)
NB	CVVC (CVCCVV) VVCVV (CVVCVVC) CVV VCCVCC(R)
OG	(CVVCVC) (CVCCVC) CVC VCVV VCV

Table 4.3 confirms the divergent patterns of BB. He is one of only two children to produce a CV utterance; the other child is IG who later produced the VC syllable in *yes*. BB and KB are the only children who did not produce at least one vowel-initial structure; for three children this occurred in their first diary entry. Five of the children produced at least one utterance that was purely vocalic.

4.1.1.2 <u>The first consonant inventories of AG and CB</u>

Table 4.4 shows the consonants produced in AG and CB's first set of diary entries, consisting of fifteen lexical targets for AG and sixteen for CB. For purposes of comparison, all of the consonants produced by the eleven children shown in Table 4.1 are included. AG is the only child who produced /l/.

Table 4.4: Consonant targets produced by AG and CB in the first diary entries

Child	Age	Entries	Cons	p	b	t	d	k	g	s	z	ʃ	h	m	n	ŋ	w	l	ɹ	j
AG	1;3.10-																			
	1;3.11	15	9		✓	✓	✓	✓				✓		✓	✓			✓	✓	
CB	1;4.2-																			
	1;4.7	16	10	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓				

When all the consonants produced in the first diary entries are taken into account, AG and CB share /b t d k ʃ m n/. CB's inventory includes all the plosives and nasals. AG's inventory includes both liquids, but like OG, she produced /ɹ/ only word medially (in *Harriet*, which was reduced to two syllables). Both children deleted /h/. Neither child produced an alveolar fricative, although only AG's vocabulary presented this possibility, with final /s/ and /z/ targets. /w/ was not a target for either child, but both children avoided /j/ by using consonant harmony. /g/ was only a target in medial position for CB in *digging* and *yoghurt*, which he produced in regressive velar assimilation in *digging* but not in *yoghurt*, where he used alveolar harmony.

Table 4.5 identifies the initial and final consonant singletons in AG and CB's first inventories. As in the first group's totals, the ratio of initial-to-final consonants is 2:1.

Table 4.5: Initial and final singletons produced by AG and CB in the first diary entries

Child	Initial consonants								No.	Final consonants					No.
	p	b	d	k	ʃ	m	n	l		t	k	ʃ	n	ŋ	
AG		✓	✓		✓	✓	✓	✓	6	✓	✓				2
CB	✓	✓	✓	✓	✓	✓			6	✓		✓	✓	✓	4
									12						6

Table 4.5 shows that all of AG's consonants were bilabial, alveolar or postalveolar. CB produced one initial velar and one final velar, which was the velar nasal. Half of the initial consonants produced were plosives, but AG only produced /b/ and /d/. Both children produced six initial consonants, compared to AG's two final consonants and CB's four. AG and CB's initial inventories share the most common consonants found in the first group, /b/, /d/ and /m/. AG and CB also share initial /ʃ/ in *shoe* and *shoes*, and both children used [ʃ] to substitute for other fricatives, which resulted in consonant harmony. CB has both initial and final /ʃ/ in his inventory.

CB had two initial cluster targets, /pl/ and /ʃɹ/, both of which were reduced; in the case of /ʃɹ/ stopped in harmony with the medial alveolar in *shredder*. AG and CB's final inventories have only /t/ in common. (/t/ was not a word-initial target for either child.) Final /k/ was produced by AG, and /n/ and /ŋ/ by CB.

The syllabic patterns for AG and CB reflect the absence of any clusters and the use of initial consonant deletion. In the case of AG, initial /k/, /ɹ/ and /l/ were deleted in addition to /h/, and she did not produce a CV or a CVC utterance. CB only produced a CV utterance as the result of final consonant deletion, in *cat*. In common with some children in the first group, AG and CB produced reduplicative forms for *Mummy*, *Daddy* and *baby*. As in JG and LB, the CVCCVC form of *Mummy* was produced by CB, who also used full reduplication in *shoe*.

Shown below are the syllable structures used by AG and CB in their first diary entries, which are in order of shape rather than the order in which they appear in the diaries, because unlike the first group they were reported in a matter of days rather than weeks or months. Phrases are shown in ( ) brackets, although there are few examples of these. Examples of reduplication are indicated as (R).

The syllable structures produced by AG in 15 lexical items:

VV VC VVC VCVC CVV CVCV(R) CVVC CVVCV (CV CVV)

The syllable structures produced by CB in 16 lexical items

VV VVV CV CVV CVC CVCV(R) CVVC CVCVC (CVV CVV) CVCVVC CVCCVC(R)

4.1.1.3 The first consonant inventories of HB and QB

Table 4.6 shows the target consonants produced by HG and QB in their respective 38 and 43 diary entries on the first day of reporting. HB produced fifteen, and QB eleven, of the target consonants in the first block of entries on that day.

Table 4.6: Consonants produced by HB and QB in the first diary entries

Child	Age	Entries	Cons	p	b	t	d	k	g	f	θ	s	z	ʃ	h	ʧ	m	n	w	l	ɹ	j
HB	1;3.28	38	15	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓		✓
QB	1;2.19	43	12		✓	✓	✓	✓		✓		✓		✓			✓	✓	✓	✓	✓	

Nine consonants are common to both inventories: /b t d k s m n w l/. HB and QB share six consonants with AG and CB: /b t d k m n/. With the exception of /l/, all of HB and QB's shared consonants, /b t d k s m n w l/, are common to the inventory for eleven children shown in Table 4.1 and Fig. 4.1. HB only produced /l/ in medial position, although this included its production in the medial cluster in disyllabic *chocolate*. QB's production of [l] is reported in an attempt at the initial cluster in *clock* (with a suggested combination of [f θ l]), and also as a singleton word finally in words with syllabic-/l/ targets, *apple*, *bubble* and *cuddle*, although not in *ball* and *owl*.

HB's inventory includes at least one constituent of every articulatory class of manner, reflecting his reported success in producing a wide range of initial cluster and medial targets. /g/ is present in HB's inventory in Table 4.6 as he produced it in the reduced /gl/ cluster in *glasses* and medially in *yoghurt*. /s/ was produced in reduced initial, medial and final clusters and as a singleton medially. /j/ is present in HB's inventory because it was reported medially in *hiya*, although it was deleted word initially in *yoghurt*. QB's inventory in Table 4.6 also consists of consonants that did not appear as singletons in initial or final positions. /w/ and /s/ targets were produced only in reduced clusters, although both consonants were also in use as substitutes for initial or final singletons.

HB reduced six initial clusters, /bl/, /gl/, /tɹ/, /kɹ, /kw/ and /st/; all reduced to the plosive with the exception of /st/ in *star*, which reduced to /s/.[10] QB reduced four initial clusters. The liquid was deleted in /bɹ/, but /k/ was avoided in the reductions of /kw/ and /sk/, as in all words with initial-/k/ targets. QB also reduced the /st/ cluster in *star* to the plosive, contrary to HB's *star* in which the fricative was retained. However, in HB and QB's attempts at the word *toast*, both children reduced the final cluster to /s/ (the same reduction process used by BB in *toast* at 1;5, although in a later version he

[10] HB went on to produce many words in which [ð] (verified by the mother) was used as a substitute in all word positions. This was the first sign of his fricative preference.

deleted it). Table 4.7 shows the range of initial and final singletons produced by HB and QB in their blocks of first diary entries.

Table 4.7: Initial and final singletons produced by HB and QB in the first diary entries

Child	Initial consonants										No.	Final consonants										No.
	p	b	t	d	k	ʧ	m	n	w	ɹ		p	b	t	k	f	θ	z	ʃ	n	l	
HB	✓	✓	✓	✓	✓	✓	✓	✓	✓		9	✓		✓	✓		✓	✓				5
QB		✓		✓			✓	✓		✓	5		✓	✓	✓	✓			✓	✓	✓	7
											14											12

QB produced more final consonants than initial consonants, and therefore does not maintain the difference in the number of initial and final singletons found in the other children. However, four of his five initial consonants produced, /b/, /d/, /m/ and /n/, are present in HB's inventory and also in those of AG and JG. QB's fifth initial consonant is /ɹ/, which he produced in all three variants of *raining*. HB's inventory of initial consonants is the largest of any child. He is the only child to have produced an initial affricate in the opening set of entries and then only one, other than CB, to have produced initial /p/. Both HB and QB deleted /h/. All QB's initial /t/, /k/, /g/ and /ʧ/ targets were reported as [d], and both of his initial-/f/ targets were reported as [w].

The first inventories of HB and QB have two final consonants in common, /t/ and /k/, although the latter was limited to one word, *clock*, by QB. Final /p/ was not a target for QB, but he produced final /f/. Final /ʃ/ was produced by QB in *fish*, and final /θ/ by HB in *teeth*, but QB's final /θ/ in *teeth* was reported as [s]. QB's final /k/ in *bike* was subject to idiosyncratic and free-variational fronting to [t] and [ʧ], variants that were also reported in the reduction of final cluster /lk/ in *milk*. QB avoided final /k/ further by also fronting /k/ in *duck*.

Final voiced plosives were in short supply. Only /b/ was present as a target, which was achieved by QB in *Bob* but was avoided by HB in *bib*.

The syllabic patterns for HB and QB reflect HB's production of medial clusters and QB's attempts at initial clusters. HB's repeated final /θ/ is also represented, as CC. As for the children in the other groups, the structures illustrate the use of initial consonant deletion. Both children reduced trisyllabic words to two syllables, but the only vowel-only or CV syllables resulted from final consonant deletion. Reduplication was limited to HB's repetition of the vowel in *Daddy*. Shown below are the syllable structures used by HB and QB in their first sets of diary entries, with phrases indicated by brackets.

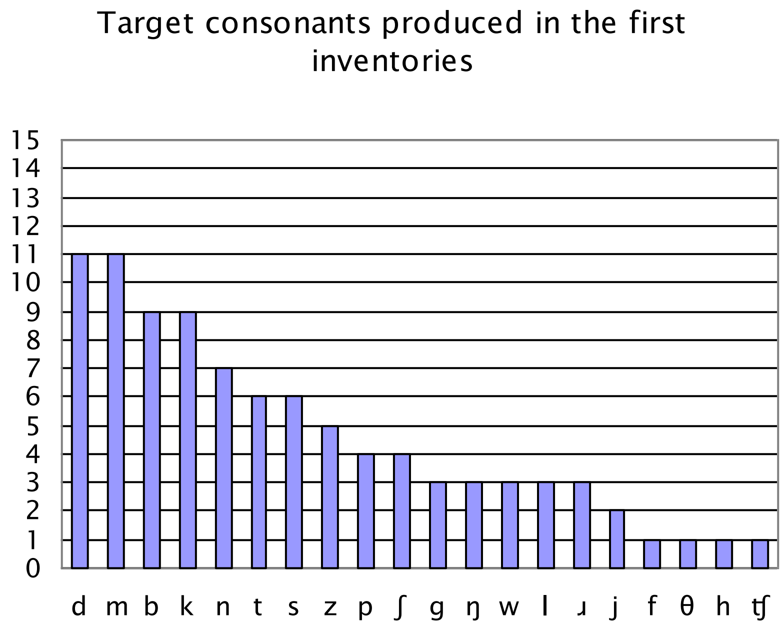
The syllable structures used by HB in 38 lexical items:
(VV VV) VVC VVCV VVCVV (VVCV VV) VCV VCVV VCVVC
CV CVV CVC CVCV CVCV(R) CVVC CVCVV (CVCVC) CVVCVV
CVCVVC (CVC CV) CVCCVVC CVVCC
The syllable structures used by QB in 43 lexical items:
VV VC VCV VCVC
CVV CVC CVCV CVVC CVCVV CVCVC CVVCV
CVVCVV CVCVVC CCCVC

These patterns show that, as for the other children, HB and QB produced a variety of syllable structures in their attempts at early words, and that some of these were vowel-initial or vowel-only articulations. However, the difference in the ages of HB and QB on the day of reporting of about six weeks might be the reason for the broader range of structures produced by HB.

4.1.1.4 Summary of the first consonant inventories

This summary of the first consonant inventories conceals significant differences in the phonological abilities of the fifteen children, ranging from GG, who missed most consonant targets, to KB who produced all targets, and HB who in 38 lexical items produced fifteen consonants including an affricate and a dental fricative. Fig. 4.2 shows the 93 consonants that appear in the first inventories of the fifteen children when all singleton and clusters consonants are included. This collective inventory consists of a range of twenty consonants. Three fricatives and one affricate had not been produced: /v ð ʒ ʤ/. However, /ʒ/ and /ʤ/ had not been targets in the first diary entries of any child.

Fig. 4.2



These data confirm the prominence and the accessibility of /d m b k n/ in early words, demonstrating the higher levels of production of bilabial, alveolar, plosive and nasal consonants. In doing so, they highlight not only the relative underperformance of consonants in other classes, but also those consonants that perform less well within their own class: /p/ and /w/ of the bilabials, /p/ and /g/ of the plosives, the liquids of the alveolars, and /ŋ/ of the nasals. Of the fricatives, /s/, /z/ and /ʃ/ were produced by the most children, but no consonants were produced to the same level of competence in, or were evenly distributed across, all word positions.

The analyses of initial and final consonants in Sections 4.1.1.1, 4.1.1.2 and 4.1.1.3 show that their distribution was highly differentiated, and that most of the children produced more initial singletons than final singletons, which is reflected in the higher incidence overall (Fig. 4.2) of consonants that occur mostly in initial position. The dominance of initial /m/ and /d/ is largely attributable to the presence of versions of *Mummy* and *Daddy* in the early vocabularies of the children, whereas final inventories reflect the presence of /z/ in the common words *cheese* and *please*, and the comparative accessibility of voiceless plosives and /s/ word finally.

The fifteen children produced a range of fourteen initial consonant targets, totalling 52 across all the first inventories. Fig. 4.3 shows their distribution. As in Fig. 4.2, initial /m/, /d/ and /b/ dominate this collective inventory. Five children produced the combination of /m/, /d/ and /b/. However, as reported above, these consonants were not initial targets for all the children, and some consonants are absent or have a low rate of occurrence in the first diary entries, so that the children’s ability to produce the range of initial consonants cannot be tested. Fig. 4.3 also conceals the identity and scale of consonants that occur frequently in English but were avoided by most or all of the children.

Fig. 4.3

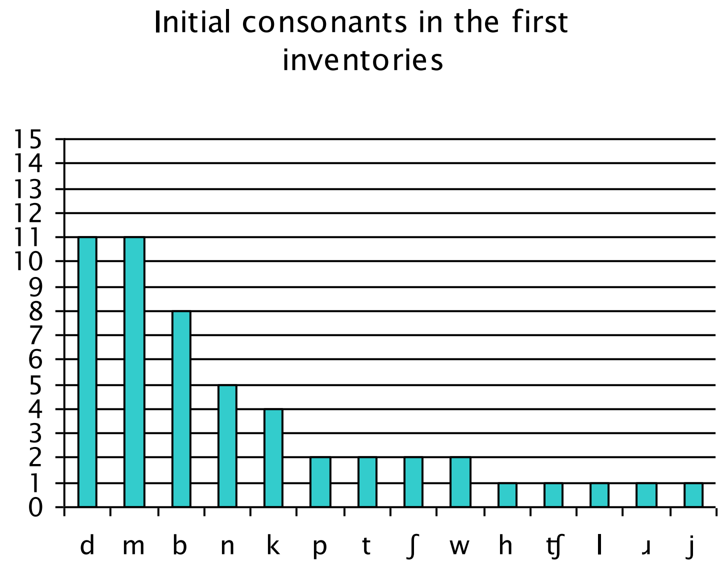


Fig. 4.3 confirms the prevalence and the accessibility of initial plosives, nasals, bilabials and alveolars in the early vocabulary, although there was only one singleton-/g/ and one singleton-/l/ target. The two children who produced only one initial target, produced /b/ or /d/, and one child produced only alveolar plosives /t/ and /d/. Two children produced only initial bilabial singletons, /b m/ or /m w/. However, two children with only three consonants in their initial inventories produced /k/ in addition to /d/ and /m/. Both of these children belong to the first group (Section 4.1.1.1), and therefore all three consonants were produced in the limited vocabulary of the first five or six reported words. A further two children, with extended vocabularies, also produced initial /k/.

The alveolar fricatives, /v/ and /ʤ/ were absent initial targets, but other fricatives, including /ʃ/, and an affricate were produced. The only /h/ was produced by a child who articulated all singleton targets (/b d h m n/) in the first six diary entries. All the approximants were produced by at least one child, including the rhotic and palatal /j/. As a group, the children therefore demonstrated that, even with limited vocabulary, their production of initial consonants encompassed a broad range of place and manner.

The consonant classes of initial singletons were produced in the following orders of frequency:

Manner:

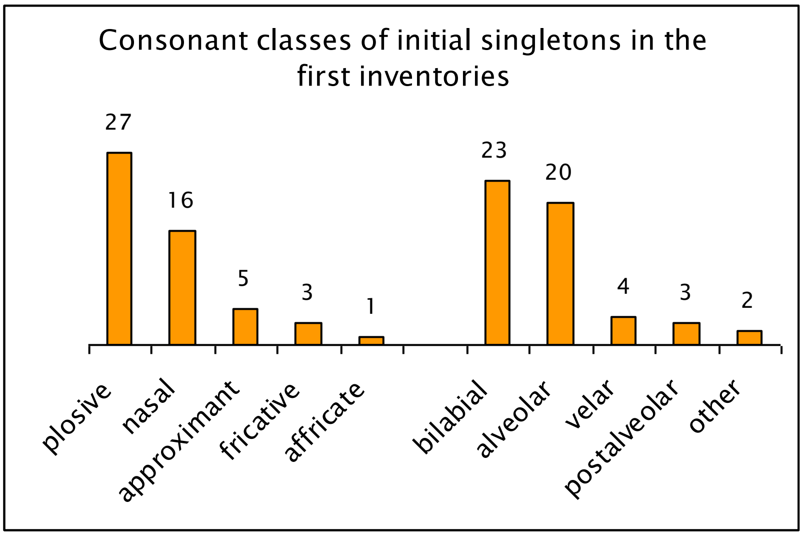
plosive > nasal > approximant (glide > liquid) > fricative > affricate

Place:

bilabial > alveolar > velar (bilabials = alveolars + postalveolars)

The order and scale of the differences within the classes of manner and place are shown in Fig. 4.4. (Differences in the number of constituent consonants in each class are not reflected.)

Fig. 4.4



Further analysis of the diary entries reveals the consonants that were most avoided. Eleven children avoided at least one initial singleton. Table 4.8 shows the initial consonants avoided by each of these children either by deletion or by substitution. Differences only of voicing, e.g. /t/→[d], are disregarded.

Table 4.8: Initial singletons avoided in the first diary entries

Child	p	t	k	g	f	θ	ð	ʃ	h	tʃ	n	ɹ	j	No.
AG			✓						✓			✓		3
CB					✓		✓		✓				✓	4
DB			✓						✓					2
EB	✓						✓		✓					3
FG									✓					1
GG		✓							✓		✓			3
HB							✓		✓				✓	3
IG													✓	1
NB					✓	✓	✓		✓			✓		5
OG									✓					1
QB			✓	✓	✓			✓	✓	✓				6
	1	1	3	1	3	1	4	1	10	1	1	2	3	32

Table 4.8 confirms that no child failed to produce initial /d/, /m/ or /b/ in target words. /h/ was an initial target for eleven of the children, but was produced by only one child, making it by far the most avoided initial consonant in the first diary entries. Moreover, for two children, /h/ was the only initial consonant that they avoided. Initial fricatives /f/, /θ/ and /ð/ were not produced by any child. The glide /j/ was successful in only one of four cases, and the initial liquid /ɹ/ in only one of three, although /ɹ/ was produced by two children word medially.

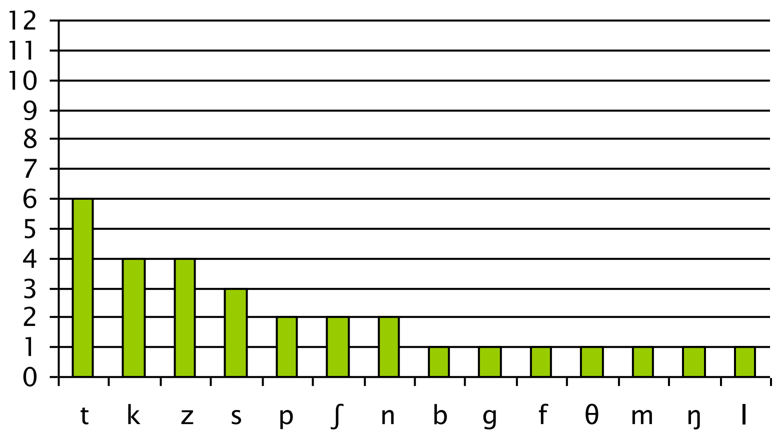
Approximately half of the initial consonants shown in Table 4.8 were avoided by four children: three of the children with extended vocabularies, AG, CB and QB, and NB who did not produce any initial singleton targets. Even excluding /h/, more than half of all the initial consonants avoided were fricatives. Five of the six avoided initial plosives were voiceless; the remaining plosive, /g/, was fronted by QB, who avoided both initial velars. Five children avoided approximants /ɹ/ or /j/, but given the comparatively high number of initial /p/, /t/ and /k/ targets in the vocabulary, the rate of avoidance of the five /ɹ/

or /j/ avoided is several times higher than for the five voiceless plosives. Initial bilabial and nasal singletons were avoided the least.

The combined data found in Tables 4.2, 4.5 and 4.7 show that the number of final singletons produced was 40 per cent smaller than the number of initial singletons. The collective inventory of final consonants consists of fourteen consonants, only half of which were produced by more than one child. Final /t/ was produced by the most children, but final /t/ did not achieve the level of success as the most common initial targets, /m/, /d/ and /b/ (Fig. 4.3), which are found in only a small number of diary entries as final consonants. Conversely, the inventories of final singletons include consonants that were avoided in initial position, such as /f/ and /θ/, and also those that were not initial singleton targets for any child, for example /s/ and /z/. Final /v/, /ð/, /ʧ/ and /ʤ/ were also absent as targets in all the first diary entries. Fig. 4.5 shows the distribution of final singletons.

Fig. 4.5

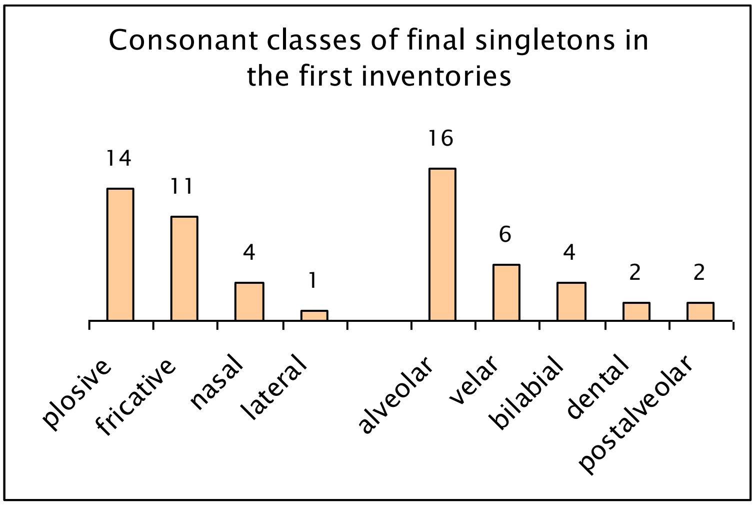
Final consonants in the first inventories



A total of 30 singletons are present in the inventories of final consonants, representing the final singletons produced by twelve children, that is all except

BB, GG and LB. /k/ is second to /t/ in the articulation of final voiceless plosives. Tables 4.2, 4.5 and 4.7 show that eight of the twelve children produced /t/, /k/ or /p/. One child produced all three, one child produced the combination /t/, k/ and /b/, and another /t/ and /k/. Seven of the twelve children produced final /z/ or /s/, with a further two children producing /ʃ/. The labiodental /f/ and the interdental /θ/ were produced, and are included in the only two inventories in which /p/ or /b/, /t/, /k/ and another fricative are also present. One child produced the alveolar lateral, and another the velar nasal; these are the only children whose inventories include final /n/. Fig. 4.6 shows the manner and place of the final singletons.

Fig. 4.6



In contrast to initial singletons (Fig. 4.4), final fricatives in the first inventories are second in number only to plosives, and final alveolars are four times the number of final bilabials. The dominance of final alveolar consonants is further demonstrated by the fact that where a child produced only one final singleton (Table 4.2), that consonant was alveolar /t/, /s/ or /z/. However, the proportion of final velars produced was higher than for initial velars, which were outnumbered by bilabials by almost six times (Fig. 4.4).

The consonants that were produced the most in initial position, /d/, /m/, /b/ and /n/, fared amongst the worst as final singletons. Only two out of a possible six children produced final /n/ and unlike their initial counterparts, final /b/, /d/ and /m/ were avoided by some children. Table 4.9 shows the final singleton targets avoided by twelve children, that is all except CB, JG and KB who produced all their final targets. As for initial consonants, where the differences are only of voicing, these are disregarded.

Table 4.9: Final singletons avoided in the first diary entries

Child	p	b	t	d	k	θ	s	z	ʃ	m	n	ŋ	l	No.
AG				✓			✓	✓						3
BB					✓						✓			2
DB					✓									1
EB	✓													1
FG	✓													1
GG											✓			1
HB		✓								✓	✓		✓	4
IG			✓											1
LB				✓			✓							2
NB									✓					1
OG											✓			1
QB						✓				✓		✓		3
	2	1	1	2	2	1	2	1	1	2	4	1	1	21

Table 4.9 confirms that final /b/ (in /bVb/), /d/ and /m/ were avoided by at least one child, but that voiceless plosives and other final nasals, particularly /n/, were avoided also. (Final /t/ in *night night* is not included as an avoided final consonant as its status as a target is uncertain.) Consistent with their higher rates of production in final position, final fricatives (even including /θ/) were avoided less than their initial counterparts, but also less than final plosives. The rate of the children's avoidance of final–/p k t/ targets is in inverse order to the rates of production of /t/, /k/ and /p/ shown in Fig. 4.5. Final /l/ was avoided completely by one child, but was avoided selectively by

another in monosyllabic words in which /l/ was preceded by a long vowel or a diphthong.

The commentary in Sections 4.1.1.1, 4.1.1.2 and 4.1.1.3 indicates that none of the initial cluster targets in the first diary entries were produced. However, attempts at two /pl/, two /bl/, two /kl/, and /gl/, /bɹ/, /tɹ/, /kɹ/ and /ʃɹ/ resulted in the deletion of the liquid. Two of the three attempts at /kw/ resulted in reduction to /k/; the reduction of /kw/ to the glide occurred in a child without initial velars. Three children reduced initial /s/+plosive clusters, in two the fricative was deleted, in the third the fricative was retained.

Three children attempted the final /st/ cluster in *toast*, which reduced to the fricative in all three cases. The production of a word-final cluster was reported in *drink*, in which the initial cluster was deleted. Two other children deleted initial clusters; one child deleted both /kl/ and /kɹ/, the other child, who otherwise produced all her initial consonant targets, deleted /fɹ/. There are no reports of deleted final clusters in the first inventories. The data on all the consonants produced in the first diary entries are carried forward into the following sections.

4.1.2 <u>Consonant inventories at 1;6</u>

Taking the consonant inventories shown in Section 4.1.1 as a baseline, the diary entries for each child are analysed to identify the consonants that appear in the intervening period up to the age of 1;6. This covers the period from the last diary entry reported in Section 4.1.1 to the child's half-birthday. As in Section 4.1.1, medial consonants in words or phrases are considered only if these are not produced in other positions. LB is not included in these analyses because a month's gap in the diary spans his half-birthday, and there are no data from the date of the last diary entry reported in the previous section (4.1.1) at 1;5.10 until he is 1;6.11.

Fig. 4.7 identifies the additional initial consonants added to the children's inventories during the period of the second set of diary entries. The graph shows smaller numbers at the upper end of the scale of consonants produced as were found in the initial inventories of the first entries (Fig. 4.3). However, consonant production is spread across a broader range of initial singletons and consists of fewer consonants that were produced by a single child.

Fig. 4.7

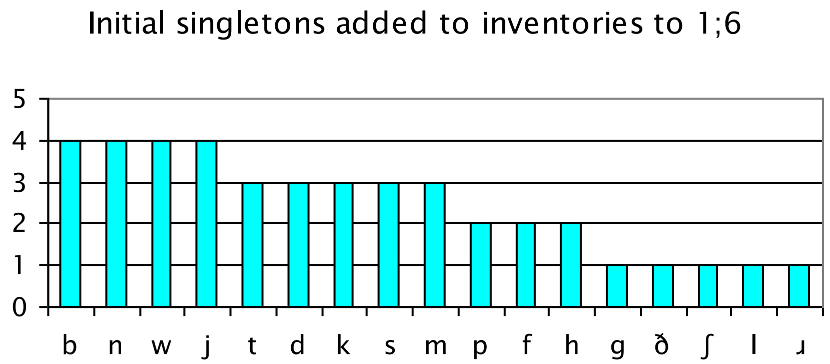


Table 4.10 shows the order in which these consonants were produced in the second set of diary entries. The age at the beginning of the second period is shown as the age at the next diary entry (taking account of gaps between the two sets of diary entries). For FG this occurred within one month, for BB within two weeks, and for KB within a few days, of their half-birthdays, resulting in a limited amount of speech data.

Table 4.10: Initial consonant singletons added to inventories up to 1;6

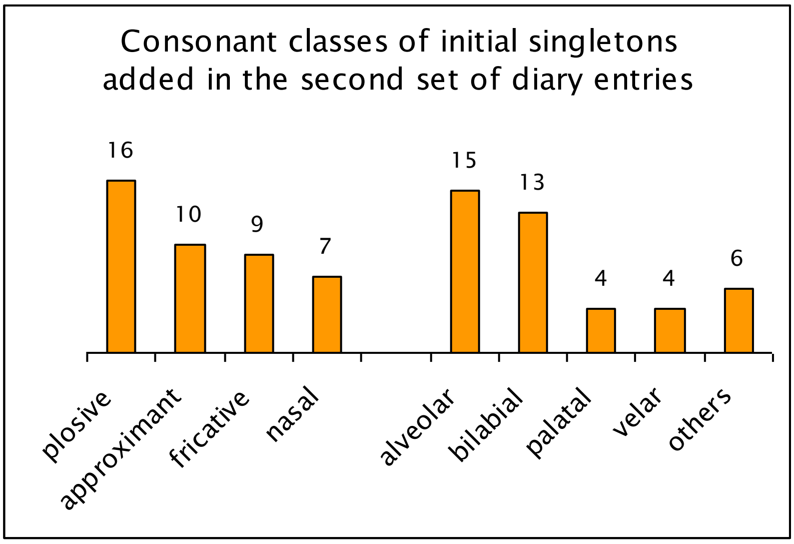
Child	Previous	From	Order of appearance	Total
AG	b d ʃ m n l	1;3.15	/p/ > /f/ > /t/ > /s/ > /w/ > /ɹ/ > /k/	13
BB	b m	1;5.16	/d k/	4
CB	p b d k ʃ m	1;4.14	/w/ > /n/ > /j/ > /g s/ > /ð/	12
DB	t d	1;4.19	/j/ > /m/	4
EB	d	1;4.26	/m/	2
FG	d m n	1;5.7	/b/	4
GG	b	1;3.29	/n/	2
HB	p b t d k ʧ m n w	1;4.0	/h/	10
IG	d k m	1;3.20	–	3
JG	b d h m n	1;1.7	/w/	6
KB	d k m	1;5.27	/b/	4
NB	–	1;4.15	/b/ > /m n/ > /d/	4
OG	m w	1;3.8	/t j/ > /d/ > /n/ > /b/	7
QB	b d m n ɹ	1;2.20	/p/ > /ʃ w/ > /s/ > /t/ > /l/ > /h/ > /j/ > /k/ > /f/	15

Table 4.10 shows that AG, CB (4.1.1.2) and QB (4.1.1.3), who had comparatively many initial consonants in period 1, expanded their inventories the most, thus increasing the disparity between the size of their inventories and those of the eleven children of the first group (4.1.1.1). QB has the largest initial inventory, consisting of fifteen consonants. His ten additions include four fricatives and the three remaining approximants, but his first initial velar, /k/, is one of the last initial consonants to appear at 1;5.6. AG adds seven and CB six initial consonants to their previous inventories, but only /s/ and /w/ are common to both children. AG's additions include /f/ and /ɹ/, whilst CB adds /ð/ and /j/.

The patterns of emerging consonants show that the children with the largest inventories produced the most challenging initial consonants. Initial /s/ was only produced by AG, CB and QB, and initial /f/ only by AG and QB. CB was the only child to produce /ð/, and HB remained the only child who had produced an affricate. HB's inventory remains one of the largest, although he has only added /h/. Initial /ʃ/, which is already present in the inventories of AG and CB, has only been added by QB. By 1;6, AG and QB have produced both liquids, but unlike AG, QB's production of initial /l/ has been consistent in all initial-/l/ targets from its first appearance at 1;3.13. At 1;6, AG, CB, HB and QB are the only children to have produced /p/ as a successful initial singleton.

Table 4.10 further suggests that additional initial consonants were produced in order of increasing complexity. /ɹ/ was one of the last, and /ð/ the last, of the initial consonants to be added. Conversely, of the fifteen consonants that were the first or the only consonants added to the first initial inventories, eight are bilabial and eight are plosive. /h/ is the only fricative and /j/ is the only approximant. Six of the fourteen children added only one initial singleton throughout the period. Two children added /b/, and /m/, /w/, /n/ and /h/ were each added by one child. However, all four of the bilabials had been produced at the first reported opportunity, as they had not been targets in the previous set of diary entries. The tally of nasals increased, as five children added initial /n/, bringing the total of children who had produced it to nine. Fig 4.8 shows the 42 initial target singletons added to the inventories as a result of their production in the second set of diary entries, according to their manner and place of articulation.

Fig. 4.8



As Fig. 4.8 indicates, approximants (most of which were added glides) were second to plosives, followed closely by the fricatives. This represents an increase for both approximants and fricatives compared with their production in the first diary entries (Fig. 4.4), when plosives outnumbered all other consonant classes together. More alveolar consonants were added to inventories than bilabials, but as most of the children had produced initial /d/ and /m/ in the earlier entries (Fig. 4.4), more of the added nasals were /n/, and most of the second-wave alveolars were non-plosive fricatives or liquids. A broader range of consonant classes of place is further indicated in the inclusion under ‘others’ of the first initial labiodental and interdental, and in the increasing number of children who produced palatal /j/ for the first time, which equalled the number of children who added a velar consonant.

Table 4.10 shows that HB and QB added /h/ at this point. However, HB continued to generally avoid /h/; its inclusion in his inventory is because it was reported once, in a truncated form of *helicopter* (hVtV). Initial consonants with an element of frication continued to be the most vulnerable to deletion and substitution.

Table 4.11 shows the initial consonant singletons that each child avoided in all targets in the second set of diary entries. These are shown alongside the initial consonants that were previously avoided (Table 4.8).

Table 4.11: Initial singletons avoided up to the age of 1;6

Child	Previous	p	b	t	k	g	f	θ	ð	ʃ	h	ʧ	ʤ	n	l	ɹ	j	No.
AG	/k h ɹ/					✓		✓	✓		✓		✓				✓	6
BB	–															✓		1
CB	/f ð h j/										✓	✓			✓	✓		4
DB	/k h/		✓		✓	✓												3
EB	/p ð h/									✓								1
FG	/h/																	0
GG	/t h n/														✓			1
HB	/ð h j/					✓									✓			2
IG	/j/										✓							1
JG	–																	0
KB	–																	0
NB	/f θ ð h ɹ/										✓		✓			✓		3
OG	/h/																	0
QB	/h ʧ/					✓			✓			✓	✓					4
		0	1	0	1	4	0	1	2	1	4	2	3	0	3	3	1	26

Table 4.11 shows that equal numbers of children avoided initial /g/ and /h/, but /h/ continued to be the most avoided initial consonant because there were more /h/ targets than /g/ targets. From the evidence in both sets of diary entries and updates on previous attempts, three children had now produced /h/ out of a possible twelve. Only one of the six children whose diary entries included an initial /ð/ target were successful. Initial /z/ was reported as [s] in the only /z/-word, QB's *Zippy*. All affricates in the second set of diary entries were avoided, but all /m/ and /n/ targets were produced. The rate of avoidance was the same for both liquids; three out of four children failed to produce either /l/ or /ɹ/, one child avoided both. The position is reversed for /j/, however, which was produced by four of five children. /w/ was not avoided, and was increasingly used as substitute for the liquids and some fricatives.

By 1;6, all the children had produced initial /m/ and /d/, except GG who had no /m/- or /d/-words in her vocabulary, although [d] had been reported in substitution and epenthesis. Nine children had produced initial /n/. Seven children had no initial velar targets in their vocabularies, and EB and IG had no initial-/b/ targets. However, DB was the only child who had avoided all initial velar targets, continuing to front both /k/ and /g/, and using alveolar substitution in his only /b/-word, *bye*. This makes DB the only child of the fifteen who had not produced an initial-/b/ target at 1;6, and the only child whose initial plosives were all realised as alveolars. Therefore by 1;6, most children had produced initial /b/, /d/, /m/ and /n/, and a growing number of children had produced /w/ and /j/. As shown above in Fig. 4.5 and Table 4.9, all these consonants demonstrate a reverse effect when in final position, either because they do not occur word finally in English, or because they occur relatively infrequently and/or tend to be avoided in final position.

Fig. 4.9 shows the distribution of the 34 final singletons added to the inventories during the period of the second diary entries. These consonants were the product of nine children, as FG, IG and KB had no new final singleton targets, and HB and OG avoided all new final singleton targets.

Fig 4.9

Final singletons added to inventories to 1;6

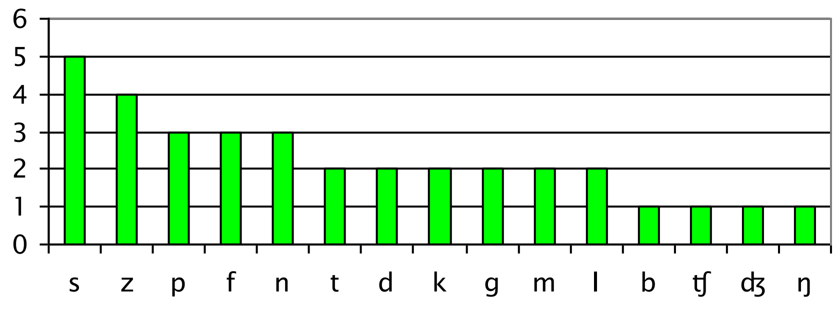


Fig 4.9 illustrates the increased production of final fricatives /s/, /z/ and /f/, the nasals, voiced plosives and /p/ in period 2. Final bilabial, alveolar and velar plosives have been added in equal numbers, although /p/ has retained its

edge over /b/. One child has produced both affricates, the only postalveolar consonants added as /ʃ/ was not a final target in the second diary entries. Table 4.12 shows the order in which the additional final consonants were produced, shown alongside the final consonants already in each child's inventory.

Table 4.12: Final consonant singletons added to inventories up to 1;6

Child	Previous	From	Order of appearance	Total
AG	t k	1;3.15	/z/ > /s/ > /l/ > /ʧ/ > /n/ > /ʤ/ > /p/ > /f/	10
BB	–	1;5.16	/t/	1
CB	t ʃ n ŋ	1;4.14	/z/ > /d/ > /l/ > /b/ > /p/ > /k/ > /f/ > /s/ > /g/	13
DB	t	1;4.19	/s/ > /z/	3
EB	s	1;4.26	/t/	2
FG	s	1;5.7	–	1
GG	–	1;3.29	/n/ > /m/	2
HB	p t k θ z	1;4.0	–	5
IG	k s	1;3.20	–	2
JG	z	1;1.7	/f/ > /k/	3
KB	p g z	1;5.27	–	3
NB	z	1;4.15	/s/ > /n/	3
OG	t m	1;3.8	–	2
QB	b t k f ʃ n l	1;2.20	/m/ > /s z/ > /d/ > /p/ > /g/ > /ŋ/	14

Table 4.12 highlights the disparity in the number of final consonants produced by the children. As in the production of initial singletons, AG, CB and QB added the most final consonants and also produced the final consonants of the greatest complexity. AG produced both affricates, and QB added the velar nasal, having first produced /n/, /m/ and /g/. CB and QB were the only children to add voiced plosives, and at 1;6 were the only children to have produced either final /d/ or final /b/, which so far had been produced only in the context of /bVb/, although avoided by HB even in this context. AG, CB and QB were the only children who had produced final /l/. HB's inventory of final consonants did not increase during the period, but no other child produced a final interdental before 1;6. CB and QB remained the only children to have

produced final /ʃ/, and AG, CB, HB and QB were the only children who had produced the /p t k/ combination. CB and QB had articulated all six plosives in final position. Both children produced voiceless /t/ and /k/ before /d/ and /g/, but the reverse was the case for /p/ and /b/.

As was found in the first diary entries (Table 4.2), when only one final singleton is added to an inventory, that consonant is alveolar. In Table 4.12, over half of all final consonants added were alveolar, of which half were fricative /s/ or /z/. Four of the nine children added both alveolar fricatives to their inventories, and a fifth child, who had already produced /z/, added /s/. Of the three children who added final /f/, two had first produced both alveolar fricatives, and the third child, who did not have /s/ as a final target, added /f/ after /z/.

Moreover, at 1;6, more children had produced a final alveolar fricative than had produced a final alveolar plosive. Eleven children had produced /s/ or /z/, whereas only eight had produced /t/ or /t d/. There were fewer /t/ or /k/ targets in the second set of diary entries than before (Fig. 4.5; Table 4.9), and more children added /p/ than added /t/ or /k/, which raised the number of final bilabials in inventories above the level, and the previous position, of velars. Fig. 4.10 shows the final consonants added, analysed according to manner and place of articulation.

Fig. 4.10

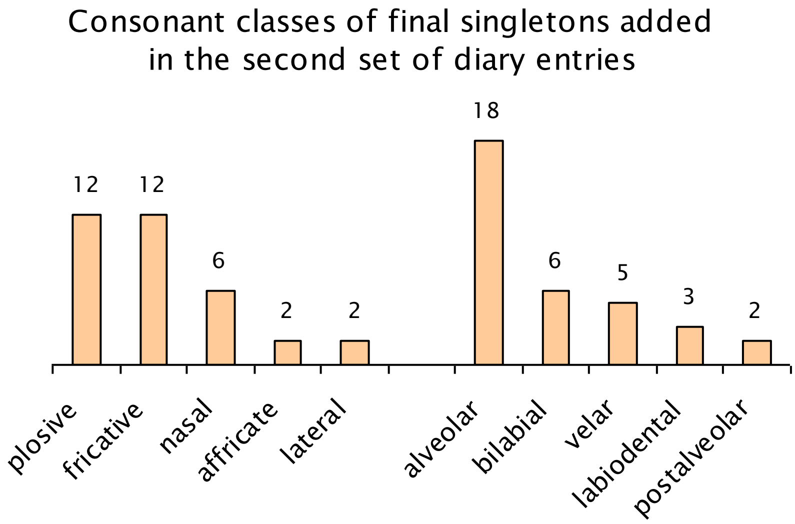


Fig 4.10 confirms that, compared with the final consonant patterns shown in Fig. 4.6, the production of final fricatives and alveolars increased, and the production of plosives declined overall, resulting in parity of final plosives and fricatives in the final singletons added. Despite the inclusion of /d/, only four of the eighteen alveolars added to inventories are plosive. The largest increase in alveolar production is therefore from the addition of nine alveolar fricatives, although the slightly increased numbers of /n/ and the liquids has also contributed to this. One child has produced a pair of final affricates. The addition of /f/ to inventories is reflected in the increased number of labiodentals, but despite its not being avoided by any child, the incidence of final /f/ remained low. However, some final consonants were systematically avoided by all or some children throughout the period of the second set of diary entries. These are shown in Table 4.13.

Table 4.13: Final singletons avoided up to the age of 1;6

Child	Previous	p	b	t	d	k	g	v	θ	s	z	ʃ	ʧ	m	n	ŋ	l	No.
AG	/d s z/				✓				✓					✓				3
BB	/k n/					✓	✓											2
CB	–																	0
DB	/k/																	0
EB	/p/										✓				✓			2
FG	/p/																	0
GG	/n/																	0
HB	/b m n l/	✓							✓						✓			3
IG	/t/																	0
JG	–				✓				✓									2
NB	/ʃ/																	0
OG	/n/				✓		✓			✓					✓			4
QB	/θ m ŋ/							✓	✓				✓					3
		1	0	0	3	1	2	1	4	1	1	0	1	1	3	0	0	19

As indicated in Tables 4.12 and 4.13, a higher proportion of children produced final fricative targets than plosive targets, although FG, GG and NB had no final plosive targets in the new vocabulary. Final target /b/, which had earlier been produced by QB in *Bob* at 1;2.19, was reported as [t] in *bib* from 1;2.20 until 1;4.22. HB also deferred to [t] in his backing of final bilabial /p/ in *sheep*. The rate of avoidance was far higher for final /d/ and /g/ than for /s/ or /z/.

The interdental /θ/ had become a final target for another two children. It was a new target for HB in *mouth*, and continued to be a target for QB in new, and fresh attempts at old, vocabulary. All four children with a final /θ/ target avoided it. In addition, QB avoided final /v/ which was stopped, and final /ʧ/ which was realised as an alveolar cluster. Final /n/ continued to present articulatory difficulties and was avoided completely by three of six children. /n/ was a new target for EB but, as Table 4.13 indicates, HB and OG had continued to avoid final /n/ in all diary entries so far.

Tables 4.10 and 4.12 show that IG did not add any initial or final consonants to her original inventories, but she produced /j/ as a medial consonant in *here* *you are* in which /h/ was deleted. Table 4.8 indicates that she had previously avoided /j/ word initially, in *yes*. However, IG's diary reveals that initial deletion of /j/ in *yes* persisted over many months, suggesting that her production of /j/ at 1;6 was confined to medial position. In a similar phrasal example in the first diary entries, NB had produced intervocalic /ʃ/ medially in *there she is*, which was included in Table 4.1 and Figs. 4.1 and 4.2, but not as an initial consonant in Table 4.2 and Fig. 4.3. NB's subsequent vocabulary does not provide the means to test his ability to produce initial /ʃ/ in a single-word utterance. Therefore, in the absence of any evidence to show that IG's /j/ or NB's /ʃ/ could be reproduced in word-initial utterances, these consonants continue to be excluded from any analyses of initial consonants, but are included in inventories that show all the consonant targets that have been produced, in the same way that consonants produced only in attempted clusters are recorded.

Four children produced initial and/or final clusters in the period of the second set of diary entries. Three children produced initial cluster targets, and two children final cluster targets. The diaries of two of the four children show that they also produced erroneous clusters in their attempts to articulate initial and final target clusters. One child reduced an initial triconsonantal cluster, and another child expanded a biconsonantal cluster target. Table 4.14 shows the clusters reported in the diaries to 1;6.

Table 4.14: Initial and final clusters produced to 1;6

Child	Initial	Reported	Word	Age	Child	Final	Reported	Word	Age
BB	/kl/	[kl]	*clock*	1;5.24	AG	/ʃt/	[ʃt]	*finished*	1;5.17
BB	/st/	[st]	*star*	1;5.24	AG	/nt/	[nt]	*elephant*	1;5.18
BB	/fl/	[fl]	*flower*	1;5.29	AG	/lz/	[lz]	*animals*	1;5.29
CB	/st/	[st]	*sticky*	1;5.2	AG	/ŋk/	[ŋk]	*drink*	1;5.29
QB	/bɹ/	[bɹ]	*broccoli*	1;3.13	QB	/ks/	[ks]	*six*	1;4.5
QB	/mj/	[mj]	*music*	1;4.22	QB	/nt/	[nt]	*elephant*	1;5.23
QB	/skw/	[sk]	*squirrel*	1;4.22	QB	/mp/	[mp]	*jump*	1;5.29
AG	/pl/	[kl]	*please*	1;4.17	AG	/ks/	[ksk]	*books*	1;5.22
AG	/kl/	[pl]	*clap*	1;5.21	AG	/ks/	[ts]	*six*	1;5.23
QB	/kl/	[fl]	*clock*	1;4.22	QB	/ps/	[ts]	*grapes*	1;2.20 1;4.22

BB and CB produced only initial clusters, all of which were realised in words that were otherwise compromised. BB's *clock*, previously kVV, was klVV, and *flower* was reduced to a monosyllable in rhyming flVV. Conversely, *star* was stV. CB's /st/ was produced in a word in which the medial consonant was harmonised, *sticky* stVdV. QB deleted the weak syllable in *broccoli* (previously bVdVV) to produce bɹVlV at 1;3.13, followed by articulation of initial and medial clusters in bɹVklV at 1;4.27. QB first produced /mj/ in *music* at 1;4.22 when the final consonant was fronted; the cluster was temporarily reduced at 1;5.14 when final /k/ was introduced, but the glide reappeared at 1;6.7 in the final version, mjVVzVk.

By contrast, the three examples of erroneous initial clusters in *please* [kl], *clap* [pl] and *clock* [fl] were produced without accommodation in other structural or segmental aspects of the words. In all three cases, the liquid was produced, the length of the target vowel was preserved and the final consonant target was articulated. In *clap*, there was assimilation of the final consonant, reflecting AG's strong sense of consonant harmony. At 1;4.22, QB produced [fl] for /kl/ in his third reported attempt at *clock*. This is not so unlikely when one considers that he had already been producing [f] word initially in *clock* for two months (Section 4.1.1.3) and that the production of /kl/ was not an option because at the time he avoided all initial velars.

Table 4.14 indicates that both AG and QB produced the first initial cluster before the first final cluster. QB produced /bɹ/ in *broccoli* two weeks before /ks/ in *six*, and there was a month between AG's production of [kl] in *please* (although not the target) and /ʃt/ in *finished*. BB and CB produced only initial clusters. Therefore, the first initial cluster reported preceded the first final cluster reported in all four of these children.

All final clusters were produced in words that were, or had been reduced to, one or two syllables, and most final clusters were homorganic. Weak syllable deletion reduced both trisyllabic words. AG produced alveolar /lz/ in *animals* VmVlz, and both AG and QB produced alveolar /nt/ in *elephant*, VfVnt. AG's first final cluster, /ʃt/, was produced in a monosyllabic form of *finished*, fVʃt. On the eve of their respective half-birthdays, QB produced the final bilabial cluster in *bump*, and AG produced the final cluster in *drink*, in which the initial cluster assimilated to the final velars in the reduction of /dɹ/ to [g].

The only word in which all targets were achieved was in QB's articulation of *six* sVks at the earlier age of 1;4.5. AG used different strategies to avoid final /ks/ in *books* and *six*, but both AG and QB used the homorganic cluster [ts] as substitute: AG in *six* and QB in *grapes*. This created alveolar harmony across both words, as QB reduced the initial /gɹ/ cluster to [ɹ]. As in the case of *clock*, QB's options were governed by the absence of initial velars; he did not produce initial /g/ until 1;6.9. QB's pronunciation of *grapes* persisted for some months as "rits", until final /ps/ was achieved at 1;6.2 in ɹVVps.

Most of the target consonants produced in the initial and final clusters (Table 4.14) have already been included in the children's inventories of initial and final singletons (Tables 4.10.and 4.12), but there are some exceptions. As in the first set of diary entries, some consonants were produced only in medial word/phrase position, for example IG's medial /j/. The following consonants were produced only as cluster or medial consonants:

AG: medial /g/ in *yoghurt* and *wiggle*
AG: medial /v/ in *Eva*

BB: /f/ and /l/ produced in initial clusters

CB: medial /ɹ/ in *lorry*
CB: /v/ in the cluster reduction of /vz/ in *gloves*

HB: /ŋ/ in the final cluster reduction of /ŋk/ in *drink*
HB: /ʃ/ in the erroneous initial cluster in *sheep*

IG: medial /j/ in *here you are*

QB: /ʒ/ in the final cluster reduction in *orange*
QB: medial /v/ in *driving*

These consonants are added to the inventories of initial and final consonants to provide an overview of all the consonants that were produced by 1;6. Fig. 4.11 shows all the consonant targets that were produced (as detailed in Section 2.1.1 and in this section) by all fifteen children. A total of 55 consonants have been added to the 93 that were reported in the first diary entries, which are illustrated separately. The total of all consonants produced to 1;6 represents an average of ten consonants per child, with a range of 3–20.

Fig. 4.11

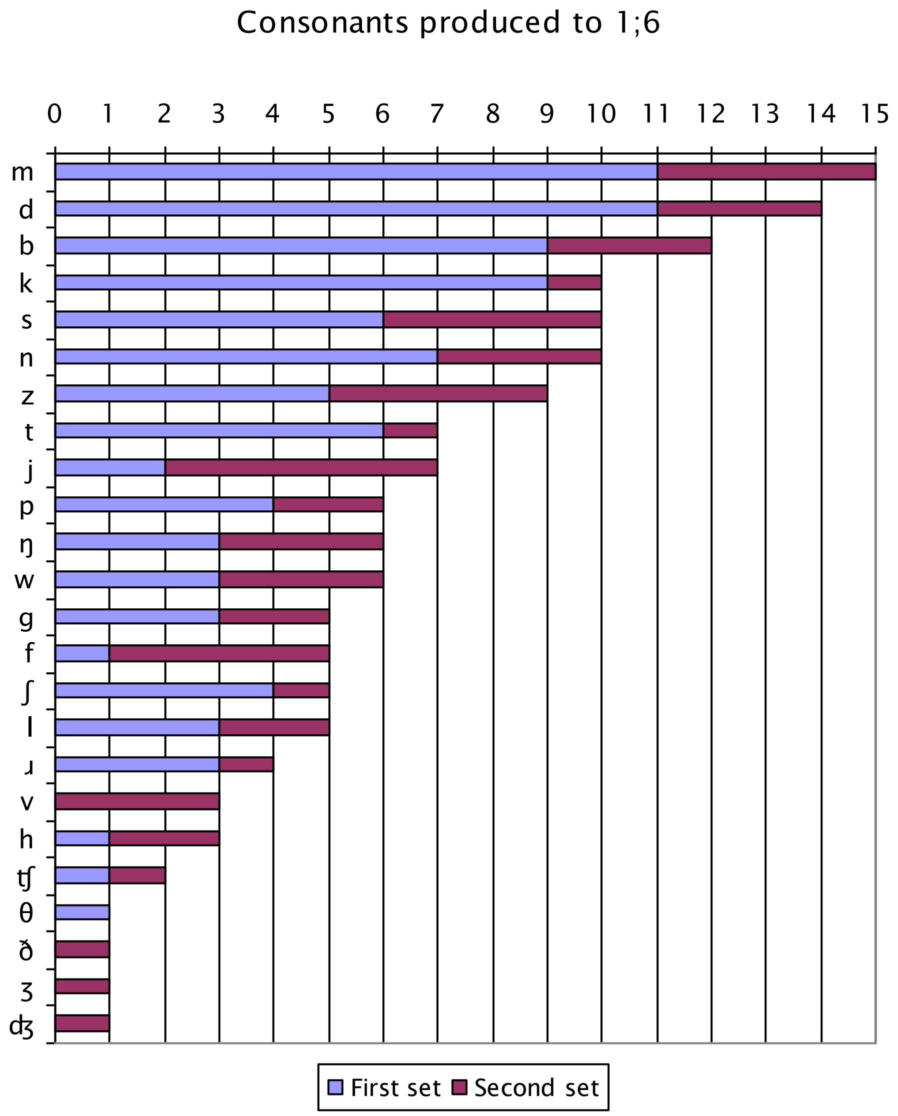


Fig. 4.11 confirms that the most common initial singletons, /m/, /d/ and /b/, had been produced by most children, although /b/ had not yet appeared as an initial target for two children. Conversely, /h/ had been a target for all the children and had been produced by three. Avoidance of the dental fricatives also remained high. Fig. 4.11 shows that more /j/ and /f/, and the first /v/ and /ʤ/, were added in the later inventories. All nine of the /z/ shown are word-final, whereas /s/ was proving to be one of most versatile consonants. Most consonants were therefore being produced in greater numbers, but no

two consonants were the same in terms of their distribution across word positions and in clusters.

4.1.3 Consonant inventories after 1;6

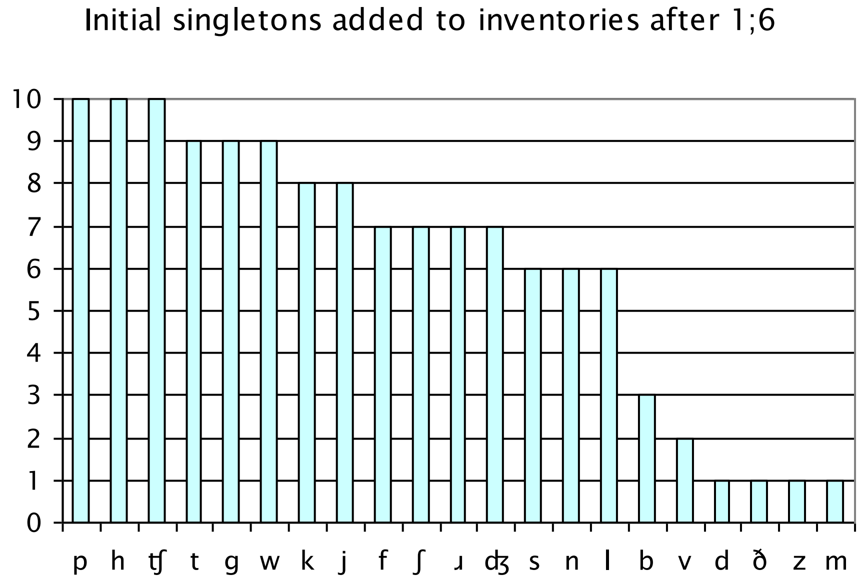
In the last section (4.1.2) it was shown that at 1;6 some children had produced most of the 24 consonants targets of English when production was measured on the basis of at least one articulation of the consonant. For other children, phonological progress had been slower and, in some cases, parental monitoring of it less intense. In this section, the remaining diary entries are analysed for evidence of the broader use of consonants already produced, whilst still reporting on consonants articulated for the first time.

As in earlier sections, the speech data are analysed to show the order and the scale in which initial, final and cluster consonants are produced, but with increasing focus on the production of consonant clusters. In the first instance, the data are analysed discretely from 1;6 to the date of the last diary entry of each child, before the scope of the investigation is expanded to include an overview of all the consonants produced. As before, the process begins with an analysis of the production of initial singletons within the new timeframe.

As Fig. 4.12 indicates, the most dramatic increases in the production of initial singletons in period 3 is in the addition of /h/ by ten children, bringing the total number of children who produced it to thirteen, and in the production of initial affricates. At the other end of the scale, three children (including DB) added /b/, and GG added /d/ and /m/, so that all fifteen children had produced the missing /b d m/ consonants indicated in Fig. 4.11 by the end of the study. But Fig. 4.12 shows that the other initial consonants that were added by fewer than six children were either those that occur infrequently in

English (initial /v/ and /z/), or those that are frequently avoided (initial /ð/). Initial /θ/ was not produced by any child.

Fig. 4.12



Four of the middle-ranking consonants, i.e. those that were added by six or seven children, are alveolar: both liquids which had thus far been avoided by most children, and /s/ and /n/ which had appeared fairly infrequently as initial singleton targets in the limited vocabulary of the earlier diary entries. The opportunity to produce /f/, /ʃ/ and /ʤ/ has previously been restricted to an even smaller number of specific target words, such as *fish*, *shoes* and *juice*.

Eight consonants were added by at least eight children. This included /h/, which continued to be avoided by two children. Ten children added the affricate /ʧ/, in several cases it has been produced in later attempts of early words, such as *cheese*, that had previously been subject to alveolar stopping. The remaining consonants consist of both of the glides and four plosives, including /p/ which had so far appeared relatively infrequently as an initial singleton target, and /g/, one of the most avoided consonants in period 2.

However, ten children had now produced all the plosives in initial position. Initial /p/ and /t/ had been produced by all fourteen children with /p/ or /t/ targets, and /g/ had been produced by ten of the twelve children with /g/ as an initial target. Thirteen children had produced both initial glides, and all fifteen children had produced /w/.

Fig. 4.13

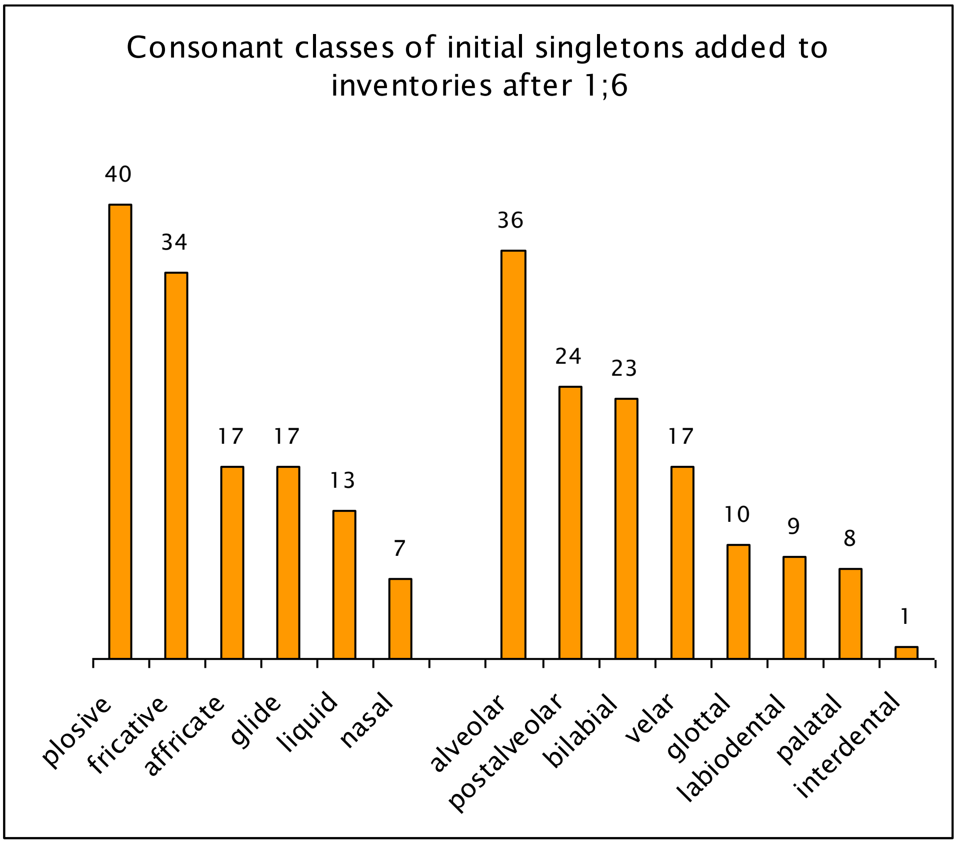


Fig. 4.13 illustrates the distribution of initial singletons that were first produced after 1;6, according to manner and place of articulation. This shows that all the classes of articulation were represented in the 128 initial consonants added to the inventories. This is three times the number of initial singletons added at 1;6 (Figs. 4.7 and 4.8), a fact that must be taken into account when comparing the two sets of data. As previously mentioned, a further consideration when interpreting these data is the disparity in the

number of phonemic constituents in each articulatory class, for example between fricatives and affricates, and between alveolars and inter/labiodentals. Notwithstanding, Fig. 4.13 shows a comparative increase in the addition of fricatives, affricates, liquids, velars, and of some classes previously in numbers so small that they were categorised as ‘others’ (Fig. 4.8). Also demonstrated is the growing disparity between the production of labiodentals and the interdentals, which with only one /ð/ so far produced, barely maintain a presence.

The classes of initial plosives, bilabials and alveolars have developed a broader base. Fig. 4.12 shows that several plosive and alveolar consonants have been added to inventories in high numbers, so that the classes of plosives and alveolars represented in Fig. 4.13 consist of collections of consonants: plosives /p t k g/; alveolars /t s n l ɹ/; whilst the newly-produced bilabials consist primarily of /p w/. Figs. 4.3, 4.4, 4.7 and 4.8 confirm that before 1;6 initial consonants from several of the classes had been produced by only a few children. Comparisons between the three points of analysis show that at the latest count all the children added at least two consonants belonging to classes that they had not produced before. Twelve children added at least one affricate (which in most cases was also their first postalveolar), and ten children produced their first liquid. Several children added their first initial fricative, and with the addition of /h/ by ten children, ten produced a glottal consonant.

Table 4.15 shows the order in which the initial consonants shown in Fig. 4.12 and represented in Fig. 4.13 were first produced by each child between 1;6 and the last diary entry. The children’s ages at this final point are variable, and occur either side of their second birthday; initial consonants that appeared after 2;0 are indicated.

Table 4.15: Initial singletons added to inventories after 1;6

Child	To	Order of appearance	Added
AG	1;10.26	/ʤ/ > /ð/ > /h/ > /g/ > /ʧ/	5
BB	2;5	/f/ > /p n/ > /s h ʤ/ > /ʃ/ > /g w ɹ/ (to 2;0) > /t j/	12
CB	2;6.10	/f l/ > /t/ > /h/ > /v/ > /ɹ/ > /ʧ/ (to 1;7.13)	7
DB	1;11.15	/ʤ/ > /ʃ/ > /ʧ/ > /b w/ > /n/ > /p/ > /s h/ > /k/	10
EB	1;11.4	/b/ > /ʧ/ > /p w/ > /k/ > /j/ > /g h/ > /n/ > /t/	10
FG	2;1.5	/l/ > /w/ > /k/ > /p/ > /t ʧ j/ (to 2;0) > /ʃ/	8
GG	2;1.5	/l/ > /g/ > /w/ > /d m/ > /p/ > /j/ > /t k ʧ ɹ/ > /f s/ (to 1;11.13)	13
HB	2;1.25	/g f ʃ/ > /l j/ > /s/ (to 1;8.23)	6
IG	2;0.17	/n l/ > /p h/ > /w/ > /ʤ/ > /b/ > /f ɹ/ (to 1;11.16)	9
JG	2;0	/ʃ/ > /t/ > /p/ > /k/ > /ʧ/ > /j/ > /g/ > /ʤ/ (to 1;10)	8
KB	2;0.11	/n/ > /t/ > /h/ > /p/ > /ɹ/ > /ʧ/ > /ʃ w/ > /g/ (to 2;0) > /j/	10
LB	2;0.3	/k/ > /h/ > /w/ > /p t/ > /n/ > /s/ (to 2;0) > /ɹ/	8
NB	1;10.20	/t h w/ > /k/ > /l/ > /j/ > /f/	7
OG	2;0.14	/g/ > /ʧ ʤ/ > /f ʃ/ > /p/ > /ɹ/ > /s h/ > /k/ (to 1;11.19)	10
QB	1;11.3	/z/ > /g/ > /ʧ/ > /ʤ/ > /v/	5

As Table 4.15 indicates, the children with smaller inventories of initial singletons at earlier points of analysis were in general the children who added the most consonants after 1;6. GG added the most consonants, thirteen, which increased her inventory of initial consonants to one of the largest. However, the three children with the largest inventories at 1;6, AG, CB and QB, maintained the differential between themselves and the remaining children, including HB. The average size of AG, CB and QB's inventory is 19 compared with an average of 13.75 for the other twelve children, although this reflects the high number of absent initial targets for some children. IG and KB each had nine absent targets, and JG, who had a strong record for producing initial targets, had eight. However, as Table 4.15 also indicates, most initial singleton targets were produced before 2;0, even in cases where the age at the last diary entry extends beyond the age of 2;0, as is the case in nine children including

IG and KB. CB and HB added the last initial singletons to their inventories at a significantly earlier age. Across the cohort, only five initial singletons were added to inventories after 2;0: one /t/, one /ʃ/, two /j/, one /ɹ/, all of which were infrequent targets in the diaries of BB, FG, KB and LB before 2;0.

Previous analyses of initial singletons suggested patterns to the order in which some consonants were produced. After 1;6, this is only apparent in the appearance of the approximants. /ɹ/ was never the first and was often one of the last of the consonants to be added, whereas /l/ was produced by four children at the earliest point of analysis after 1;6, and was produced before /ɹ/ in all three of the inventories in which both appear. Similarly, in all six inventories after 1;6 where both /w/ and /j/ were produced, /w/ preceded /j/, with /j/ appearing after 2;0 in BB and KB, as mentioned above.

The addition of the affricates is a particular feature of the latest inventories. Twelve children produced at least one initial affricate, and four of the children added both affricates, one child on the same day. Some children produced other consonant combinations that suggest a focus on sounds of the same manner or place. This is particularly the case for emerging fricatives. Fourteen children now had inventories consisting of initial /f/, /s/, /ʃ/ or /h/. Six children had produced all four of these consonants word initially. In addition, QB had produced initial /v/ and /z/ after 1;6. Table 4.12 shows that many of the children first produced initial alveolar /t/, /s/, /n/, /l/ or /ɹ/ after 1;6. DB, EB and IG, who added initial /b/ to their inventories after 1;6, also added bilabial /p/ and /w/; /b w/ (DB) and /p w/ (EB) were produced on the same day.

Despite the higher level of initial consonant production by all the children, some initial consonants were avoided in all targets. Table 4.16 shows the initial singletons to which this applies; for consonants that had been avoided in earlier diary entries, these are included only if there is evidence of continued avoidance.

Table 4.16: Initial singletons avoided after 1;6

Child	Previous	g	f	v	θ	ð	s	z	ʃ	h	ʧ	ʤ	n	l	ɹ	j	No.
AG	/k g θ ð h ʤ ɹ/				✓												1
BB	/ɹ/				✓												1
CB	/f ð h ʧ l ɹ j/				✓												1
DB	/b k g h/	✓	✓			✓								✓	✓		5
EB	/p ð ʃ h/		✓				✓					✓			✓		4
FG	/h/		✓				✓			✓					✓		4
GG	/t h n l/					✓			✓	✓							3
HB	/g ð h l j/			✓	✓							✓			✓		4
IG	/h j/				✓											✓	2
JG	–		✓														1
KB	–																0
LB	–		✓		✓	✓			✓			✓		✓			6
NB	/f θ ð h ʤ ɹ/				✓	✓	✓	✓							✓		5
OG	/h/																0
QB	/g ð h ʧ ʤ/																0
		1	5	1	7	4	3	1	2	2	0	3	0	2	5	1	37

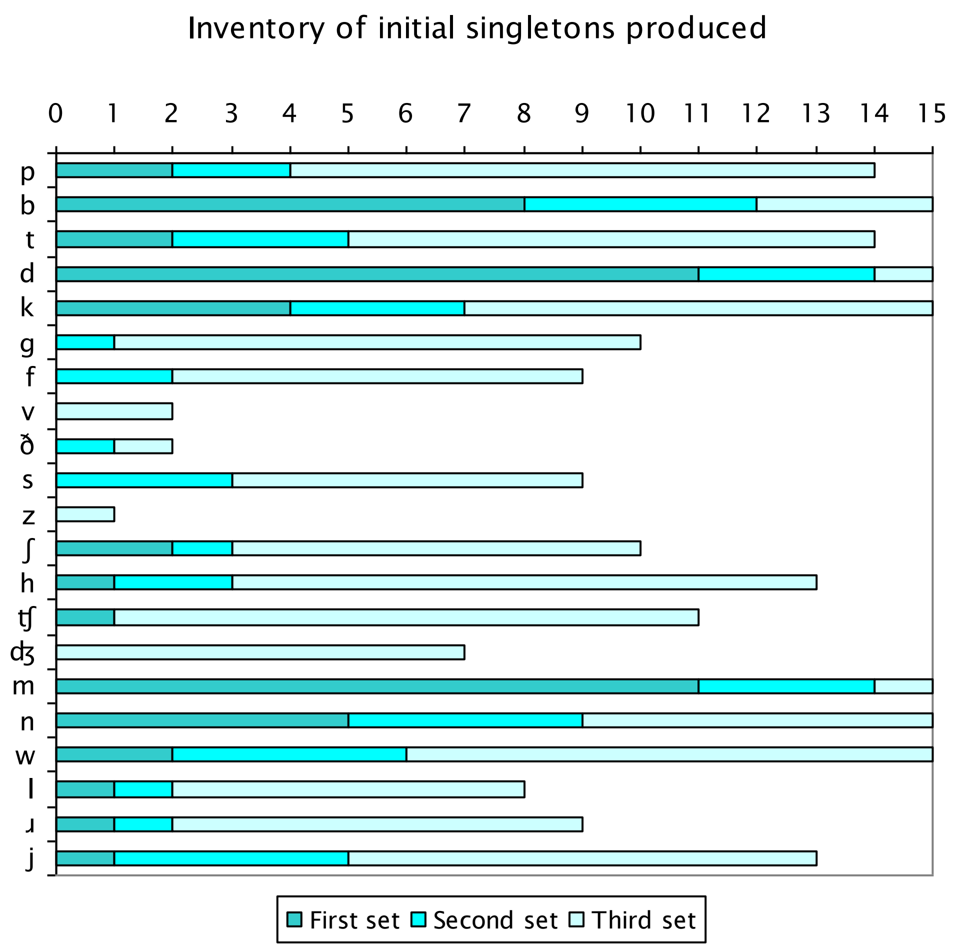
As Table 4.16 shows, the dental fricatives continued to be avoided, particularly /θ/. According to the diaries, only FG and GG still avoided /h/. KB, OG and QB had produced all initial targets after 1;6, but neither of the interdentals were initial targets for KB and OG, and there is no evidence that QB, who avoided initial /ð/ before 1;6, had produced it since. Similarly, there were no updates on the pronunciation of initial-/ð/ targets for EB, HB or NB, so the number of children who avoided this consonant is likely to be still higher.

The rate of avoidance of other fricatives appears high, but in all twelve cases where initial /f/, /v/, /s/, /z/ or /ʃ/ was not produced, these were new initial targets. Three of the children who avoided these initial fricatives also failed to produce the affricate /ʤ/, which was also a new target for all of them. However, initial /ʧ/ was not avoided, a fact that is consistent with the high rate of production of /ʧ/ after 1;6 (Fig. 4.12). Initial labiodentals proved particularly vulnerable to labial stopping. Seven children are reported as having substituted [b] for /f/ or /v/. /g/ was the only initial plosive still avoided in period 3, although this was confined to DB.

Consistent with the order in which the approximants were added (Table 4.15), /ɹ/ proved the more likely of the liquids to be avoided, and /j/ the more likely of the glides. These were new initial targets for all the children except IG and NB. Table 4.16 shows that the children who failed to produce liquids avoided the most initial consonants. This includes the child who avoided the only plosive, /g/. The only children who avoided more than three initial consonants are the six children who did not produce their liquid targets. The only child to avoid an initial plosive after 1;6 was the child who avoided both liquids. This suggests that the ability to produce initial liquids is indicative of a greater ability to produce other initial consonants.

Nevertheless, significant progress had been made by all the children in the production of initial singletons and new classes of initial singletons since /b d m/, and to a lesser extent /k n w/, dominated the inventories. Fig. 4.14 summarises the production of initial singletons across the three periods of analysis. This confirms that initial /b/, /d/, /k/, /m/, /n/ and /w/ were produced as singletons by all the children.

Fig. 4.14



The production of final singletons gathered pace after 1;6. Ninety-three final consonants have been added to the inventories, but on an individual basis the number of final consonants added are insufficient to match the total of initial consonants produced by any child, even allowing for the smaller number of English consonants in final position. Moreover, the number of absent final targets is even higher than for initial targets in several children; the two children with the highest number of absent initial targets over the course of the study have eleven absent final targets. Final singleton /ð/ remains absent in all diary entries, and there are no final-/b/ targets in the new vocabulary, leaving its production in earlier words unresolved. Fig. 4.15 shows the final consonants that were first produced after 1;6.

Fig. 4.15

Final singletons added to inventories after 1;6

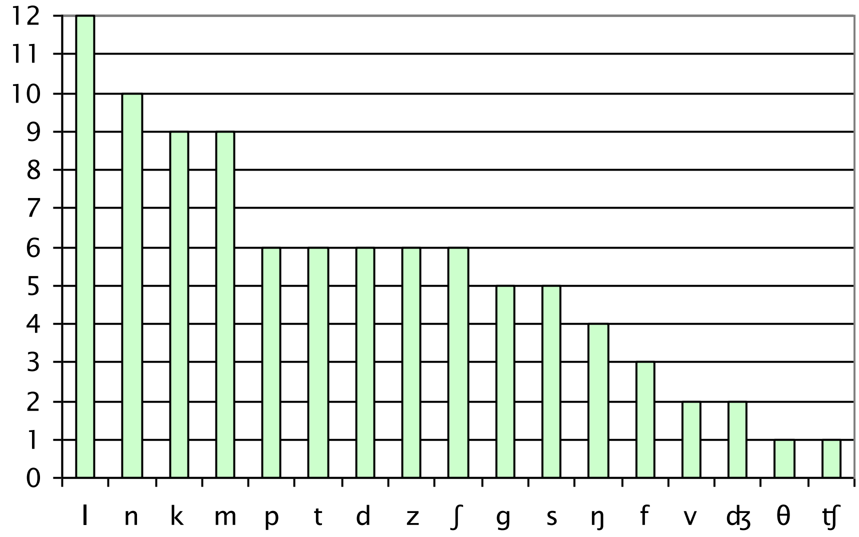


Fig. 4.15 shows that the largest increases were in the production of alveolar /l/ and /n/. Three children had previously produced /l/ and five children had produced /n/, so at the end of period 3 all the children had produced final /l/ and /n/. This is also the case for /k/. Other consonants that were the mainstay of previous inventories, /t/, /s/ and /z/, have consolidated their lead over /p/, /f/, /ʃ/, the velar nasal and the voiced plosives, although they have not been produced by all the children. Final /m/, which had appeared rather infrequently in the diaries and had been avoided previously, was added to the inventories of the nine remaining children with final-/m/ targets. /ŋ/ continued to be systematically fronted by some children.

More children had produced final labiodentals, although the number of /f/ targets was smaller than for initial /f/. /v/ is well represented in the inventories from a limited number of targets. The number of final affricate targets was considerably smaller than for initial counterparts in period 3, as was the number of final affricates that were produced. Only one child produced the dental fricative /θ/, which when it appeared was with sacrifice of the initial consonant, /b/ in *bath*. The children added final voiced plosives, /d/ and /g/, in similar numbers to /p/, /t/, /s/ and /z/, but on a smaller base of three for /g/ and two for /d/. Eight more children had produced /g/ or /d/ by the end of the current timeframe, the same number that had already produced /s/ or /z/ by 1;6. The number of children who have produced final /b/ at the end of period 3 remains at two.

Table 4.17 shows the order in which the final consonants emerged after 1;6. As for initial consonants, the final consonants that were first produced before 2;0 are indicated if the diary entries straddle the child's second birthday.

Table 4.17: Final singletons added to inventories after 1;6

Child	To	Order of appearance	Added
AG	1;10.26	/ʃ/ > /m/ > /d/ > /g/ > /ŋ/	5
BB	2;5	/k/ > /l/ > /n/ > /g m/ (to 2;0) /s z/ > /ʤ/ > /d/	9
CB	2;6.10	/m/ (to 1;9.3)	1
DB	1;11.15	/k/ > /n/ > /ʧ/ > /f/ > /ʃ/ > /p/ > /g/ > /l/	8
EB	1;11.4	/l/ > /k/ > /p/ > /n/ > /z/ > /m/	6
FG	2;1.5	/n/ > /z/ > /t/ > /k/ > /m/ > /l/ > /θ/ (to 2;0) > /d/	8
GG	2;1.5	/z/ > /k/ > /t/ > /s/ > /l/ > /v/ > /p/ (to 2;0) > /d/ > /ŋ/	9
HB	2;1.25	/s ʃ l/ > /d f/ > /n/ > /ŋ/ > /m/ (to 1;9.20)	8
IG	2;0.17	/t/ > /d/ > /g/ > /n/ > /p l/ (to 1;11.10)	6
JG	2;0	/n/ > /l/ > /m/	3
KB	2;0.11	/n/ > /l/ > /k/ > /t/ (to 2;0) > /ʃ/	5
LB	2;0.3	/t l/ > /m/ > /z/ > /g/ > /f n/ > /k/ > /ʃ/ > /s/ > /p/ (to 2;0)	11
NB	1;10.20	/m/ > /t k/ > /l/	4
OG	2;0.14	/l/ > /n/ > /s/ > /z ʃ/ > /k/ > /p ŋ/ (to 1;10.14)	8
QB	1;11.3	/v/ > /ʤ/	2
			93

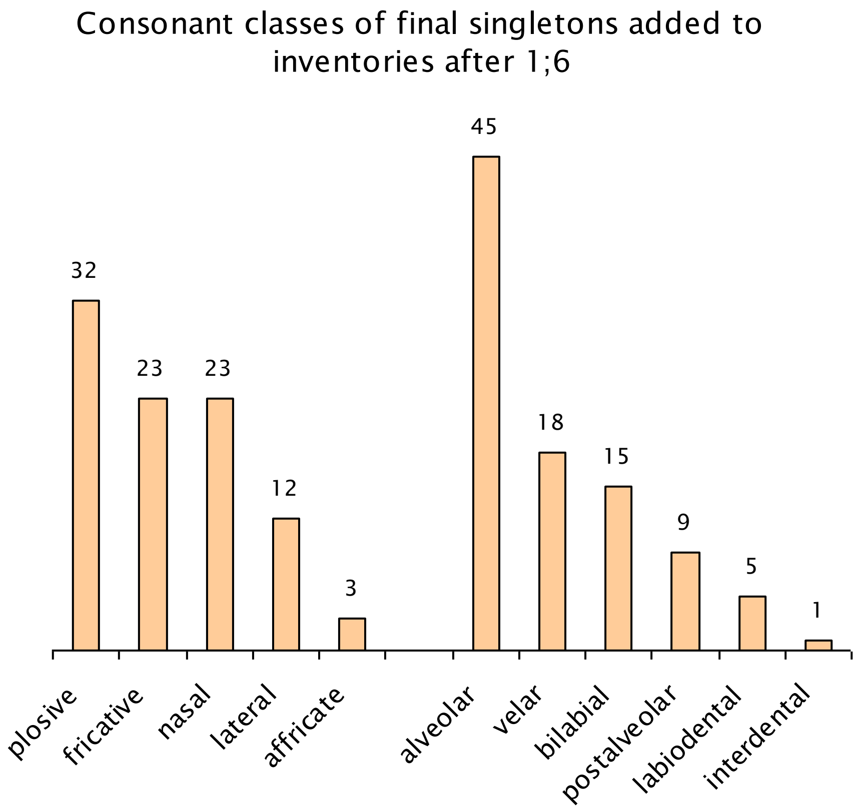
Table 4.17 illustrates the considerable disparities in the number of final singletons that children produced over the period, which are even greater than

those found for initial consonants. All the children with overall totals of eight consonants or under had large numbers of absent targets. The child who had added the most final consonants since 1;6 was LB, who produced no final singletons in his first diary entries and who was excluded from analysis on the last occasion.

Final consonants appear in a more ordered fashion than in the latest inventory of initial consonants shown in Fig. 4.15, particularly for the children who were still in the relatively early stages of final consonant production. All the children with a maximum inventory size of three final consonants at 1;6, produced /t/, /k/, /z/, /n/ or /l/ as their next consonant. IG added /d/ and /g/ afterwards, but she is an exception to the rule. Otherwise /d/, /g/ and /ʤ/ were amongst the last, and /ŋ/ was generally the last, to be added. Table 4.17 shows that of the four children who added consonants after 2;0, three added /d/. BB added four consonants to his inventory after 2;0: /s/, /z/, /d/ and /ʤ/. FG added only /d/ after 2;0, but this was later than her production of /θ/ before 2;0. GG added /d/ followed by /ŋ/. One child added /ʃ/ after 2;0, but several children first produced it around the same time as /s/ or /z/. However, in most cases where /p/ had been produced, it entered the inventory at a late stage.

The three children with the largest inventories at 1;6 proceeded differently. CB appears to have reached a plateau in terms of his production of final singletons, and added only /m/ after 1;6. But AG, who had already produced both final affricates, added /ʃ/, both /d/ and /g/, /m/ and the velar nasal. QB, who had already produced /ʃ/, /ŋ/ and /b d g/, produced /v/ and /ʤ/. Fig. 4.16 shows the distribution of the final consonants produced after 1;6 according to manner and place of articulation.

Fig. 4.16



The scale and order of the classes of final consonants shown in Fig. 4.16 highlight not only the changes that occurred after the previous inventory at 1;6 (Fig. 4.10), but also the differences between final singletons and initial singletons over the same period (Fig. 4.13). The clearest difference between additions to initial and final inventories is in the increase in the production of initial affricates, which was not matched in the inventories of final consonants. Over the same period, final inventories saw large increases in the number of nasals and velars, which as Fig. 4.13 shows, were the two classes with the lowest rates in inventories of added initial consonants after 1;6.

The increase in final nasals and velars also accounts for the differences between Fig. 4.13 and the previous analysis of the classes of final consonants

(Fig. 4.10), when equal numbers of plosives and fricatives were added, and the number of nasals and velars were low. The rise in the number of plosives indicated in Fig. 4.13 reflects the addition of final /t/, /k/ and /p/ to small inventories, and final /d/ and /g/ to larger or extended inventories.

In period 3, the ratio of final alveolar to bilabial consonants is the same as before, but velar consonants have overtaken the bilabials with a small contribution from /ŋ/. Fig. 4.13 shows that there has been a significant increase in the number of nasals added, which reflects the latest surge in the production of final /m/ and /n/, both of which had a low rate of success in previous diary entries. At the latest count, the fricatives in the inventories consist of a broader mix of alveolars, labiodentals and /ʃ/ than before, but the only final interdental target /θ/ remains inaccessible to most of the children, and continues to be generally avoided.

Table 4.18: Final singletons avoided after 1;6

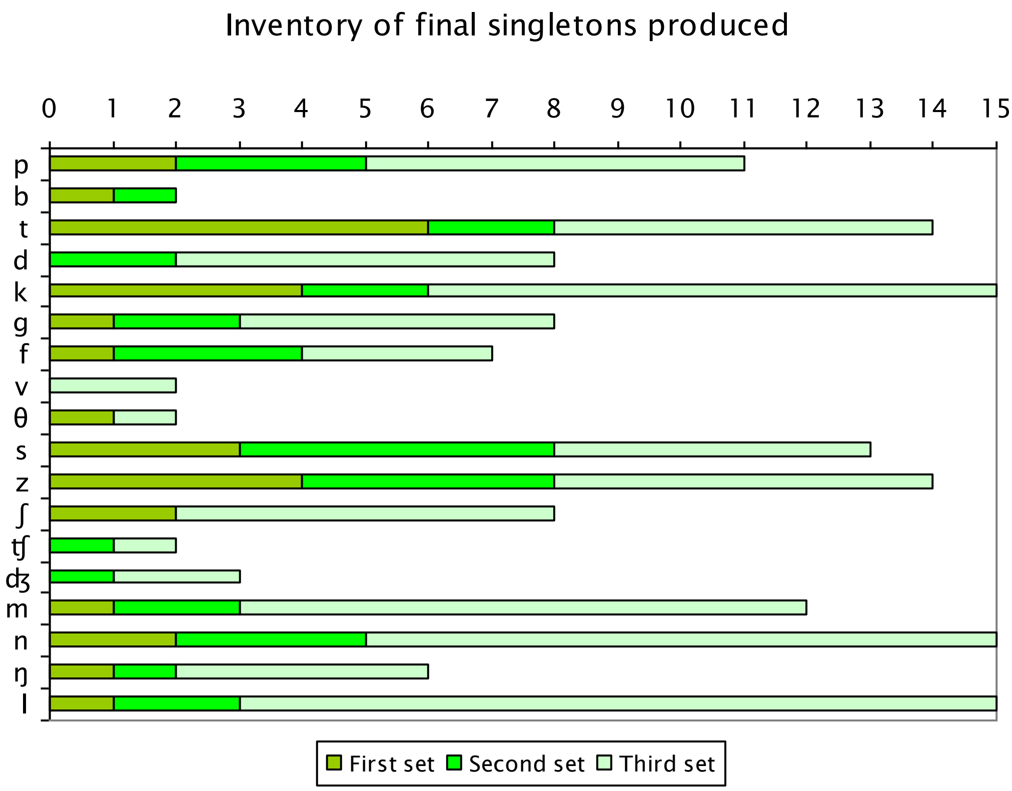
Child	Previous	p	b	t	d	k	g	f	v	θ	s	z	ʃ	ʧ	ʤ	m	n	ŋ	l	No.
AG	/d θ s z m/																			0
BB	/k g n/												✓							1
CB	–									✓					✓					2
DB	/k/				✓				✓	✓								✓		4
EB	/p z n/									✓			✓							2
FG	/p/																			0
GG	/n/									✓										1
HB	/p b θ m n l/									✓				✓	✓					3
IG	/t/											✓								1
JG	/d θ/	✓			✓					✓	✓									4
KB	–										✓									1
LB	–				✓					✓								✓		3
NB	/ʃ/									✓										1
OG	/d g s n/							✓	✓	✓										3
QB	/v θ ʧ m ŋ/													✓						1
		1	0	0	3	0	0	1	2	9	2	1	2	2	2	0	0	2	0	27

Table 4.18 shows the final singletons that were, or continued to be, avoided after the age of 1;6. (As in previous tables, only consonants for which there is evidence of current avoidance in all targets are included.) These data confirm the interdental fricative /θ/ as the most avoided final consonant, with nine children avoiding it in the latest diary entries. This includes HB, whose production of /θ/ was reported in the first diary entries in *teeth* (on which there is no update), but who has subsequently avoided /θ/ in all his attempts at *mouth*. Final /θ/ was avoided by a further two children (AG and QB) in earlier vocabulary, on which up-to-date accounts have not been provided either. Given that three of the remaining children have not attempted any words in which /θ/ was a final target, FG is the only child for whom there is current evidence of production of final /θ/, which as Table 4.17 shows, was the last consonant added to her inventory before her second birthday.

Tables 4.17 and 4.18 further show that the only children who avoided final /p/, /d/, /f/, /v/, /s/, /z/, /ʃ/ or /ŋ/ are seven of the children with the smallest inventories at 1;6 (BB, EB, IG, JG, KB, LB and OG). Conversely, children whose inventories were amongst the largest at 1;6 (CB, HB and QB) only avoided affricates and /θ/ in period 3. The tables also indicate that several of the final consonants produced by AG, CB, HB and QB after 1;6 had been avoided by them at an earlier age. However, Table 4.18 shows that final alveolars /t l/, velars /k g/ and nasals /n m/ were not avoided by any child after the age of 1;6.

Fig. 4.17 illustrates the incremental stages of final singleton production of the cohort. As for initial singletons (Fig. 4.14), the consonants are arranged according to place within classes of manner. (All final-position consonants have been included except /ð/ and /ʒ/ which were not targets in any diary entries.)

Fig. 4.17



In previous sections, the production of some consonant clusters was reported, but most of the children did not produce their first clusters until after 1;6. In Section 4.1.2, it was shown that BB, CB and QB produced initial target clusters, and that AG and QB produced final target clusters. However, the children who produced the most clusters during the final period of the study were the children whose inventories of initial and final singletons were the largest at 1;6, AG, CB and QB. BB added only two further initial clusters in a set of diary entries that extended beyond the age of most children and that had few new initial cluster targets. Furthermore, at no point did BB's production of final clusters keep pace with his production of initial clusters, and he is one of only two children who over the whole period of the study produced more initial clusters than final clusters, in his case 6:3. The other child is OG with a ratio of 5:3. DB and EB did not produce any initial clusters, but all the children produced at least one final cluster. The following tables of initial and final clusters incorporate all the clusters produced during the study.

Table 4.19 shows the initial clusters produced and the number of initial clusters produced by each child. Table 4.20 shows the order in which initial clusters were first produced according to the diary entries. Clusters produced before 1;6 are indicated with the age of the child when the cluster was first reported. As in previous tables, clusters reported on the same day are bracketed together.

Table 4.19: Initial consonant clusters produced from first to last diary entries

Initial	pl	pɹ	bɹ	tɹ	dɹ	kl	kɹ	gɹ	fl	fɹ	sp	st	sk	sl	sn	mj	No.
AG			✓	✓		✓		✓				✓	✓				6
BB			✓			✓	✓		✓			✓					5
CB	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓			11
DB																	0
EB																	0
FG											✓						1
GG											✓						1
HB						✓											1
IG								✓									1
JG													✓				1
KB												✓					1
LB			✓	✓								✓					3
NB				✓													1
OG			✓	✓	✓			✓	✓								5
QB	✓	✓	✓	✓			✓								✓	✓	7
	2	1	6	6	2	3	3	4	3	1	3	5	2	1	1	1	44

Table 4.20: The order of appearance of initial clusters

Child	Order of appearance
AG	/gɹ/ (1;6.10) > /tɹ/ > /st/ > /kl/ > /bɹ sk/
BB	/kl st/ (1;5.24) > /fl/ (to 1;6) > /bɹ/ > /kɹ/
CB	/st/ (1;5.24) (to 1;6) > /kɹ/ > /fɹ gɹ/ > /fl/ > /tɹ/ > /bɹ/ > /dɹ/ > /sp sl/ > /pl/
DB	–
EB	–
FG	/sp/ (by 1;10.15)
GG	/sp/ (by 1;10.15)
HB	/kl/ (1;6.3)
IG	/gɹ/ (2;0.11)
JG	/sk/ (1;10)
KB	/st/ (1;11.8)
LB	/bɹ/ (1;9.10) > /st/ > /tɹ/
NB	/tɹ/ (1;10)
OG	/bɹ/ (1;9.15) > /dɹ/ > /gɹ/ > /tɹ/ > /fl/
QB	/bɹ/ (at 1;3.13) > /mj/ (to 1;6) > /sn/ > /pɹ/ > /tɹ/ > /pl kɹ/

As Table 4.19 shows, most of the initial clusters produced were obstruent + liquid, of which most were plosive + /ɹ/. The most common of these were /bɹ/ and /tɹ/, but as Table 4.20 illustrates, in most cases /bɹ/ was produced before /tɹ/, in terms of both the order and the age at which it appeared. /bɹ/ was the first cluster produced by three children, the earliest by QB at 1;3.13. /tɹ/ was more often produced after repeated attempts in which it was stopped or affricated. AG was the exception; her first cluster was /gɹ/ in *grape*, followed by /tɹ/ with /bɹ/ last. /dɹ/ was produced only in words without final velars, in *dry* (OG) and in a grammatically- and metrically-altered form of *drunk*, "drinkend" (CB). Otherwise, /dɹ/ remained unresolved in *drink* as [g] (AG), [b/d] (HB) or [d] (QB). /kɹ/ clusters were the last to be produced by two of the three children; for BB this was at 2;5.

Initial /bl/ and /gl/ targets were not produced by any child, although /bl/ in particular was a common target in *blue* and *black*. However, at 1;6 AG reduced all /bl/ targets including *blue* to [b], whilst at the same time producing [bl] in *glue*, *floor* and *flower*. AG's /pl/ and /kl/ clusters, previously realised as [kl] and [pl] respectively (Table 4.14) were now reduced to the initial plosive, but /pl/ was not achieved at any later point in /pl/ targets, although she produced it at 1;8.3 in the cluster reduction of /spl/ on the same day that she achieved /kl/. /kl/ proved the more accessible of /kl/ and /pl/ cluster targets. CB and QB were the only children to produce /pl/ in biconsonantal cluster targets, both children producing it as their last cluster, which at 2;6.10 remained in free variation with the reduced form in CB's *please*. Curiously HB, who had previously demonstrated a clear preference for fricatives in initial cluster reduction, produced only a non-fricative cluster, /kl/.

Contrary to the patterns of plosive-liquid clusters, more children produced /fl/ than /fɹ/. CB produced both. QB who produced [fl] for /kl/ in the absence of initial velars (Table 4.14) is not one of the children who later produced target /fl/ or /fɹ/. However, /fl/ has a particularly high record of avoidance. Three children produced /fl/, but five of the children with /fl/ as a target in *flower* reduced it to [f], [w] or [d], although the liquid is represented in HB's transposition of /l/ in "fowler".

The homorganic cluster /st/ proved the most accessible of the /s/-clusters. /st/ was not only also a common final cluster (see Table 4.21 below), but was produced by a further three children in medial position in *upstairs* (EB and OG) and *Christian* (GG). Nevertheless, four children reduced all initial /st/ clusters, generally in favour of the plosive. /sk/ is a comparatively rare target in the diaries, which was produced in two of the three examples of *school*. However, JG produced the cluster at 1;10 when the utterance was without final /l/, but at 2;0 reversed it, reducing it to the plosive when the final consonant was added. Conversely, initial /sp/ is a common target in the diaries, particularly in *spoon* and *spider*, but it was produced by only three of the thirteen children with /sp/ as a target. The success of initial /s/ + plosive clusters is therefore dependent on the pairing, in which /st/ was generally the most successful and /sp/ undoubtedly the least. However, in other cases, homorganic /s/-clusters do not have a particular advantage. Alveolar clusters /sl/ and /sn/, which were produced only by CB in *sleep* and QB in *snail*, fare little better than /sm/ and /sw/. Furthermore, the triconsonantal homorganic cluster /stɹ/, which was a target for two children in *strawberry*, was in both cases reduced to a single consonant, [f] or [ɹ], whereas the alveolar-velar / fricative-plosive combination was retained in the reduction of /skw/ by both children with *squirrel* as a target word. It may be important that those two children are AG and QB, because along with CB, they produced initial singletons and clusters that proved beyond the reach of the other children.

Tables 4.21 and 4.22 show the final clusters that were produced over the period of the study, and the order and age at which the children produced them, using the same format as for initial clusters. The collective inventory of final clusters is considerably larger than for initial clusters, consisting of 24 two-consonant and two three-consonant clusters.

Table 4.21: Final consonant clusters produced from first to last diary entries

Final	ps	pt	ts	ks	ft	st	ʃt	ðz	mp	mz	nt	nd	nz	ns	nʒ	ntʃ	ndʒ	ŋk	ŋz	lp	lt	ld	lk	lf	lz	sps	nts	No.
AG	✓		✓	✓		✓	✓	✓			✓	✓					✓	✓		✓			✓		✓			13
BB						✓					✓												✓					3
CB	✓		✓		✓	✓				✓		✓	✓							✓	✓	✓	✓	✓	✓			13
DB	✓			✓		✓						✓																4
EB										✓													✓			✓		3
FG	✓									✓		✓															✓	4
GG	✓			✓								✓			✓					✓			✓				✓	7
HB		✓		✓							✓					✓		✓					✓					6
IG									✓																			1
JG														✓														1
KB																				✓		✓						2
LB						✓						✓						✓										3
NB	✓										✓																	2
OG				✓								✓								✓								3
QB	✓		✓	✓					✓		✓	✓						✓	✓				✓					9
	7	1	3	6	1	5	1	1	2	3	5	8	1	1	1	1	1	4	1	5	1	2	7	1	2	1	2	74

Table 4.21 confirms that BB and OG were the only children who produced fewer final clusters than initial clusters. Three children produced the same number: IG and JG produced one initial and final cluster, and LB produced three of each. JG's final cluster /ns/ was the only one that she produced.

AG and CB produced thirteen final clusters; QB produced nine, GG seven and HB six. AG, CB, HB and QB, in particular, continued to produce new final clusters long after they had ceased to add final singletons to their inventories. Table 4.17 shows that the last additions of final singletons to the inventories of these children were completed by: 1;8.3 (AG), 1;9.3 (CB), 1;9.20 (HB) and 1;6.25 (QB). The difference between the age at which the last singleton and the last cluster was added is particularly marked in CB, whose last final cluster was produced at 2;5.

Table 4.21 shows that thirteen of the final clusters were produced by a single child, which in many cases had been produced in one word reported on a single occasion and in the closing days of the diary. These include the most complex clusters, produced by children with the largest final cluster inventories: AG's fricative cluster /ðz/produced in *clothes* with the initial cluster articulated, nasal-affricate clusters produced by AG and HB, GG's nasal-fricative, QB's nasal-fricative produced in *buildings* with the medial cluster articulated, HB's /pt/, AG's /ʃt/ and CB's /ft/. CB produced a range of /l/+consonant clusters, /lp/, /lt, /ld, /lk/, /lf/ and /lz/, of which /lt/ and /lf/ were only produced by him.

Some children produced consonants in final clusters that they had been unable to articulate as final singletons, particularly when both cluster targets are of the same class of place. Tables 4.18 and 4.21 show that DB produced /nd/ but avoided final singleton /d/, HB produced /ntʃ/ but avoided final /tʃ/ and JG produced /ns/ but avoided final /s/. LB did not re-produce /ŋ/ (see Section 4.1.1.1) as a final singleton.

Table 4.22: The order of appearance of final clusters

	Order of appearance
AG	/ʃt/ (1;5.17) > /nt/ > /lz ŋk/ (to 1;6) > /st/ > /ks/ > /lp/ > /ps/ > /lk/ > /ts nd ndʒ ðz/
BB	/nt/ (2;1) > /st/ > /lk/
CB	/mz/ (1;6.12) > /st/ > /lp/ > /nd lt/ > /nz/ > /ps/ > /ft lf/ > /ts ld/ > /lz/ > /lk/
DB	/ps/ (1;6.20) > /st/ > /ks nd/
EB	/mz sps/ (1;10.16) > /lk/
FG	/ps/ (1;10.15) > /mz/ > /nd/ > /nts/
GG	/nʒ/ (1;10.4) > /lp/ > /ps/ > /ks/ > /nd/ > /lk/ > /nts/
HB	/ŋk/ (1;6.8) > /ks/ > /lk/ > /pt/ > /nt/ > /ntʃ/
IG	/mp/ (2;0.16)
JG	/ns/ (1;10)
KB	/ld/ (1;10.4) > /lp/
LB	/ŋk/ (1;1.27) (to 1;6) /nd/ > /st/
NB	/nt/ (1;8) > /ps/
OG	/lp/ (1;10.12) > /ks/ > /nd/
QB	/ks/ (1;4.5) > /nt/ > /mp/ (to 1;6) > /ps/ > /lk/ > /nd/ > /ŋk/ > /ŋz/ > /ts/

Table 4.21 shows that the most common final cluster in the inventories is /nd/, produced by just over half of the children. However, as Table 4.22 indicates, /nd/ was not the first cluster produced by any child and was generally one of the last. Three children continued to reduce /nd/ to [n]. Final /nt/ was found in fewer target words but was more successful. The advantage of final voiceless targets is further demonstrated in the production of both triconsonantal /nts/ targets (FG and GG). All three final /ndz/ targets in *hands* were reduced to [nz] by CB and QB, and to [ts] by DB. There were fewer alveolar nasal-fricative than alveolar-plosive cluster targets. /mz/, /ns/ and /nz/ were all reduced by at least one child. Four children attempted final /mp/ in *bump* or *jump*, which was reduced to [m] or [p] in *bump* but was articulated in *jump*.

The largest group of final clusters in terms of the total number produced were the plosive + /s/ clusters, including words in which the final consonant is graphically represented as ‘x’. Six children did not produce /ps, /ts/ or /ks/; AG and QB produced all three, however. There were few final /ts/ targets, but [ts] was reported as a common substitute for a range of final singleton and cluster targets which, as shown above includes /ndz/, but also /ŋk/, /t/, /g/ and /ʧ/. Table 4.14 shows that in the period before the age of 1;6, [ts] was used as substitute by QB for /ps/ and AG for /ks/, but there are no further examples of substitution of either of these clusters, and all the children except NB with /ps/ or /ks/ targets eventually produced them. The advantage of final voiceless targets is further demonstrated in EB’s production of /sps/ in *crisps*, although /sps/ was reported as [bz] in QB’s *crisps*.

There are no final /sp/ or /sk/ targets to allow a comparison with the production of /ps/ and /ks/, but /st/ was a common target throughout the diaries. In Sections 4.1.1 and 4.1.2, it was shown that all the children’s attempts to produce final /st/ failed. This is confirmed in Table 4.22 which shows that all final /st/ clusters were produced after 1;6. BB did not produce it until 2;5, a year later than he first produced initial /st/. QB continued to reduce all /st/ targets to the fricative, as he had since his first attempts at *toast* in period 1. OG also ended the period of study with the final /t/ in *toast* deleted.

Two other words that appeared frequently in the diaries are *help* and *milk*. /lp/ was found only in *help*, and /lk/ only in *milk*. *Milk* appeared in the diaries of nine children, and *help* in the diaries of six. However, the patterns of cluster production are quite different. /lp/ was produced by five of the six children at the first attempt. Seven children produced /lk/, in several cases after frequent attempts. JG and KB reduced /lk/ to the plosive. Table 4.22 shows that /lk/ never appeared first, often appeared last and, where both appeared in the same inventory, was always produced after /lp/. Further indications of the comparative difficulty of the /l/+/k/ combination is demonstrated in the diaries of KB and CB. KB, who had only /l/+plosive cluster targets, produced /lp/ and /ld/ (in free variation) but did not produce /lk/. Furthermore, /lk/ was the last of CB's six /l/-clusters to be produced. These data suggest that /lk/ was the most difficult of the common final-cluster targets present in the corpus.

Some of the consonants (all fricatives) produced in initial or final clusters have not been included in earlier inventories or in the latest inventories of initial and final singletons. These consonants are shown in the following list, which includes medial singleton and cluster consonants that are otherwise unaccounted for.

AG: /j/ in the medial cluster in *love you*

BB: /v/ in the cluster reduction of /vz/ in *gloves* (in free variation)
BB: /ʧ/ in the medial cluster reduction in *pushchair*

CB: medial /ʒ/ in *television*

EB: /f/ in the cluster reduction of /fl/ in *flower*
EB: /ɹ/ in the medial cluster in *toothbrush*

FG: medial /g/ in *doggie*, *Tigger* and *Piglet*
FG: medial /ŋ/ in *uh oh jungo!*
FG: medial /ɹ/ in *lorry* and *carrot*

GG: /ʒ/ in the final cluster in *orange*

HB: medial /ð/ in *another one*

IG: medial /ŋ/ in *finger*

JG: /s/ in the initial cluster in *school* and the final cluster in *bounce*

KB: /s/ in the initial cluster in *stick*
KB: medial /ð/ in *another*

NB: /g/ in *tiger* and *again*
NB: /ɹ/ in *triceratops*, *ice cream*, *zebra* and *sorry*

QB: medial /ð/ in *with us*

Fig. 4.18 shows the distribution of the target consonants that have been produced when these data are included. The 24 consonants are grouped according to classes of manner, and the set of diary entries indicated when the consonants were first produced.

Fig. 4.18

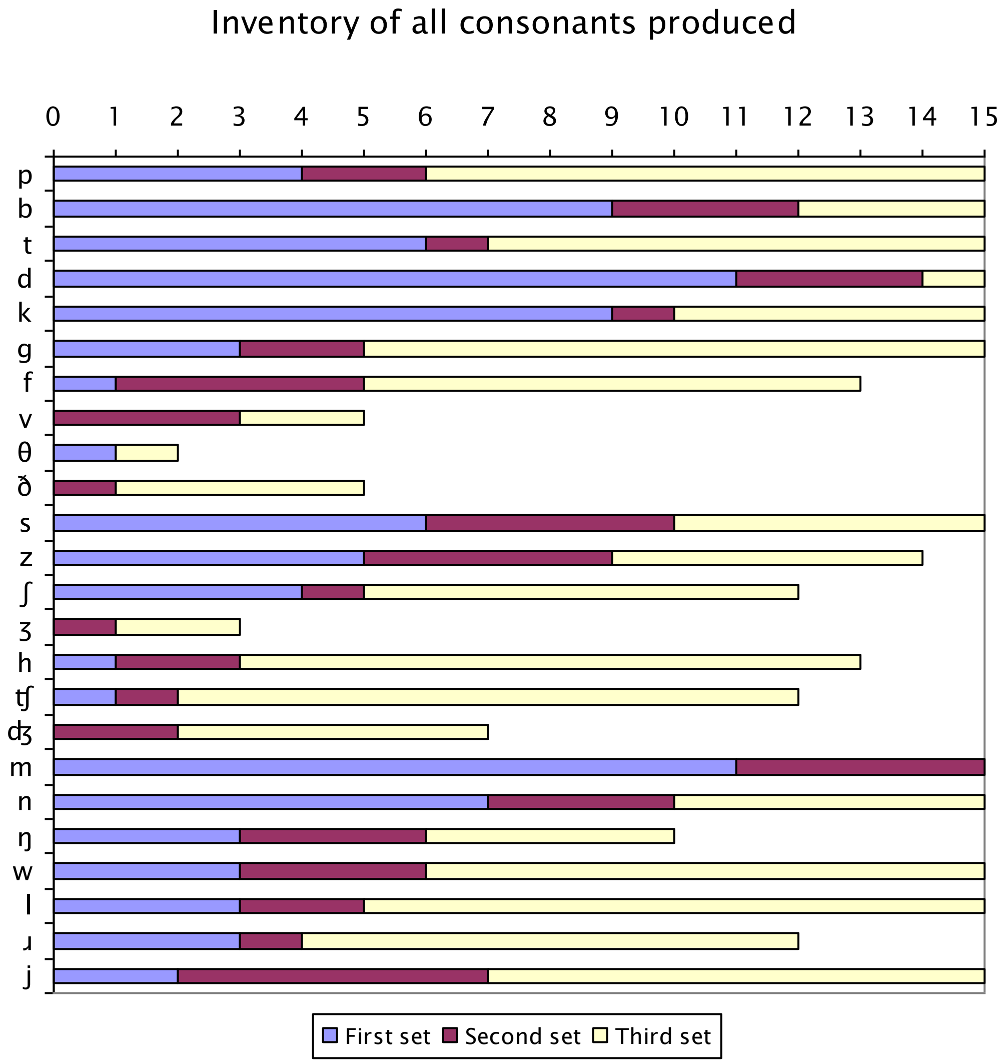


Fig. 4.18 shows that each of the 24 consonants of English has been produced by a minimum of two children, the number who have produced /θ/. All the plosives, plus /s/, /m n/ and /w l j/ have been produced by all the children at least once. All the children produced /m/, and fourteen children produced /d/, before 1;6. At least half of the children also produced /b k s z n/ before 1;6, but most children first produced /p t g f ʃ h ʧ l j/ after 1;6. At least 75 per cent of children have produced /f z ʃ h ʧ ɹ/; fourteen children have produced /z/. The first /v/, /ð/ and /ʤ/ were produced in the second set of entries, although /ʤ/ was not a target in the first set. The interdental fricative /θ/ has been produced the least and avoided the most.

Table 4.23 shows the total number of target consonants that each child has produced, together with the patterns of avoided and absent consonant targets.

Table 4.23: Individual inventories of all consonants

Child	p	b	t	d	k	g	f	v	θ	ð	s	z	ʃ	ʒ	h	ʧ	ʤ	m	n	ŋ	w	l	ɹ	j	No.
AG	✓	✓	✓	✓	✓	✓	✓	✓	✖	✓	✓	✓	✓	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	22
BB	✓	✓	✓	✓	✓	✓	✓	✓	✖	✖	✓	✓	✓	0	✓	✓	✓	✓	✓	✖	✓	✓	✓	✓	20
CB	✓	✓	✓	✓	✓	✓	✓	✓	✖	✓	✓	✓	✓	✓	✓	✓	✖	✓	✓	✓	✓	✓	✓	✓	22
DB	✓	✓	✓	✓	✓	✓	✓	✖	✖	✖	✓	✓	✓	0	✓	✓	✓	✓	✓	✖	✓	✓	✖	✓	18
EB	✓	✓	✓	✓	✓	✓	✓	✖	✖	✖	✓	✓	✖	0	✓	✓	✖	✓	✓	✖	✓	✓	✓	✓	17
FG	✓	✓	✓	✓	✓	✓	✖	✖	✓	0	✓	✓	✓	0	✖	✓	✖	✓	✓	✓	✓	✓	✓	✓	18
GG	✓	✓	✓	✓	✓	✓	✓	✓	✖	✖	✓	✓	✖	✓	✖	✓	0	✓	✓	✓	✓	✓	✓	✓	19
HB	✓	✓	✓	✓	✓	✓	✓	✖	✓	✓	✓	✓	✓	0	✓	✓	✖	✓	✓	✓	✓	✓	✖	✓	20
IG	✓	✓	✓	✓	✓	✓	✓	0	✖	0	✓	✖	0	0	✓	0	✓	✓	✓	✓	✓	✓	✓	✓	17
JG	✓	✓	✓	✓	✓	✓	✓	0	✖	0	✓	✓	✓	0	✓	✓	✓	✓	✓	0	✓	✓	✖	✓	18
KB	✓	✓	✓	✓	✓	✓	✖	✖	0	✓	✓	✓	✓	0	✓	✓	0	✓	✓	0	✓	✓	✓	✓	18
LB	✓	✓	✓	✓	✓	✓	✓	✖	✖	✖	✓	✓	✓	✖	✓	0	✖	✓	✓	✓	✓	✓	✓	✓	18
NB	✓	✓	✓	✓	✓	✓	✓	0	✖	✖	✓	✓	✓	0	✓	✖	✖	✓	✓	✓	✓	✓	✓	✓	18
OG	✓	✓	✓	✓	✓	✓	✓	✖	✖	✖	✓	✓	✓	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	20
QB	✓	✓	✓	✓	✓	✓	✓	✓	✖	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	23

✓ – Consonant produced
✖ – Consonant avoided
0 – Consonant not a target

Table 4.23 confirms that by the time of the last diary entries all the children had produced /p b t d k g m n s w l j/. Of the remaining twelve consonants, /z/ had been produced by fourteen children, and /f/ and /h/ by thirteen. /ʃ/, /ʧ/and /ɹ/ had been produced by twelve children, but /ʧ/ has the best record of these because it was not a target for two children. /ʒ/ was absent from the diaries of eleven children, but has a far better rate of production than /θ/, which was avoided by twelve children.

The most avoided consonants were fricatives, particularly the interdentals and /v/. The affricate /ʤ/ was avoided by six children, and /ŋ/ and /ɹ/ by three. EB avoided the most consonants, which span several classes: /v/, both interdentals, a postalveolar fricative, an affricate and the velar nasal. Four children avoided the combination of /v/ and both interdentals, which are the only target consonants that were not produced by OG. IG, JG and KB have the highest numbers of absent targets. All these are consonants that were avoided by other children: /v/, interdental and postalveolar fricatives, affricates and the velar nasal, which raises the question of whether IG, JG and KB avoided using some words because of the perceived difficulty of the consonants. But regardless of these considerations, all the children produced a minimum of 17 target consonants. This includes children whose early consonant production was tentative, notably GG.

QB produced the most consonants, followed by AG and CB; all three avoided /θ/ but produced /ð/ and /v/. Otherwise, CB's inventory lacks only /ʤ/, although its production was reported in substitution. Moreover, AG and QB produced all target consonants except /θ/, and both children achieved this some time before their second birthday. The data from the diary entries have therefore shown that, despite the limited evidence in some cases, all the children demonstrated the ability to produce most of the consonants of English by the age of 2;0 when counted on the basis of the production of the consonant at least once.

4.2 Analysis of Strand A/B word-position bias and simplification processes

In this section, the children's utterances reported in the diaries are analysed for evidence of the Strand-A characteristics of alveolar and word-initial bias, fronting, word-final deletion, word-initial stopping and reduplication, and the Strand-B characteristics of velar/bilabial and word-final bias, backing and word-initial deletion. The patterns of six children whose speech is identified as characteristic of either Strand-A or Strand-B features are examined more closely.

The analysis of the first diary entries in Section 4.1 showed that there were considerable differences in the size of the children's lexical output and the range and success of their consonant production. Several of the younger children had not developed any consonantal patterns, and in some cases their earliest reported words were essentially vocalic. As the analyses of the children's syllable structures in Section 4.1.1 show, except for BB and KB, all the children realised at least one word or phrase as a vowel-initial utterance in their first diary entries, which in most cases resulted from the deletion of /h/.

In Chapter 2 (2.2), it was shown that it is common for /h/ to be deleted in the early stages of speech regardless of word-position bias. The deletion of /h/ by ten of the eleven children with /h/ as a target is the most striking pattern of avoidance to emerge from the first diary entries, as was indicated in Table 4.8.

These were reported as outright deletions without any suggestion of substitution. /h/ was the only initial singleton deleted by seven of the children, and was a target in *hello* for eight children, including the child who produced it, JG. Table 4.24 shows the initial singletons that were deleted in the first diary entries. (The number in the last column indicates the number of words in which consonants were deleted; the number at the base of each column indicates the number of different initial consonants that each child deleted.)

Table 4.24: Initial singleton deletion in the first diary entries

Cons	Word/s	AG	BB	CB	DB	EB	FG	GG	HB	IG	JG	KB	LB	NB	OG	QB	
/t/	*ta*							ø									1
/k/	*cat*	ø															1
/f/	*fish*													ø			1
/h/	*hair*	ø		ø													2
	hello			ø	ø	ø	ø	ø						ø	ø		7
	Harriet	ø															1
	hiya | horse								ø								2
	hat | heavy | Holly | hot															ø	4
/n/	*no*							ø									1
/l/	*look*	ø															1
/ɹ/	*Reece*	ø															1
	Ruby													ø			1
/j/	*yoghurt*								ø								1
	yes									ø							1
		4	0	1	1	1	1	3	2	1	0	0	0	3	1	1	

Table 4.24 confirms the widespread use of /h/-deletion, and identifies the six children whose only initial deletions were of /h/ as CD, DB, EG, FG, OG and QB. Four children, BB, JG, KB and LB, did not delete any initial singletons, but see below for JG and LB's deletions of initial clusters. AG used the process of initial consonant deletion the most and also deleted the highest number of initial singletons. Two of her deleted initial consonants were alveolar.

As Table 4.24 indicates, many of the target words were without codas. However, the diary entries show that there was no deletion of final segments in the ten words with final consonants. Moreover, the deletion of the initial consonant seems to have facilitated the production of medial and final consonants. AG produced /ɹ/ and /t/ in *Harriet* and HB produced /g/ and /t/ in *yoghurt*. Only AG produced a deleted initial target in another word: /l/ in *love you*.

JG produced all her initial singleton targets including /h/, but is one of three children who deleted initial clusters. In all three cases of initial cluster deletion, there is no evidence that the child had produced either of the cluster consonants as singletons. JG deleted /fɹ/ in *Freddie* and LB deleted /dɹ/ in *drink*, with the final cluster produced. FG omitted both of her /k/+ liquid targets. FG's two earliest recorded utterances were produced without consonants, hence initial /kl/ and final /p/ were avoided in the first entry in *clap*. In the third entry, /kɹ/ was also avoided in *Chris*, but the diary indicates that production of /s/ was emphatic and without the preceding cluster or vowel. The first consonant that FG produced was therefore final and fricative. A later diary shows that this pronunciation of *Chris* persisted for at least a further six months, at which time initial /k/ and initial /ɹ/ still had not been produced. The fact that these words were attempted at stages of FG, JG and LB's phonological development when they had few articulatory alternatives suggests that this early use of initial cluster deletion was of necessity rather than choice.

However, some children did produce alternatives by substituting initial cluster and singleton consonants, which is demonstrated in their patterns of fronting and stopping. Table 4.25 shows the children who fronted initial and final velar consonants in the first diary entries. (Examples of initial fronting are included only where the initial substitute does not assimilate to any medial or final consonant.)

Table 4.25: Velar fronting processes in the first diary entries

Fronted	Initial	Substitute	Word	Fronted	Final	Substitute	Word
DB	/k/	t	*kick*	QB	/k/	t/ʧ	*bike*
DB	/kl/	d	*clock*	QB	/lk/	t/ʧ	*milk*
QB	/k/	d	*car*	QB	/k/	t	*duck*
QB	/sk/	d	*sky*				

The table shows that DB and QB were the only children who fronted initial velar consonants under these conditions. QB also applied velar fronting processes to final segments, and was the only child who used alveolar harmony in *duck* at any time. Both DB and QB were without the use of initial velars in period 1. QB produced final /k/ in *clock* but in no other word position or cluster, therefore all his initial velar singleton and cluster plosives were fronted. DB did not produce /k/ in initial or final position in *kick* or *clock*, suggesting that velars were beyond his articulatory control.

The pronunciations indicated by the transcriptions are remarkably similar to Grunwell's (1987: 227) examples of common processes (cited in Section 2.2), which include *sky*, and which imply that it more usual for children below the age of 2;0 to front initial velars than to produce them. (This assumes that, in *sky*, the child is fronting the velar rather than stopping the fricative.) However, there was some articulation of initial /k/ at this early stage: CB and IG in *cat*, HB and KB in *car(s)*, IG in *quack*, BB in *clock* and KB whose production of *cow* was reported as a consonant-only utterance.

In Chapter 2 (2.2), it was shown that the initial /ð/→[d] process was common to Strand-A and Strand-B children. In the limited vocabulary of the first diary entries, all avoided initial /ð/ and most avoided initial /ʧ/ were reported as realised by [d]. These are shown in Table 4.26.

Table 4.26: Stopping processes in the first diary entries

Stopped	Target	Substitute	Word/phrase	Stopped	Target	Substitute	Word
CB	/ð/	d	*there*	QB	/θ/	p/t	*bath*
EB	/ð/	d	*this*				
NB	/ð/	d	*there she is*				
QB	/ʧ/	d	*cheese*				
QB	/ʧ/	d	*choo choo*				
HB	/ʧ/	k	*chocolate*				

The table shows that three children used the initial /ð/→[d] stopping process, and that these are different children from those who used initial fronting processes, DB and QB (Table 4.25). However, it would be reasonable to predict that if QB had any initial-/ð/ targets, he would have used the same process as CB, EB and NB, given his articulation of [d] for all initial /d/, /t/, /k/, /g/, /ʧ/ and /s/+plosive targets. HB's backing and stopping of the affricate in *chocolate* was no doubt under the influence of the medial velar, as it occurred on the day that his production of /ʧ/ in *cheers* and *cheese* was reported. In addition to the initial affricate, QB stopped the final interdental in *bath*, in bilabial harmony with [p] and with alveolar substitution in [t]. However, there was alveolar fricative substitution of the final consonant in *teeth*.

NB adopted an alternative approach to initial /θ/, which contrasted with his own and other children's alveolar stopping of /ð/. /θ/ was substituted by [h] in *thank you*. (At the same time, he deleted /h/ in *hello* (see Table 4.24).) NB's diary suggests that eight months later, [h] was still the substitute in *thank you*, long after he had begun to produce /h/ in *hello* and other /h/-words.

In Section 4.1, it was suggested that many of the children produced early CVCVV target words, such as *Mummy*, *Daddy* and *baby,* in reduplicative forms, particularly as CVCV. DB produced the only reduplicative form of *hello* in the first diary entries, in a vocalic (VV VV) utterance. Conversely, KB used initial-[j] epenthesis in *up* to produce a CVC CVC utterance from a VC target. CB and NB also used contrary processes in words with initial and final /ʃ/: CB in *shoe* as ʃV ʃV, and NB in *fish* in which the initial consonant was deleted (Table 4.24) and /ʃ/ was realised in a repeated convoluted coda, which according to the diary transcription was affricated. AG produced reduplicated initial consonants in *bird* and *duck*, thus allowing her to avoid any attempt at final /d/ or /k/.

These examples therefore demonstrate not only the link between the use of reduplication and the omission of final segments (see Section 2.2), but also the converse patterns of initial production/final deletion and final production/initial deletion found between Strand-A and Strand-B children. Table 4.27 shows the examples of final consonant omission in the first diary entries.

Table 4.27: Final singleton omission in the first diary entries

Cons	Word/phrase	AG	BB	CB	DB	EB	FG	GG	HB	IG	JG	KB	LB	NB	OG	QB	
p	*clap*						ø										1
b	*bib*								ø								1
t	*cat*			ø						ø							2
	nunight															ø	1
	open it								ø								1
k	*clock*		ø														1
s	*yes*												ø				1
z	*glasses / upstairs*								ø								2
n	*Aaron*														ø		1
	down															ø	1
	moon		ø														1
	muslin								ø								1
l	*ball*								ø							ø	2
	owl															ø	1
	apple								ø								1
		0	2	1	0	0	1	0	5	1	0	0	1	0	1	3	

Comparisons between Table 4.24 (initial deletion) and Table 4.27 (final deletion) show that AG, GG and NB, the children who applied the deletion process to the widest range of initial singletons, did not delete final consonants.[11] The tables further confirm that JG and KB produced all initial and final singleton targets. Final /t/ and /n/ were deleted the most; each were deleted by four children, but HB and QB deleted both. HB deleted five final singletons, /b t z n l/, to QB's three, /t n l/. HB's extensive use of final consonant deletion corresponds to his lower range of final consonants compared to initial consonants (see Table 4.7). LB had begun to use reduplication, and deleted /s/ in *yes* (CVCVCV).

Conversely, IG's deletion of /t/ in *cat* was her first diary entry. Two weeks later and within the period of the first diary entries, /t/ harmonised with initial /k/, and *cat* rhymed with *quack*. CB's only final consonant deletion was /t/ in *cat*. Otherwise, he produced /t/ in *yoghurt* and target /ʃ/, /n/ and /ŋ/. This realisation of *cat* was the only example in his diary of a minimal CV utterance.

Earlier, it was suggested that BB is an exception in that he is one of only two children who did not produce a vowel-initial structure in his first admissible diary entries. He is a special case in several other ways. BB is the only child whose diary entries do not include *Mummy*, *Daddy* (or any other parental name) or *hello*. At 1;4.23, he was the oldest child in the cohort by some weeks when the diary was delivered, which could account for the absence of these typical early words.

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[11] AG's deletion of /d/ and /k/ in *bird* and *duck* are not included.

BB is also the only child whose syllable structures in the first diary entries were limited to basic CV, CVV and CVC forms (see Section 4.1.1.1; Table 4.3). The first five words reported from 1;4.23 were produced as monosyllables, which involved the structural reduction of trisyllabic *banana* to monosyllabic CVC variants. However, notes made by the mother suggest that these were not BB's first words and that not all of his earlier utterances had been monosyllabic. This suggests strategic use of the basic consonant-initial structures, which allowed BB to focus on his production of initial consonants, if necessary at the expense of final consonants. This is supported by the fact that all initial consonants produced in monosyllabic targets were faithful to place and manner, including /k/ in the liquid cluster reduction of initial /kl/ in *clock* (*contra* DB /kl/→[d]). Furthermore, the final singleton was deleted and the vowel lengthened, suggestive of compensatory lengthening, in *clock*.

BB's patterns of syllable reduction and compensatory lengthening continued beyond 1;6 and into period 3. The monosyllabic rule was not broken until 1;7. Meanwhile, his production of initial singletons and clusters developed within CV, CVV and CVC frameworks. Most attempted words that were reported in period 2 were monosyllabic; those that were not were reduced. *Rabbit* had CV and CVC variants, and *flower* was CCVV. /fl/ was one of three initial clusters that BB produced within the five days leading up to his half-birthday (shown in Table 4.14). Compensatory lengthening continued in *clock*, which also was CCVV. BB was the only child with final-/k/ deletions in period 2. Table 4.28 shows the patterns of final consonant deletion in period 2 of all the children, except LB (see Section 4.1.2 for explanation). As in Chapter 2, examples of syllabic-/l/ omission are included. The same methods of counting words and deleted consonants apply.

Table 4.28: Final consonant omission in period 2 to 1;6

Cons	Word/phrase	AG	BB	CB	DB	EB	FG	GG	HB	IG	JG	KB	NB	OG	QB	
p	*clip clop*								ø							1
	cup														ø	1
t	*cat*				ø											1
	light								ø							1
	plate								ø							1
d	*bird*										ø					1
	bread			ø												1
	Dad													ø		1
	food	ø														1
	Grandad	ø														1
	road	ø														1
k	*clock*		ø													1
	duck		ø													1
g	*dog*		ø											ø		2
s	*bus*													ø		1
z	*nose*	ø							ø							2
	upstairs					ø										1
m	*Adam*	ø														1
	Liam							ø								1
n	*moon*	ø											ø			2
	bean								ø							1
	down			ø												1
	Nan													ø		1
ŋ	*bang bang*							ø								1
l	*apple*	ø														1
	bubble												ø			1
	cuddle	ø														1
	squirrel														ø	1
		5	2	2	1	1	0	2	4	0	1	0	2	4	2	

Table 4.28 confirms that BB was the only child who deleted final /k/, and shows that he only deleted velar plosives. The other child who deleted /g/ in *dog*, OG, was currently in a period of systematic final consonant deletion. Unlike BB, she produced disyllabic utterances, but all her CVC words were reduced to CV. The absence of final consonant deletion in FG, IG and KB reflects the limited number of entries in their diaries between periods 1 and 2.

There was no deletion of final /θ/, despite its prominence in the table of avoided consonants to 1;6 (Table 4.13). GG's attempts at *Liam* and *bang bang* were vocalic, in similar vein to some of her utterances in period 1. Four children deleted final /d/. Of the remaining consonants, /p/, /t/, alveolar fricatives, nasals and the lateral, these are typical of those found in previous tables of final deletion (Tables 2.10 and 2.13, and Table 4.24), although in Strand-B children deletion of voiceless plosives was confined to /t/ and final nasals were not deleted (Table 2.13).

AG used final deletion the most, but she deleted multiple targets of two consonants, and all her deleted consonants were voiced targets which, as shown in previous sections, are produced less and avoided more in final position. Nevertheless, this was a reversal for AG, who had not deleted any final consonants in the first diary entries (Table 4.27).

HB deleted a similar number of consonants as AG, but these included /p/, /t/ and /z/, all of which he had produced in the first diary entries and which had been produced by many of the children by 1;6, as Section 4.1.2 shows. HB's deletion of these consonants is consistent with the fact that his production of final consonants had fallen behind that of AG, CB and QB, at 1;6. Several children had begun to produce clusters in period 2, and no deletion of initial clusters was recorded. There was one example of final cluster deletion, however. This was CB's deletion of /ts/ cluster in *boots*.

The only children who used reduplication in period 2 were the same four children who were originally grouped according to their blocks of diary entries, AG, CB, HB and QB. Their vocabularies had remained the largest according to the diaries. Examples of their reduplicated forms are presented below, in the order in which they appear in the diaries, with the mothers' transcriptions shown:

AG	*bunny rabbit*	CVC CVC	"bub bub"
AG	*Tabitha*	CVCV	"ba ba"
CB	*what's that?*	CVC CVC	"wot wot"
HB	*onion*	VV VV	"owow"
QB	*bottle*	CVC CVC	"bot-bot"
QB	*pasta*	CVCV	"da-da"
QB	*chocolate*	CVC CVC	"dok dok"

These reduplications appear rather immature, considering the level of success of these children in achieving increasingly complex consonant targets during period 2 (see Section 4.1.2). Furthermore, these utterances consist only of initial bilabial, plosive and alveolar consonants, which are more typical of the limited patterns of initial consonant production found in the children with the smallest inventories in the earlier period of the first diary entries (Table 4.2). However, AG's reduction of polysyllabic targets to manageable disyllables, and CB's avoidance of the interdental, could explain their use of reduplication. HB's motivation might have been avoidance of /n/, as he had previously deleted all final /n/. QB's reasons for using reduplication are unclear. His examples were not produced in a batch and the same reduplicated form in *pasta* was repeated. Unless on both occasions it was a case of alveolar harmony, this suggests further use of [d] as a default consonant in initial substitution, a pattern already established in the fronting of velars (Table 4.25) and the deaffrication of initial /ʧ/ (Table 4.26).

Table 4.29 shows that QB continued to front initial velar consonants in period 2, and that he used the process more than any other child. He also expanded his range of final velar fronting processes to circumvent his general lack of final velar consonants. (As before, examples of initial fronting include only words in which medial and final alveolars are absent.)

Table 4.29: Initial and final velar fronting in period 2 to 1;6

Fronted	Initial	Substitute	Word
AG	/k/	d	*catch*
CB	/k/	d	*car*
QB	/k/	d	*cake / coffee / cow / cup*
AG	/g/	d	*go*
DB	/g/	d	*go*
QB	/g/	d	*gosh*
QB	/kɹ/	d	*cream*
Fronted	**Final**	**Substitute**	**Word**
AG	/k/	t	*back*
QB	/k/	t	*book / park / music / sock / snake*
QB	/k/	t	*bike / duck* (to 1;5.6)
QB	/lk/	t	*milk*
QB	/g/	d	*frog / leg*
QB	/g/	ts	*pig*
QB	/ŋ/	n	*bang / swing / swimming*
QB	/ŋ/	n	*tongue / song / ring*
QB	/ŋ/	n	*raining / talking*
QB	/ŋk/	s	*drink*

Table 4.29 shows that only four children fronted initial velars in words without alveolar targets. DB and QB already had a record for doing so (see Table 4.25). However, CB had fronted initial consonants only in assimilatory processes in the first diary entries, and AG had followed an entirely different strategy in period 1 of either producing initial targets (/b d ʃ m n l/) or deleting them (/k h l ɹ/) (Table 4.27).

In period 2, AG also used final velar fronting, but on a considerably smaller scale than QB, whose attempts to avoid final velars included the use of spirantisation in *drink*. At 1;5.6, QB produced final /k/ in *bike* and *duck*, and on the same day he produced his first initial /k/ in *castle*. This signalled the end of his use of fronting processes of initial and final consonants. At 1;5.14, QB demonstrated his newfound command of final /k/ by using the reverse process in the velar backing of final /t/ in the all-alveolar word, *toilet* .

In Section 2.2, it was shown that the children who used velar fronting in non-alveolar words (Strand-A) made greater use of stopping processes than Strand-B children. This link was found in QB's first diary entries, in which he fronted initial and final consonants, and stopped initial and final fricatives and initial affricates (Tables 4.25 and 4.26). Table 4.30 shows the stopping processes used in period 2, and identifies the children who used them.

Table 4.30: Initial and final stopping in period 2 to 1;6

Stopped	Initial	Substitute	Word/phrase	Stopped	Final	Substitute	Word
AG	/f/	d/b	*feather*	QB	/v/	b	*olive*
AG	/θ/	d	*thank you*	JG	/θ/	t	*bath*
AG	/ð/	d	*that way*				
CB	/ʧ/	t	*cheese* (from 1;4.29)				
CB	/ʧ/	t	*chin*				
QB	/ʧ/	t	*cheese*				
QB	/ʧ/	d→t	*chair*				
QB	/ʧ/	d	*Charlie / cherry / chin*				
QB	/ʧ/	d	*chicken / chocolate*				
CB	/ʧ/	k	*cheese* (from 1;4.14)				
AG	/ʤ/	d	*George*				
QB	/ʤ/	d	*Jack / jump*				

Table 4.30 shows that most stopping of fricatives and all stopping of affricates was of initial segments, and that the only children who used these processes were AG, CB and QB. As noted before, this was a departure for AG, who had not used fronting or stopping processes in the first diary entries, but who in the current period produced all the examples of initial fricative stopping shown in Table 4.30. Not all of these examples are of stopping by an alveolar. In one of the variants of *feather*, the labiodental was stopped by [b]. The same process was used by QB in the stopping of final /v/ in *olive*, the only example of its kind because there was no reported stopping of final labiodentals after

1;6. JG's final /θ/ was stopped by [t] in *bath* (cf. QB's period-1 stopping of /θ/ in *bath*, when the alternatives were [t] and [p]).

No initial affricates were produced in period 2, and in almost all cases stopping processes were used to avoid them. AG reduced initial /ʤ/, but produced final /ʤ/, in *George*. However, progress in the acquisition of initial /ʧ/ is indicated in the table: in CB's progression from velar stopping to alveolar stopping in *cheese* and in QB's closer match with the voiceless target in the progression from [d] to [t] in *chair*. But alveolar plosives were not used as substitutes in all cases, and some children deleted initial plosive targets. Examples are included in Table 4.31.

Table 4.31: Initial singleton deletion in period 2 to 1;6

Cons	Word/phrase	AG	BB	CB	DB	EB	FG	GG	HB	IG	JG	KB	NB	OG	QB	
/b/	*bang bang*							ø								1
	Balamory												ø			1
/d/	*down*												ø			1
	Daddy												ø			1
/g/	*get out*	ø														1
/θ/	*thank you*			ø												1
/ð/	*this one*														ø	1
/h/	*hair / hairy / hand / hanger*														ø	4
	head / heart / higher / house														ø	4
	hello / horsie								ø						ø	4
	here you are									ø						1
	horse	ø														1
	happy														ø	1
	happy birthday to you												ø			1
/ʤ/	*giraffe*														ø	1
/w/	*where*												ø			1
	wiggle	ø														1
/l/	*Liam*							ø								1
	light				ø											1
	lucky	ø														1
/ɹ/	*Ruby*												ø			1
/j/	*yoghurt*	ø														1
		5	0	1	1	0	0	2	1	1	0	0	5	0	3	

Table 4.31 confirms that voiced plosives were amongst the initial consonants deleted and shows that AG, GG and NB were the only children who deleted them after 1;6. GG avoided all consonants in *bang bang*. Just before 1;6, NB entered a stage of deleting most initial consonants, including /b/ and /d/ which he had previously produced in initial /bl/ cluster reduction and in /ð/→[d] stopping. However, his /ʤ/ in *juice* was not deleted or stopped but glided. AG still used initial deletion occasionally in a considerably larger vocabulary, so that her use of the process, although involving the same number of consonants as NB, was more sporadic. Both children deleted approximants: AG /w l j/; NB /w/ and /ɹ/ in its continued deletion in *Ruby*.

Six children did not use initial consonant deletion: BB, EB, FG, JG, KB and OG. Five children deleted /h/; HB and IG only deleted /h/. HB and QB produced /h/ during the period, QB at 1;5.18 after producing the eleven examples shown in Table 4.31. These included *hello* and *horsie*, which HB had also attempted. Otherwise, QB deleted initial /ð/ and /ʤ/, CB deleted initial /θ/ and DB deleted initial /l/.

By the end of period 2 (1;6), all the children had used at least one of the following simplification processes: reduplication, initial or final deletion, velar fronting and stopping. However, some children had used most of these processes and other children hardly any. KB had used simplification processes the least; this was confined to his use of reduplication (with initial epenthesis) in *up* during the period of his first diary entries.

The third set of diary entries, covering the period from 1;6 to the end of study, is a large corpus which includes most of the data on most of the children. Most of the diary entries in period 3 fall within Grunwell's (1982) Stage 2 (1;6 to

2;0). Analysis of the simplification processes used during the period begins with reduplication, which according to Grunwell, declines after 1;6 in comparison to the processes of final consonant deletion, velar fronting and stopping.

Eight children produced at least one reduplicative utterance after 1;6, leaving seven children who did not reduplicate: AG, DB, GG, HB, NB, OG and QB. Therefore, three of the four children who used reduplication in period 2, AG, HB and QB, did not use the process after 1;6. For these children, at least, the decline in reduplication seems to apply. Moreover, two of the children used reduplication on an isolated occasion:

EB	in *chocolate*	"choc choc"
JG	in *breakfast*	"be be"

Of the six children remaining, three used reduplication in two words:

FG	in *flower*	"wa wa"
FG	in *trousers*	"chow chow"
IG	in *Grandad*	"gog gog" → "ga ga"
IG	in *tractor*	"ca ca"
KB	in *digger*	"dig-dig"
KB	in *postman*	"pah-tah"

KB's examples were produced on the same day at 1;10.5, and were the first reported since his reduplication of *up* at 1;3.11. IG produced *Grandad* as "ga ga" and *tractor* as "ca ca" on the same day at 1;8.3. Reduplication had not been reported in EB, JG, IG or FG before.

This leaves only three children, BB, CB and LB, who appear to have used reduplication during period 3 in a systematic way. CB and LB had produced reduplicative forms in earlier periods. BB had not used reduplication before, although he had been constrained from doing so by the imposition of his monosyllabic rule (see above). The examples of BB, CB and LB's reduplication are shown in the order in which they were first produced:

BB	in *Grandpa*	"ger ger"
BB	in *door*	"door door"
BB	in *fish*	"fif fif"
BB	in *Robin*	"roh roh"
CB	in *sultana*	"naa naa"
CB	in *radio*	"der der" (reported twice)
CB	in *snail*	"nainai"
CB	in *Cheerios*	"wo-wos"
LB	in *Diane*	"ya ya"
LB	in *Pocoyo*	"da da" (reported twice)
LB	in *the gym*	"beebee"
LB	in *orange*	"ngng"
LB	in *Natasha*	"shsh"
LB	in *tape measure*"	"mesh mesh"

Some children used final consonant deletion extensively in period 3. BB used the process the most, producing 23 per cent of all the examples of final deletion reported in the diaries. Four children, BB, LB, KB and DB, produced 60 per cent of all the examples. BB also deleted the highest number of different consonants, ten. LB deleted eight consonants, AG, DB and KB deleted six. (See Table 4.32.)

Three final clusters were deleted. BB deleted /st/ in *toast* in a reversal of his earlier pronunciation in which the fricative was articulated. HB deleted /nz/ in *raisins*, and NB's final /lz/ cluster in *bubbles* was lost through vocalisation.

However, the number of final singletons deleted by HB and NB was small. QB, and FG once again, did not delete any final singletons. EB used the process only once, to delete /θ/ in *bath*. The two children who deleted only two final consonants also deleted /θ/: CB /θ/ and /z/; NB /θ/ and /l/. Conversely, the child who deleted the most final singletons, BB, deleted the broadest range of the cohort's most commonly-produced final obstruents as well as /l/ and /n/: /p t d k g s z ʃ n l/. These data are confirmed in Table 4.32.

Table 4.32: Final singleton omission after 1;6

Con	Word/phrase	AG	BB	CB	DB	EB	FG	GG	HB	IG	JG	KB	LB	NB	OG	QB	
p	*cup*		ø														1
	sheep										ø						1
b	*bib*	ø															1
t	*alright / cot / fart / hot / nut*		ø														5
	bat / cricket				ø												2
	cat / stamp your feet	ø															2
	hat				ø							ø					2
	Kit											ø					1
	Marmite / tip out												ø				2
	Pat				ø					ø							2
	wet				ø										ø		2
d	*bird*	ø	ø														2
	cupboard	ø															1
	head								ø								1
	red												ø				1
k	*bike*		ø									ø					2
	book		ø		ø								ø				3
	Brooke / duck														ø		2
	hook												ø				1
	kick								ø								1
	stick											ø					1
g	*bug / egg*												ø				2
	pig		ø							ø							2
v	*Eve*				ø												1
	five / move														ø		2
θ	*bath*					ø							ø		ø		3
	mouth			ø				ø									2
	teeth				ø									ø			2
	underneath			ø													1
s	*bus*														ø		1
	horse									ø							1
	house / yes											ø					2
	juice												ø				1
	mice / rice / walrus		ø														3
z	*cheese*											ø					1
	mayonnaise / sunrise		ø														2
	neighbours			ø													1
	nose							ø		ø							2
ʃ	*bash*											ø					1
	fish		ø														1

<table>
<tr><th>Con</th><th>Word/phrase</th><th>AG</th><th>BB</th><th>CB</th><th>DB</th><th>EB</th><th>FG</th><th>GG</th><th>HB</th><th>IG</th><th>JG</th><th>KB</th><th>LB</th><th>NB</th><th>OG</th><th>QB</th><th></th></tr>
<tr><td>m</td><td>*Apple Tree Farm*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr>
<tr><td>n</td><td>*bin*</td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr>
<tr><td></td><td>*brown | onion | open | pumpkin*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td>4</td></tr>
<tr><td></td><td>*cocoon | iron | man*</td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>3</td></tr>
<tr><td></td><td>*down*</td><td>ø</td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td>ø</td><td></td><td></td><td></td><td></td><td>4</td></tr>
<tr><td></td><td>*get down*</td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td></tr>
<tr><td></td><td>*gone*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td>1</td></tr>
<tr><td></td><td>*hot cross bun*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr>
<tr><td></td><td>*mine*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td>1</td></tr>
<tr><td></td><td>*moon*</td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td>2</td></tr>
<tr><td></td><td>*policeman*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr>
<tr><td></td><td>*rain*</td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td>2</td></tr>
<tr><td>ŋ</td><td>*earring*</td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr>
<tr><td></td><td>*raining*</td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr>
<tr><td>l</td><td>*apple | bubble | turtle*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td>3</td></tr>
<tr><td></td><td>*ball*</td><td></td><td>ø</td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td>3</td></tr>
<tr><td></td><td>*bottle | good girl*</td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td></tr>
<tr><td></td><td>*bowl | heel*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td>2</td></tr>
<tr><td></td><td>*cereal | owl*</td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td></tr>
<tr><td></td><td>*school*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr>
<tr><td></td><td>*wall*</td><td></td><td></td><td></td><td>ø</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>6</td><td>10</td><td>2</td><td>6</td><td>1</td><td>0</td><td>4</td><td>4</td><td>4</td><td>3</td><td>6</td><td>8</td><td>2</td><td>5</td><td>0</td><td></td></tr>
</table>

As the table shows, final /n/ was deleted the most, followed by /t/ and /l/. Half of all the examples are of the omission of these alveolar consonants. This is in proportion with the number of children who carried out these omissions because eight children deleted /n/, seven children deleted /t/, and six children deleted /l/.

Some consonants proved less vulnerable to deletion than others. There was no deletion of final /f/ or either of the affricates. Some voiced plosives were deleted but these together amounted to only 10 per cent of the total number of examples, and there were few examples of the deletion of final nasals other than /n/. /k/ was deleted far less than /t/, and by a small group of six children, BB, DB, HB, KB, LB and OG, one of whom was also responsible for two of the three examples of final-/g/ deletion. Table 4.33 shows examples of the contrary process of initial singleton deletion.

Table 4.33: Initial singleton deletion after 1;6

Cons	Word/phrase	AG	BB	CB	DB	EB	FG	GG	HB	IG	JG	KB	LB	NB	OG	QB	
/p/	*Piglet*						ø	ø									2
/b/	*bath*						ø										1
	bird						ø	ø									2
	baa baa black sheep							ø									1
/t/	*Tigger*						ø	ø									2
	Tubbies						ø										1
	Thomas												ø				1
	tomato													ø			1
/d/	*Dipsy*						ø										1
	door							ø									1
/k/	*car / cow*						ø	ø									4
	carrot							ø									1
	kitchen							ø									1
/g/	*get / go away*						ø										1
	get down							ø									1
/f/	*face*	ø															1
	fall down / five / football							ø									3
/θ/	*thank you*			ø													1
/ð/	*that one*	ø			ø												2
	that's it	ø															1
	this way													ø			1
/s/	*six*							ø									1
	sock						ø	ø									2
	sorry													ø			1
/ʃ/	*shower*						ø	ø					ø				3
/h/	*haircut*				ø												1
	hammer		ø														1
	happy / have it / hoover	ø															3
	hat						ø	ø							ø		3
	head						ø										1
	hedgehog / honey	ø		ø													4
	help	ø		ø				ø							ø		4
	here you are / hole			ø													2
	horse / hot cup of tea			ø													2
	hippo															ø	1
	hot						ø	ø							ø		3
	hotdog															ø	1
	house	ø			ø			ø									3
/ʧ/	*chippy*						ø										1
/m/	*milk*					ø											1
	mouth							ø									1
/n/	*knock it over*													ø			1
	nappy							ø									1
	Niamh / nose						ø										2
/w/	*where*													ø			1
	wee				ø												1
	wipes / wipers			ø													1
/l/	*leg*	ø															1
	Lizzie									ø							1
	lorry				ø		ø	ø									3
	Luca							ø									1
/ɹ/	*rabbit*				ø					ø							2
		4	1	3	5	1	12	13	0	2	0	0	2	5	1	1	

FG and GG were the most excessive users of initial consonant deletion, but GG had the edge over her sister. Half of all the examples were theirs. Furthermore, FG and GG were the only children whose deleted initial consonants included all the plosives, contrary to the patterns of the children who used final deletion the most (see Table 4.32). NB and LB were the only other children to delete an initial plosive, in both cases this was /t/. Four initial clusters were deleted. FG and GG deleted /pl/ in *plane*. GG deleted /kɹ/ in *Chris* and /tw/ in *Twinkle, twinkle little star*; LB deleted /gɹ/ in *Granny*. Table 4.33 suggests that HB, JG and KB did not use initial consonant deletion in period 3; BB, OG and QB only deleted /h/. Six children deleted initial /l/, but only two children deleted /ɹ/. IG only deleted the liquids. AG, CB, DB and NB used the process to delete an interdental fricative, but an increasing number of children employed initial-stopping and affricate-reduction strategies to avoid challenging consonants. Table 4.34 shows the children who used stopping processes during period 3.

Table 4.34: Stopping processes after 1;6

	Initial	Sub	Word/phrase		Final	Sub	Word
AG	/f/	b	*fish*	QB	/ʤ/	b	*sandwich*
CB	/f/	b	*fingers / fizzy / fork / found*	CB	/ʤ/	d	*fridge*
DB	/f/	b	*football / fox*				
GG	/f/	b	*Phoebe*				
IG	/f/	b	*phone*				
OG	/f/	b	*finger*				
AG	/fl/	b/bl	*flower*				
FG	/fl/	d	*flower*				
HB	/v/	b	*van*				
IG	/θ/	t	*thank you*				
HB	/θ/	t/d	*thank you*				
BB	/ð/	d	*that*				
CB	/ð/	d	*there*				
EB	/s/	t	*soap*				
HB	/ʧ/	t	*chew*				
OG	/ʧ/	d	*Charley*				
GG	/ʧ/	k	*chocolate*				
AG	/ʤ/	b	*John*				
EB	/ʤ/	t	*Josie*				
CB	/ʤ/	d	*jingly jangly*				
HB	/ʤ/	d	*gently / juice*				
LB	/ʤ/	d	*Julia*				
LB	/ʤ/	k	*juice*				

These patterns show that most of the stopped fricatives were now labiodental. Only one child used the initial /s/→[t] process. There was no stopping of final fricatives and there was only limited reduction of final affricates. Not all initial affricate stopping was alveolar; one child produced a bilabial substitute, and two children used a velar backing process, although there is an element of consonant harmony in GG's example of *chocolate*. Table 4.35 shows the children who used non-assimilatory velar fronting after 1;6.

Table 4.35: Velar fronting processes after 1;6

Fronted	Initial	Substitute	Word
AG	/k/	t	*cow*
DB	/k/	t	*car*
EB	/k/	t	*car*
HB	/k/	t	*kiss*
CB	/k/	d	*coming*
FG	/k/	d	*cake*
GG	/k/	d	*cake*
DB	/g/	d	*get up | gone*
Fronted	Final	Substitute	Word
AG	/k/	t	*shake*
LB	/k/	t	*black*
OG	/k/	t	*clock*
CB	/ŋ/	n	*running | laughing | chasing*
DB	/ŋ/	n	*wing*
HB	/ŋ/	n	*hiding | sleeping*
LB	/ŋ/	n	*bang*
QB	/ŋ/	n	*rocking*
LB	/ŋk/	ts	*bank*
EB	/ŋk/	nt	*pink*

As Table 4.35 indicates, more children were using velar-fronting processes, although QB's contribution to the list (see Table 4.29) has been reduced to a single example of final fronting which he produced before 1;7. AG, CB, DB and HB produced at least one example of initial and final singleton fronting. EB produced one example of initial singleton fronting and one of the two first examples of fronted biconsonantal clusters. Tables 4.34 and 4.35 show that NB did not use any stopping or velar fronting processes in period 3.

FG and GG are amongst the new entrants to the list (Table 4.35). For both children, the fronting of initial /k/ in *cake* is the only example of fronting reported but it runs counter to the other indicators of Strand-B identity demonstrated in period 3 including GG's example of postalveolar backing listed in Table 4.34. However, FG and GG's examples of velar fronting (Table 4.35) together with their use of initial velar deletion (Table 4.33) demonstrate that their production of initial velar consonants was far from secure. But note that evidence of velar preference in all Strand-B children, Daniel, Richard and Grace, was based on their production of final velar consonants, which is not in question here. Unlike, AG, CB, DB. EB, HB, LB, OG and QB, FG and GG did not use alveolars to front final velar consonants or clusters.

Given the evidence, BB, DB and QB have been selected as examples of Strand-A children, and GG, IG and NB have been selected as examples of Strand-B. The following profiles of these children summarise the reasons for this categorisation.

BB – Strand-A

BB was the first child to be identified as having a clear word-initial and syllable-initial bias. Throughout periods 1 and 2, all his utterances were reduced to monosyllables, allowing him to focus on the production of initial consonants. In period 2, three initial cluster targets were produced in close succession. Throughout the period of the study, BB bucked the trend and produced more initial clusters than final clusters, and the study ended with BB having the largest margin of any child between the number of initial and final clusters produced: 3:6.

BB demonstrated Strand-A features at each point of analysis. In the first diary entries, he did not use initial consonant deletion, and was one of only two children who did not delete any initial singletons or clusters and who did not produce a vowel-initial utterance. He produced /k/ in *clock* in a kVV utterance in which the final velar was deleted and the vowel extended in compensatory lengthening. /k/ was one of two final consonants that he deleted, the other was /n/.

In the short time between the end of period 1 and BB's half-birthday, he produced three initial clusters, in *star*, *clock* still with lengthened vowel, and *flower* reduced to a monosyllable. There was no initial consonant deletion, and all initial velars were articulated. Conversely, BB deleted all his final velar targets, which were the only final consonants that he deleted. All utterances remained monosyllabic.

In the final period of assessment, BB was still demonstrating Strand-A characteristics. He produced four examples of reduplication after the constraint of the monosyllabic rule had been lifted. His word-initial bias was most evident in the fact that his significant use of final consonant deletion in period 3, contrasting with that of GG's deletion of initial consonants. The only initial consonant that BB deleted was /h/. BB's diary continued to 2;5, by which time he had produced 16 initial consonants, 11 final consonants, six initial and three final clusters, the reverse of the typical pattern for cluster production and a further indication of his Strand-A word-initial bias.

DB – Strand-A

In the first diary entries, the only initial consonant DB deleted was /h/. He fronted initial /k/ and the reduced /kl/ cluster in *clock*, in which the final /k/ target was not articulated. None of the four velar targets in *kick* and *clock* was achieved. The only final target that he produced was /t/. He used reduplication in *hello*.

In period 2, DB produced the typical Strand-A example of velar fronting (/g/→[d]) in *go*. /k/ in *cat* was also fronted, and the final consonant deleted. There was an isolated case of initial deletion of /l/ in *light*, but /j/ was produced in *yes*. There were no initial fricative targets, but both final alveolar fricatives were produced.

These patterns continued into period 3. Initial velar fronting continued in *car*, *get up* and *gone*, and also word finally in *wing*. There was also initial labial stopping in *football* and *fox*. Six final consonants were deleted: /t k v θ l n/, but he also made greater use of the initial deletion process to avoid some /h/ targets and also /w ð l ɹ/. By 1;11.15, DB had produced 14 initial and 11 final consonants. Four final clusters had been produced, but no initial clusters.

QB – Strand-A

QB first diary entries were produced in a block of 43 when aged 1;2.20. He was two months younger than BB at the commencement of the study. QB's speech was prolific, but his use of simplification processes in the early months was extensive. His first whole sentences started to appear at around 1;8.

In the first block of diary entries, QB's only deleted initial consonant was /h/. All initial velars and the reduced initial /sk/ cluster were fronted. He produced final /k/ in *clock*, but applied fronting processes to /k/ in *bike* and *duck* and to /lk/ in *milk*. He also used stopping in the affricate reduction of /ʧ/ in *cheese* and *choo-choo*, and in the /ð/→[p]/[t] process in *bath*, although alveolar presence was retained in the fricative substitution in *teeth*.

During period 2, QB produced three examples of reduplication. He continued to delete /h/ in many words, even after he produced it in *hello* at 1;4.22. He also deleted complex initial consonants, /ð/ and /ʤ/, in *this one* and *giraffe*, but deleted less complex consonants, for example /p/ in *cup*, word finally. He deleted the final consonant in *squirrel* but produced a reduced initial cluster. Other clusters developed at this time. His first substitute cluster, [ts], was produced at 1;2.20. By 1;6 QB had produced three initial- and three final-target clusters; the first of these was word-initial in *brown* at 1;3.13. Nevertheless, in the absence of initial velars, fronting remained systematic in initial velar clusters. Systematic fronting ceased with the appearance of the first velars at 1;5.6, but the stopping of all initial affricates continued. There were two examples of final stopping, both of which used [b] as substitute, in *sandwich* and *olive*.

QB's speech advanced rapidly after 1;6 and he ceased using any of the specifically Strand-A processes. This is reflected in the fact that no final consonant deletion was reported for period 3 and that his initial deletion remained limited to some /h/ targets. His diary ended at 1;11.3, by which time he had produced 20 initial and 16 final consonants, seven initial clusters and nine final clusters.

GG – Strand-B

GG's first diary entry was written at 1;1.24. This was a fairly inauspicious start because the first consonant target in *boo* was not achieved at the first reported attempt. The first five diary entries show minimal consonantal use, but with deleted initial consonants in minimal words *ta* and *no*, and with *hello* also vocalic, GG's record at the first point of analysis was the highest of any child for initial consonant deletion. At this point only the initial /b/ target had been produced and the only final consonant target, /n/. In period 2, there were equal numbers of initial and final deletions, and no initial velar or fricative targets that can be assessed.

The extent of GG's Strand-B activity only became evident during the seven months of period 3. During this time, she deleted thirteen initial consonants, which included the full range of plosives and initial nasals (shown in Table 4.33), therefore including initial velars. She also deleted three initial clusters: /pl/, /kɹ/ and /tw/. There were few final velar targets, which were not always successful. However, the patterns of dichotomy with the Strand-A profile are strong in GG, particularly when her production of velars in medial and final cluster contexts and her alveolar avoidance strategies are taken into account. GG used the same harmonisation process as IG in the initial stopping of the labiodental in *Phoebe*. She used an alternative process to alveolar stopping in the /ʧ/→[k] backing process in *chocolate* however, and the only example in the diaries of the alternative to /ð/→[d] substitution, /ð/→[v] in *that one*. By 2;1.5, GG had produced 15 initial and 11 final consonants, one initial cluster and seven final clusters.

IG – Strand-B

IG demonstrated accuracy in the production of velar consonants from the first diary entry, *cat*. This was first realised as [kV] which soon became [kVk], contrasting with BB's [kVt], DB's [dVV] and QB's [dVt]. The third diary entry was *quack*, also pronounced as [kVk], contrasting with QB's *quack* as [wV]. When the first five diary entries were analysed, IG had produced all her velar targets and had deleted initial /j/ in *yes*. In period 2, there was no final consonant deletion. /h/ appeared in the diary for the first time and was deleted.

In period 3, IG produced a series of reduplicative utterances in *Grandad* and *tractor*, which suggested that her word-position bias might be changing, although the velars were not lost in these reduplications. For a short time, she used final compensatory lengthening in *Pat* and *pig*. Her rate of final consonant deletion therefore increased. A period followed when the vowel was lengthened in all monosyllabic words with final velar and /t/ targets. Words with diphthongs were given an extra syllable (some of which are not dissimilar to Jennika's diminutive forms (Ingram, 1974a)). This led to further sacrifice of final targets.

The only recorded initial deletions in period 3 were from early reports (at 1;7) of the deletion of the liquids. All other initial consonants including /h/ were secure (*contra* GG). IG's use of the /θ/→[t] substitution process in *thank you* (*contra* NB) completed the picture of abandonment of the Strand-B profile. By 2;0.17, IG had produced 12 initial and only 6 final consonants. She produced one initial (velar) cluster /gɹ/ and one final cluster /mp/. Both clusters were produced after the age of 2;0, at 2.0.11 and 2;0.16, respectively.

NB – Strand-B

NB's first seven diary entries demonstrated complex patterns of consonant production and use of a variety of processes. His first consonant inventory consisted of /ʃ/ and velars /k/ and /ŋ/ all of which had been produced medially, /z/ which had been produced twice word finally, and both bilabial plosives which had been produced in initial cluster reduction. He had deleted three initial consonants: /f/, /h/ and /ɹ/, but no final consonants. NB's early attempt at *fish*, with the initial consonant deleted, would be his only example of reduplication. The /ð/→[d] stopping process had been used in *there she is*, but he had used a counter-stopping process in the /θ/→[h] substitution process in *thank you*.

In period 2, NB deleted five initial consonants, the highest number recorded. These included /b/ and /d/ (in *Daddy*) as well as /h/, /w/ and /ɹ/ which continued in *Ruby*. Initial /ʤ/→ [j] gliding in *juice* provides another example of NB's use of processes that run counter to typical Strand-A stopping. During period 2, NB attempted several polysyllabic words or phrases, for example *Balamory* and *happy birthday to you*, all of which retained their rhythmic structure, in sharp contrast to the monosyllabic strategy of BB at the same age.

More extended utterances followed in period 3. These included a smattering of phrases and shortened sentences, but also polysyllabic words, such as *dinosaur* and *triceratops*, both of which were produced without any loss of syllabic structure. *Triceratops* also provided NB with the opportunity to attempt an initial and a final cluster in one word, both of which he achieved by all accounts. By contrast, many initial singleton targets at this time were deleted, and several final-/t/ targets were backed by [k]. There were several versions of some words or phrases, for example *ice cream* and *again*, which was sometimes disyllabic but at times subject to weak syllable deletion.

During period 3, initial alveolar /s/ and /n/ were deleted, as was the voiced interdental. NB's last diary entry, *tunnel*, is reported with [h] substitution (a consonant previously used to substitute initial /θ/), which demonstrates not only the continuing instability of NB's initial alveolars, but also the difference of his substitution patterns from the Strand-A rule of using [d] as the default substitute for many anterior targets but most certainly for /t/. There were no further examples of stopping since the /ð/→[d] process in period 1, and there had been no examples of velar fronting. NB, therefore demonstrated the Strand-B profile to the end of the study.

At 1;10.20, NB was the youngest child at the time of the final diary entries. He had one of the smallest inventories of both initial and final consonants, with a final singleton inventory consisting of only seven consonants. This did not include /g/ or the velar nasal, which had not been final targets. However, the many polysyllabic utterances that he produced provide adequate means to demonstrate his ability to produce a range of consonants in word-medial contexts. By 1;10.20, in addition to his seven final consonants, NB had produced eleven initial consonants, the initial alveolar cluster /tɹ/ cluster in *triceratops* and two final clusters /nt/ and /ps/, demonstrating that he was able to produce alveolar consonants in final clusters that he could not produce, or could not produce reliably, as singletons.

Table 4.36 is a summary of the contrary features of the Strand-A and Strand-B profile, as found in BB and GG. Inventories of deleted consonants relate to period 3, which extends to 2;5 for BB, and ends at 2;1.5 for GG.

Table 4.36: Strand A/B features in BB and GG after 1;6

Process	Strand A	Strand B
	BB	GG
Reduplication	Yes	No
Final consonant deletion	/p t d k g v s z n l/	/θ z n ŋ/
Final cluster deletion	Yes	No
Non-assimilatory velar fronting	Yes	Once
Stopping of initial /ð/	Yes	No
Initial affricate reduction to [t d]	Yes	No
Initial consonant deletion	/h/	/p b t d k g f s ʃ h m n l/
Initial cluster deletion	No	Yes
Systematic syllable reduction	Yes	No

There was a general tendency amongst the other children in the study towards the Strand-A profile, in that they generally produced initial targets, deleted only initial /h/, deleted some final consonants, and used the common processes of fronting and stopping that resulted in alveolar substitution. The case is made for this in the fact that other children, JG, HB or OG for instance, could have been used as examples of the Strand-A profile, whereas FG was the only other child that could have been used as an example of Strand-B. Furthermore, it has been shown that the adoption of a Strand-A or Strand-B profile can last for only a short time and that some children can change from one profile to the other. This occurred over some weeks in IG, but in AG the switch was dramatic. In the first diary entries AG deleted more initial consonants than any other child (Table 4.24), there was no final deletion (Table 4.27), no velar fronting except in assimilation, and no stopping (Tables 4.25 and 4.26). Immediately, after entering period 2, she demonstrated Strand-A processes of reduplication, non-assimilatory velar fronting (Table 4.29), initial stopping (Table 4.30), final deletion (4.28) but no initial deletion (Table 4.31). This highlights the transitory nature of some early speech phenomena and the importance of monitoring them because, without evidence to the contrary, it is assumed that the widespread use of these processes does not occur.

5. Discussion

5.1 Consonant inventories

The phonological analyses of consonant production presented in Chapter 4 indicate that the fifteen children in this study produced at least 17 of the 24 consonants of English at least once (Netsell 1981). Consonant inventories at three points of analysis demonstrated the progress of all the children in the production of initial and final singletons and final clusters. But at the end of the study, all the children had at least one target consonant that had not produced in any word context. All of these were consonants at the highest levels of articulatory complexity (Kent 1992).

The first inventories consisted of 20 target consonants produced between 1;0.26 (JG) and 1;5.10 (BB) using Netsell's measure. These included all consonants of English except /v/, /ð/, /ʒ/ and /ʤ/, but of which only /v/ and /ð/ had been targets. The most common consonants in the inventories were /d/ and /m/, which had each been produced by eleven children, and /b/ and /k/ which had each been produced by nine. /s/ and /z/ had each been produced by six children but only in word-final position. /f/, /θ/, /ʧ/ and /l/ had been produced by individual children, all of whom were from one of the two groups with the largest vocabularies. Inevitably, these four children had the largest inventories, ranging from nine to fifteen consonants, in two cases consisting of all the plosives, in two of both the liquids, and in one all the approximants. Of the other eleven children assessed on five to seven diary entries, one child had produced all his target consonants, but one child had produced only /b/. Two children produced only alveolars, /t d/ and /d s/. The number of consonants in individual inventories therefore ranged from one to fifteen, with the children with the smallest inventories producing only bilabials or alveolars (cf. Stoel-Gammon's (1985) Group C).

Initial and final consonants were highly differentiated at this stage. Nine children produced more initial singletons than final singletons (cf. Stoel-Gammon 1985; Robb and Bleile 1994); only two children produced more final singletons. Two children produced only initial singletons (cf. Stoel-Gammon 1985). Initial consonants produced were predominantly bilabial, alveolar, nasal and plosive. Consistent with Stoel-Gammon (1985), initial velars and /w/ proved to be second-wave initial consonants, as they were not produced by as many children as other plosives or bilabials in period 1 although one child produced initial /k/ first. ([w] was K's last bilabial (Lewis 1936).) The eleven children who produced /d/ or /m/ produced them word initially, but there were no initial /v/, /s/, /z/ or /ʤ/ singleton targets (see Ingram, 1988).

Final consonant inventories included the first fricatives for most children (cf. Edwards 1978; Kent 1981; Kent and Bauer 1985), but there were no final /v ð/ or /ʧ ʤ/ singleton targets. More than a third of all final singletons produced were fricatives. A similar number were voiceless plosives, which were produced in the same order of frequency as the order in which final consonants were added to inventories in Stoel-Gammon's (1985) study: /t/>/k/>/p/. /k/ was fairly evenly spread across initial and final inventories and was produced more than /p/. The child with the largest vocabulary had the largest inventory of final consonants. He was the only child to produce final /b/, /f/, or /l/ but only in words with syllabic-/l/ targets. Five children produced only one final consonant, /t/, /s/ or /z/. Therefore, if a child produced only one final consonant, it was alveolar and in four of the five cases, fricative.

The incidence of consonant deletion and substitution was high in period 1. Some singletons were routinely deleted, whilst others were always substituted. /h/ was a target for eleven children, but was produced by one child and deleted by the other ten. The interdental /ð/ was an initial target for four children and was substituted by [d] in all cases. Initial /k/, /f/ and /j/ were avoided by three children, but there was no avoidance of initial /b/, /d/ or /m/. There were fewer instances of the avoidance of final consonants because there were fewer final targets. /n/ was the most avoided of the final consonants and was deleted in all cases. Final voiced and voiceless plosives were amongst the consonants avoided. Final /d/ was not produced, and final /b/ was produced by one child but avoided by another. (Stoel-Gammon (1985) found that neither final /b/ nor /d/ met the criteria for inclusion in the inventory of any child.)

The second set of inventories showed consonant production to the age of 1;6. This was a period of consolidation for initial bilabials, nasals and voiced plosives /b/ and /d/. Children without initial /b/, /d/, /m/ or /w/ targets in previous diary entries were presented with these targets in their new vocabulary. All new bilabial targets were produced, so that by 1;6 all the children with initial /m/ or /w/ targets had produced them. Fourteen children had produced initial /b/; one child with strong alveolar tendencies still produced /b/ as [d]. Initial /d/ had been produced by the fourteen children with initial-/d/ targets. All new or existing initial /p/, /t/, /f/ and /n/ targets were produced.

The children with the largest inventories of initial consonants in period 1 (identified in Sections 4.1.1.2 and 4.1.1.3) continued to increase the size of their inventories in period 2. (cf. Stoel-Gammon (1985) which found that Group-A children continued to outperform their age-matched peers throughout the period of the study.) One of these children had produced fifteen initial consonants by 1;6. These were the only children who added initial velars to their inventories (another characteristic of Stoel-Gammon's Group A), and were the only children who produced the most complex initial consonants during the period: /s/, /ʃ/, /ð/, /l/ and /ɹ/. However, most of these consonants were amongst the last produced by the children before reaching the age of 1;6, which lends some support to Kent (1992). But the production of several consonants was not consistent, demonstrating the variability in the production of initial targets found in Ferguson and Farwell (1975), contrary to Jakobson (1941/1968). This was particularly the case for initial /l/ and /h/. At 1;6, /h/ had been produced by three children but continued to be avoided by all others. By 1;6, more children had produced initial /j/ than /h/, contrary to Sander (1972).

The last sets of diary entries covered the period after 1;6 to the close of the study, which for most children ended around the age of 2;0, after which few initial consonants were added to the inventories. This was a further period of consolidation for initial consonants with a dramatic rise in the production of affricates, velars and /h/. Initial /p/, /h/ and /ʧ/ were produced for the first time by ten children, /t/, /g/ and /w/ by nine, /k/ and /j/ by eight, and /f/, /ʃ/, /ʤ/, /ɹ/ by seven. (Initial /ʃ/ and /ʧ/ were transitional in Dyson's (1988) younger subjects at 2;0; /j/ was inventorial.)

Some of the previous patterns continued. The elite group of children, reduced to three by 1;6, added affricates, liquids, /g/ and the only initial /v/, /ð/ and

/z/ produced in period 3 to their inventories, now consisting of 18, 19 or 20 initial consonants, which remained the largest. Few initial consonants were added after 1;11 (cf. Dyson 1988, in which initial inventories were the same from 2;0 to 2;9). The gap was narrowing with the production of initial velars, affricates and liquids by other children, but a pattern emerged suggesting that children who avoid initial plosives avoid liquids, children who avoid /f/ or /s/ and another fricative avoid /ɹ/.

By the end of period 3, all the children had produced initial /b d k m n w/ singletons, and the child without /p/ as an initial singleton target had produced it in a reduced initial cluster. (/p b d k m n w/ is Sander's (1972) pre-2;0 inventory minus /h/ but plus /k/.) By the age of 2;0, six children had produced the combination of initial /f/, /s/ and /h/ (cf. Stoel-Gammon 1985), but initial /θ/>/f ɹ/>/ð/>/s ʤ/ were avoided the most. Production of final /b/, which although found in fewer words, remained far behind /d/ and /g/ although found in fewer words. An equal number of children produced final /d/ and /g/ (8), but /g/ had a higher rate of success, consistent with Dyson (1988) in which /g/ was the only voiced plosive to achieve transitional status.

The production of final singletons had increased since period 1, when three children had not produced any final targets (cf. Stoel-Gammon 1985). The same three children whose initial consonant inventories had increased the most by 1;6 had also added the most final singletons to their inventories, which consisted of 10, 13 and 14 consonants, increased from two, four and seven in period 1. These consonants included the addition of the only voiced plosives, affricates, /ŋ/ and /l/ produced in period 2. One child had produced /b/, /d/ and /g/ by 1;6. The size of the other inventories ranged from one to five consonants, consisting mainly of /p t k s z m n/, although some children with smaller inventories avoided /n/, /k/ and /s z/ in addition to the voiced plosives, and /θ/ which all children with final /θ/ targets failed to produce during period 2. Despite this, by 1;6, eleven of the fifteen children had produced at least one of the alveolar fricatives word finally.

After 1;6, some of the smaller inventories of final consonants increased significantly, whilst other remained small. There was a high number of absent final targets in some vocabularies. The size of the final consonant inventories at the end of period 3 ranged from six to sixteen, all of which were smaller than the size of the child's inventory of initial singletons (cf. Prather *et al.*, 1975; Dyson, 1988; Watson and Scukanec, 1997). The last consonants added to final inventories were generally produced later than the last added to initial inventories. Four of the children with small final inventories at 1;6 continued to add consonants after 2;0. Three children produced /d/ after 2;0; one child produced /d/, /ʤ/, /s/ and /z/ after 2;0, almost as many as in the previous six months. One child produced final /θ/ around 2;0, but all the nine other children with final /θ/ targets avoided it.

By the end of period 3, all the children had produced final /k/, /n/ and /l/; most children had added them to their inventories since 1;6. All the children had produced /s/ or /z/, and many had produced both. This is above the expectations of Olmsted (1971: 204) who suggested an age-norm for final /s/ of 2;0–2;6, and of 2;6–3;0 for final /z/, but consistent with Holmes (1927), Menn (1971), O'Neal (1998), Klein (2008) and Gerlach (2010), who found that their subjects produced final /s/ and /z/ before 2;0.

The first consonant clusters were produced before 1;6. Over the period of the study, almost twice as many final clusters were produced as initial clusters. All the children produced at least one final cluster but two children produced only final clusters. Seven children produced only one initial cluster. The children with the largest initial and final singleton inventories (AG, CB and QB) had the largest inventories of initial and final clusters, and produced the most complex final clusters. Initial clusters proved more prone than final clusters to reduction (cf. Olmsted, 1971; McLeod *et al*. 2001a;b; Kirk and Demuth 2005). Children who produced erroneous initial obstruent+/l/ clusters before 1;6, [kl] in *please*, [pl] in *clap* and [fl] in *clock*, were more successful in producing the liquid than in clusters in which the plosive was not substituted.

Contrary to McLeod, van Doorn and Reed (2001b), some children produced initial clusters first. This was marked in one child who produced three clusters before 1;6, but the first final cluster at 2;1. He was one of only two children who produced more initial clusters than final clusters. He was also unusual in that he produced /kl/ and /fl/ clusters before /bɹ/. The six other children who produced a plosive+/ɹ/ cluster, produced it as their first or only cluster (three were /bɹ/), whereas plosive+/l/ continued to be reduced in most cases (contrary to Kirk and Demuth's 2005 order of accuracy, but consistent with Vihman and Greenlee 1987, and as in O'Neal 1998). Twenty-one plosive+/ɹ/ clusters were produced, but only five /pl/ or /kl/ clusters, but more children produced /fl/ than /fɹ/. /st/ was generally produced earlier than other /s/-clusters (cf. Petty, 1973), and /p/+liquid and /k/+liquid clusters later than other plosive+liquid clusters.

The children produced a range of 27 final clusters, two of which were triconsonantal /sps/ and /nts/. One child produced the final /ðz/ in *clothes*; one child produced clusters with /f/ targets, /ft/ and /lf/, and two children produced nasal-affricate clusters. These were all produced late in the study, although one child produced /ʃt/ as a first final cluster at 1;5.17.

Typical first or only final clusters were nasal + fricative and nasal + plosive where there was agreement of place, and plosive + /s/ depending on the place of the plosive. Target /ts/ was always produced late and after /ps/ or /ks/, but two children produced [ts] in substitution for /ps/ or /ks/, the first at 1;2.20. Final /st/ was produced later than initial /st/. /lk/ was always produced after other /l/+C clusters. /lk/ in *milk* and /lp/ in *help* were common targets; five children produced /lp/ at the first attempt, whereas /lk/ was produced late in the sequence or after previous attempts.

The closing inventories of the fifteen children suggest that some of the most complex consonants (Kent 1992) were beyond the children's articulatory control. The final tally of target consonants that children did not produce in any word position or context shows that these are primarily Set-3 and Set-4 consonants, of which the most avoided consonants were the interdental fricatives, with twelve children avoiding /θ/:

/θ/	- 12
/ð/ /v/	- 7
/ʤ/	- 6
/ŋ/ /ɹ/	- 3
/f/ /h/ /ʃ/	- 2
/z/ /ʒ/ /ʧ/	- 1

These data confirm the findings of other studies:

1. Robb and Bleile's (1994) study showed that all English consonants met the criteria for inclusion in at least one of the monthly inventories except for the Set-3 consonant /ŋ/ and the Set-4 consonants /v/, /θ/, /ð/, /ʒ/ and /ʧ/.
2. O'Neal (1998) found that the interdental /θ/ was Richard's only outstanding consonant at 2;7.
3. Lewis (1936) found that the interdental /ð/ was the last consonant to appear in K's inventory at 2;4.
4. Both interdentals and /v/ are absent from the inventories of Petty (1973) and Chirlian and Sharpley (1992) of children aged between 2;0 and 3;0.
5. /θ/ and /ʤ/ are absent from the inventories of all initial and final consonants of children aged between 2;0 and 3;3 in Prather *et al.* (1975), Dyson (1988) and Watson and Scukanec (1997).
6. At 3;0, /θ ð ʃ ʧ ʤ/ failed to meet the criteria in any of the large-scale studies (Section 2.1.2.3) in which they were tested.

Other issues arising from the data on consonant production:

It has been shown that articulatory capacity is affected by age. None of the children who attempted *hello* in the early diary entries were able to produce it with both consonants articulated. JG at 1;0.26 produced most of her consonant targets in the first six words including /h/ in *hello*, whereas FG and GG produced hardly any consonants, and none in *hello*. This suggests that the twins' prematurity was a factor in their inability to produce utterances comparable with JG and other age-matched peers. However, the hearing impairment of JG's mother could be a factor here, although under the circumstances the mother is more likely to have underestimated rather than overestimated JG's level of articulation.

The survey of syllable structures used in the first diary entries showed that only one child produced CV and CVC forms. However, he was the oldest child in period 1, and these were not his first words (see Appendix 5a). None of the younger children's reported first words were CV syllables, therefore disputing Fikkert (1994) and Demuth (1995).

There was no evidence of a lower rate of production of initial /d/ than other plosives at 2;0 (Prather *et al.*, 1975), or of the gender differences highlighted in Petty (1973) in which the production of initial /d/ at 2;0 was higher in boys, although the imbalance in the number of girls and boys in the present study makes such comparisons difficult. However, to the extent that the children who used initial [d]-substitution the most were three boys (identified as Strand-A children and discussed below), suggests that boys tend to use [d] more than girls.

5.2 Strand-A and Strand-B simplification processes and word-position bias

The children's use of simplification processes addresses some of the questions left unanswered under the previous lines of enquiry on consonant production. Such questions arise from the quite different patterns of consonant production and avoidance found in Section 4.1 (and also in Section 2.1). Section 4.2 (also Section 2.2) suggests that the different rates of success and failure demonstrated by the children in the production of initial and final consonants is a consequence of their underlying word-position bias, which is also manifested in their use of phonological processes in specific word contexts.

Grunwell's (1982) Profile of Phonological Development sets out a profile of typical Strand-A characteristics (O'Neal 1998). The existence of the alternative, Strand-B, profile challenges the claims made, since Jakobson (1941/1968), for the universality of some Strand-A characteristics in early speech. In Chapter 2, it was shown that the Strand-B feature of initial consonant deletion was used by all the children in the deletion of /h/, and is therefore typical in this respect. (/h/ was the only initial consonant that K deleted, in *here you are* at 1;7 (Lewis 1936: 298).) In the present study, the typicality of /h/-deletion was confirmed at the first point of analysis in the consonant deletion of /h/ by ten of the eleven children with /h/ targets, including children who were later identified as Strand-A children. The question therefore is not if, but the extent to which, initial consonant deletion is used; a question which has a parallel in the extent of final consonant deletion by Strand-B children. However, the first diary entries consisted of a large number of disyllabic and codaless target words, which for many of the children were presented in *Mummy*, *Daddy* and/or *hello*. The true extent of the tendency to delete final consonants could not therefore be assessed in period 1, particularly in children with a maximum of five, six or seven diary entries.

The child with the largest inventory of initial singletons in period 1 deleted the most final consonants. Conversely, there was no deletion of final consonants in words in which an initial singleton was deleted. These contrary patterns suggest that there is a natural tendency in early speech to sacrifice consonants in one word position in order to produce them in another, thus creating the asymmetries of word-initial or word-final bias. The speech patterns of Strand-A and Strand-B children demonstrate consistently the balance between initial consonant production and final deletion on one hand and the production of final consonants and initial deletion on the other.

The patterns of initial consonant deletion proved a reliable indicator of word-position bias within the timeframe of the first diary entries. Three children who were later identified as Strand-B children in period 1 used initial consonant deletion the most. All three children deleted /h/ and at least one alveolar consonant; AG deleted both liquids, GG /t/ and /n/, and NB deleted /ɹ/. A fourth child identified as Strand-B in this stage, IG, deleted only one initial consonant because she produced the other initial targets consisting of velar /k/. Conversely, the three children identified as typical of the Strand-A profile, BB, DB and QB, either did not delete any initial consonants or only deleted /h/.

This pattern continued throughout the following periods. During period 2 (to 1;6), Strand-B NB's use of initial consonant deletion was at its most intense. His deleted initial consonants included /b/, and /d/ in *Daddy*, in the only occurrence of its kind in the study, whilst his final singleton deletion was confined to /θ/ and /l/. In period 3, NB still deleted more initial consonants than most children, but GG's deletion of initial consonants had intensified. Between 1;6 and 2;1 (the same age of intense initial deletion found in Richard (O'Neal 1998)), GG is reported as having used initial consonant deletion twenty-one times, in the process deleting thirteen different initial consonants. These included all the plosives, /m/ and /n/. The two children who deleted the largest range of initial consonants in period 3 (FG and GG) were the only children who had not produced /h/ by the end of the study, by which time GG had produced seven final clusters but only one initial cluster. GG deleted three initial clusters in period 3, /pl/, /kɹ/, and /tw/ which according to Smit *et al.* (1990) is one of the first initial clusters to be acquired.

Conversely, Strand-A child, BB, by 2;5 had produced only three final clusters but six initial clusters, three of which had first been produced before 1;6. His patterns of initial and final consonant deletion mirrored those of GG. In period 2, BB deleted all final velar targets. In period 3, he used final consonant deletion fourteen times, deleting ten different consonants, which included typical early final consonants, /p t k/ and the alveolar fricatives. (/t/ was DB's key target for final deletion of his six deleted consonants which included /k/.) Over the same period of eleven months, the only initial consonant that BB deleted was /h/. The other Strand-A children in period 3 were less restricted in their use of initial deletion, using the process to avoid interdental fricatives and liquids but not the less complex initial targets deleted by Strand-B children.

The children's use of substitution processes proved a reliable indicator of Strand-A alveolar and Strand-B velar bias. Strand-B children produced, rather than deleted, velar singleton and cluster consonants, and did not engage in the practice of velar fronting unless there was a harmonic influence. Strand-A children fronted velars without such an influence, and their patterns of avoidance of final velars contrasted with the patterns of Strand-B production of final /k/ in particular, although across the cohort, as in the earlier reviewed Strand-A children (in Chapter 2), final /k/ was not systematically avoided. Contrary to the pattern of velar harmony found in Mollie (Holmes 1927) and Jennika (Ingram 1974a) however, one of the Strand-A children used alveolar harmony in *duck*, contrasting with the backing processes of all Strand-B children.

Strand-A children's use of stopping processes provided another indicator of alveolar bias. The study confirmed the findings of the review (in Chapter 2) that, although Strand-A and Strand-B children use fricative and affricate stopping processes that result in the articulation of alveolar consonants, these are not systematic in Strand-B children. Alternative processes were used in /θ/→[h] substitution in *thank you*, /ʤ/→[j] reduction in *juice*, /ʤ/→[k] backing in *chocolate*, and /ð/→[v] substitution in *that one* (cf. Richard in O'Neal 1998). No such patterns were found in any of the Strand-A children despite having higher rates of substitution owing to their lower use of initial consonant deletion. Furthermore, there was no stopping of final fricatives by Strand-B children, who generally used a process of substitution by another fricative.

Reviewing the findings overall, the patterns of some children did not fit either of the profiles, and some children vacillated between the two. Amongst these children, there was a general conservatism that favoured the production of initial consonants and so tended towards the Strand-A profile. Some children achieved a high degree of accuracy in their production of consonantal targets and did not make any significant use of simplification processes. The use of Strand-A processes ceased abruptly in the most advanced child in terms of speech development (QB), after the Strand-A package had outlived its usefulness following the production of the first initial velars.

Reduplicative forms ranged from “roh roh” for *Robin* to “yup-yup” for *up* to “door door” (*door*) (BB’s example). Full reduplication was used almost entirely by children exhibiting Strand-A features which, contrary to Grunwell (1982), did not decline in these children after 1;6. According to the diaries, two children did not use reduplication at all (contrary to Moravcsik, 1978). Strand-B GG was one of these children. There was a marked difference between the syllabic patterns of one Strand-A child (BB) (mentioned above), who reduced all utterances to monosyllables for an extended period, and those of two Strand-B children (GG and NB), who maintained the rhythmic structures of polysyllabic targets. There is a common geographical link between the three children with the strongest Strand-B tendencies after 1;6, FG, GG and NB, in that they all have a parent originating from a western region of England, as does Richard (O’Neal).

One child (AG) demonstrated a clear shift from the Strand-B to Strand-A profile after period 1, which was marked by the use of full reduplication, velar fronting, stopping and an increase in the use of final consonant deletion. The fact that all these factors were reversed in tandem suggests that the Strand-A/B model is robust. The dichotomies of alveolar/velar preference, reduplication/non-reduplication, and the patterns of initial/final production and deletion found in Strand-A BB and Strand-B GG, in particular, provide further evidence of the existence of two discrete and coherent pathways of typical phonological development based on word-position bias.

6. Conclusions

A longitudinal study of the phonological development of fifteen monolingual learners of British English has been conducted. This found that despite wide variation in the rate of consonant production in the early stages, all the children produced most of the consonants of English at least once. Asymmetries were found in the production of initial and final singletons. These showed that initial position favoured bilabials, and plosives /d/ and /k/, and that final position favoured voiceless plosives and the alveolar fricatives. Consonants added later were often more complex than those produced early. At 2;0, more initial consonants had been produced than final consonants. Final consonant clusters were generally produced before initial clusters. Three children with the largest vocabularies in period 1 outperformed their age-matched peers throughout the period of study in their production of initial, final and cluster consonants. The study identified the interdental fricatives, /v/ and the voiced affricate as the consonants that were most avoided.

The secondary study found that all the children in the study used simplification processes. All the children provided examples of the deletion of at least one final consonant and one initial consonant or cluster. Fourteen children deleted /h/. Some children did not demonstrate a marked bias towards either of the profiles identified as Strand-A or Strand-B, but children who exhibited either of these tendencies used simplification processes in combinations characteristic of the profile. The three Strand-A children demonstrated similar patterns of reduplication, velar fronting, fricative and affricate stopping, and final consonant deletion. Strand-B children used systematic initial consonant deletion, deleted more initial clusters than Strand-A children and used final consonant deletion less. They employed some of the stopping processes used systematically by Strand-A children, but also used alternative processes that avoided the production of alveolar substitutes. Strand-B children did not use systematic velar fronting processes except in velar assimilation. One Strand-B child did not use reduplication at all. Two children with Strand-A tendencies produced more initial clusters then final clusters, and both these children produced initial clusters first. The study found that some children demonstrated Strand-A and Strand-B bias at different times, but when they switched from one profile to the other, previous patterns of consonant production and use of simplification processes were reversed. The present study has shown that such differences in the patterns of consonant production and in the use of simplification processes during the course of phonological development are determined by the direction and the strength of the child's word-position bias. This challenges theories of uniformity, universality and exclusivity of children's consonantal preferences in first language acquisition.

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Appendix 1

University of Sussex

1 November 2005

Dear

Thank you for expressing an interest in our studies on infant communication. We are currently recruiting volunteers to take part in a study on the acquisition of consonants in early language development. This is the first study of its kind undertaken on English children and any contribution that you are able to make will greatly increase our knowledge of how babies learn the sounds of their first language. The only requirements are that English is your child's first language, that English is your own native language, and that you are likely to remain your child's principal carer for the foreseeable future.

The aim of the study is to create a record of the sounds that your child makes in intended speech, as distinct from the sounds of babbling. It will focus on two main aspects of phonological development. First, it will seek to establish the order in which consonants are acquired. Then it will look at the range of simplification strategies, such as consonant deletion, substitution and transposition, which enable very young children to attempt words or phrases beyond their articulatory capacity.

In order to build up a comprehensive picture of how these processes work, we are looking to recruit up to 24 infants from the age of one year to take part in the study. We are asking parents to keep a diary (which will be provided) of any key developments in their child's pronunciation. (A separate help sheet will explain this task in more detail.) As we are also interested in how a child's pronunciation can change over a period of time, we are hoping that you will be willing to maintain the diary for about a year, although, of course, there is no obligation to this.

It may be necessary to make the occasional tape recording to identify ambiguous sounds in the child's speech, but this will be entirely at your convenience. At no time will your child be left alone with a researcher, and you will not be required to visit the university. It is envisaged that the study will be set up, and monitored, at home.

At the end of the period of note-taking, the diaries will be collected for detailed analysis of the contents. At this point, each child will be given a code name, so that any information held by electronic means will be anonymous. The data will be stored on secure and protected systems and there will no public access to the files. Full confidentiality will be observed in respect of your participation in the research. The diary and any tape recordings will be returned to you at the end of the study.

This project has been granted formal approval, and meets the university's stringent guidelines on research ethics. As the named researcher, I am responsible for all aspects of this investigation, and will be the only person with whom you will have direct contact during the period of the study. I hold an enhanced Criminal Records Bureau certificate for work with children. I will be in touch shortly to see if you are able to help us in this exciting and very rewarding work.

Yours sincerely

Carol O'Neal
Research Co-ordinator

Appendix 2

Name:

Mum:

Best time to contact:

Contact time with mother:

Child's place in family:

Born to term/premature:

Mother's accent – where originated:

Accents of other regular caregivers:

Use of baby words:

TV programmes watched:

Any comments about development/influences/activities:

Appendix 3

What we would like you to do:

Please make a note of any new word that your child says, or that they pronounce in a different way, by writing down as close as you can the actual sounds produced. Note alongside it the date and the word or phrase attempted; if the word is pronounced correctly you could use a tick.

In the early stages most words will be mispronounced in some way. If there is an English word that matches the sound of the mispronounced word, you could use this to describe it, for example, if he/she says ‘tea’ for *sea*, or ‘queue’ for *thank you*, although ‘kyou’ would do; but listen out for non-English sounds, like ‘tsea’ for *sea*, as well. Please include any attempted words in which consonants are omitted, even if the result is minimal, such as ‘o’ for *hello*.

The type of examples we are looking for:

1. Consonant success: e.g. ‘dog’ ✓
2. Consonant substitution: e.g. ‘gog’ for *dog*
3. Consonant reduction: e.g. ‘back’ for *black*
4. Consonant deletion: e.g. ‘pa’ for *park*
5. Consonant transposition: e.g. ‘par cark’ for *car park*
6. Any combination of the above

We are also looking for changes in pronunciation that occur within words over a period of time. A difficult word, such as *yellow*, might go through six or seven permutations before it can be articulated correctly, and we are keen to trace the various stages of such words. This is why we are asking you to write down words pronounced differently from a previous rendering.

The space in the final column of the diary is for use at your discretion. You might wish to use it to provide further description of the word attempted in terms of rhyme, rhythm, stress or vowel length, or to place what is said in some context. You could use this space to record milestones in speech, or some aspect of development that will be of interest to you in the future, such as the production of a first phrase or first question.

Of course, we don't expect you to carry the diary round with you, but just to use it to record, at your convenience, any examples that you have gathered. A useful tip is have paper and pen handy for anything your child might say when out and about, that can be transferred to the 'diary' later, but please remember to note the date and the target word or phrase.

We have no expectation of what you might achieve. The most important thing is that you enjoy participating in this exciting stage of your child's development. If at any time the task of collecting speech samples become onerous, or if your circumstances change so that you are no longer able to maintain day-to-day monitoring of your child's speech, please discontinue the diary keeping and advise me (xxxxx xxxxxx) straight away. Be assured that any contribution you are able to make to the study will be greatly appreciated.

Appendix 4

University of Sussex

CONSENT FORM

Name of child:

Date of birth:

I hereby agree to participate in this child language study and accept that this will involve the collection of samples of my child's speech by means of note taking and occasional tape recording.

I have read and understood the information sheet provided which sets out the reasons for the study and explains the process of data collection, retrieval and storage.

I hereby give my permission for any information held on my child to be used for the purposes of research.

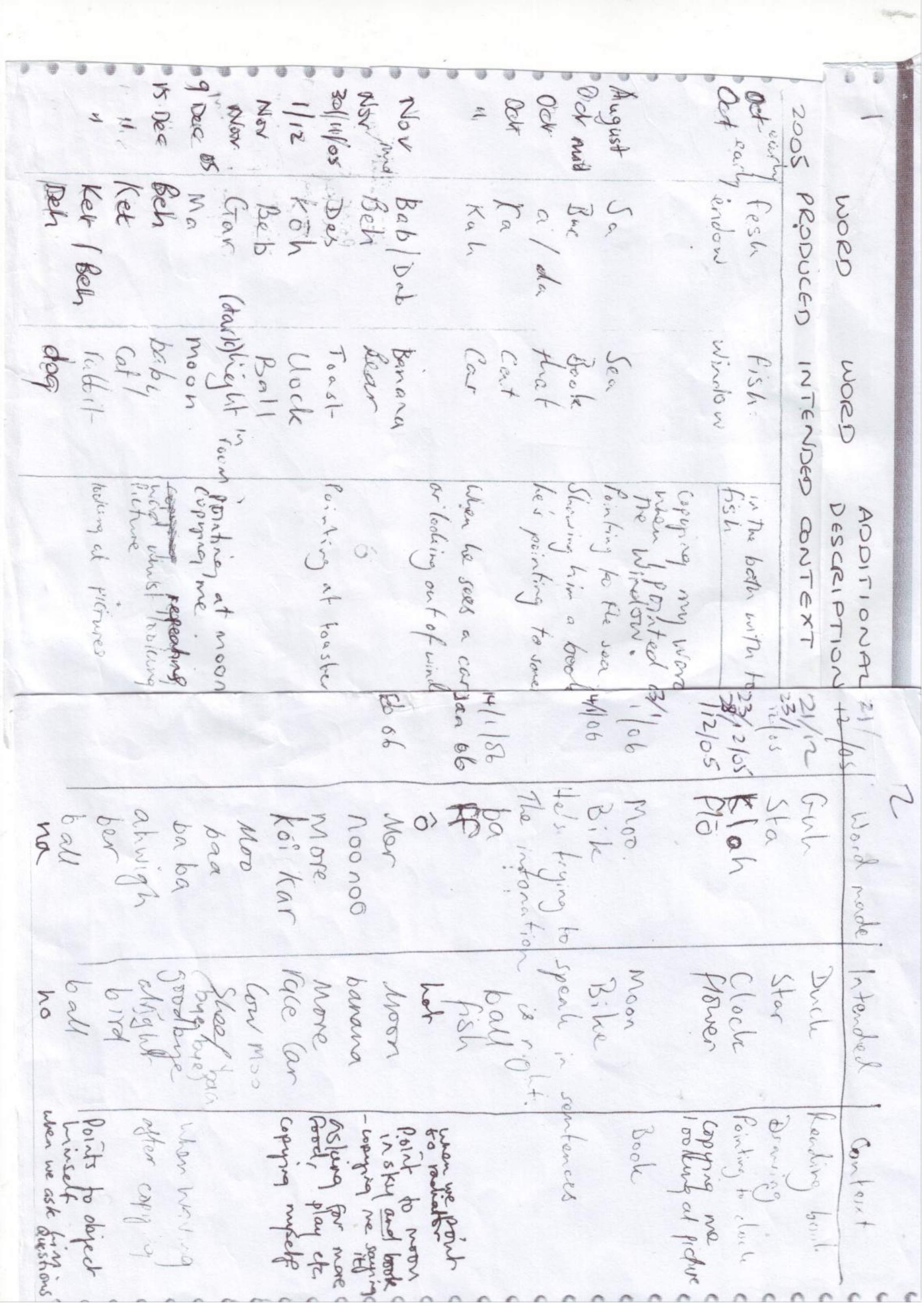
I understand that my child's contribution to any published or unpublished work will be anonymous.

I understand that I will have no legal or moral claim over any work that uses the information provided by me during the course of the study.

Signature of parent ……………………………………………………………..

Name…………………………………Date……………………………….

Appendix 5a: BB



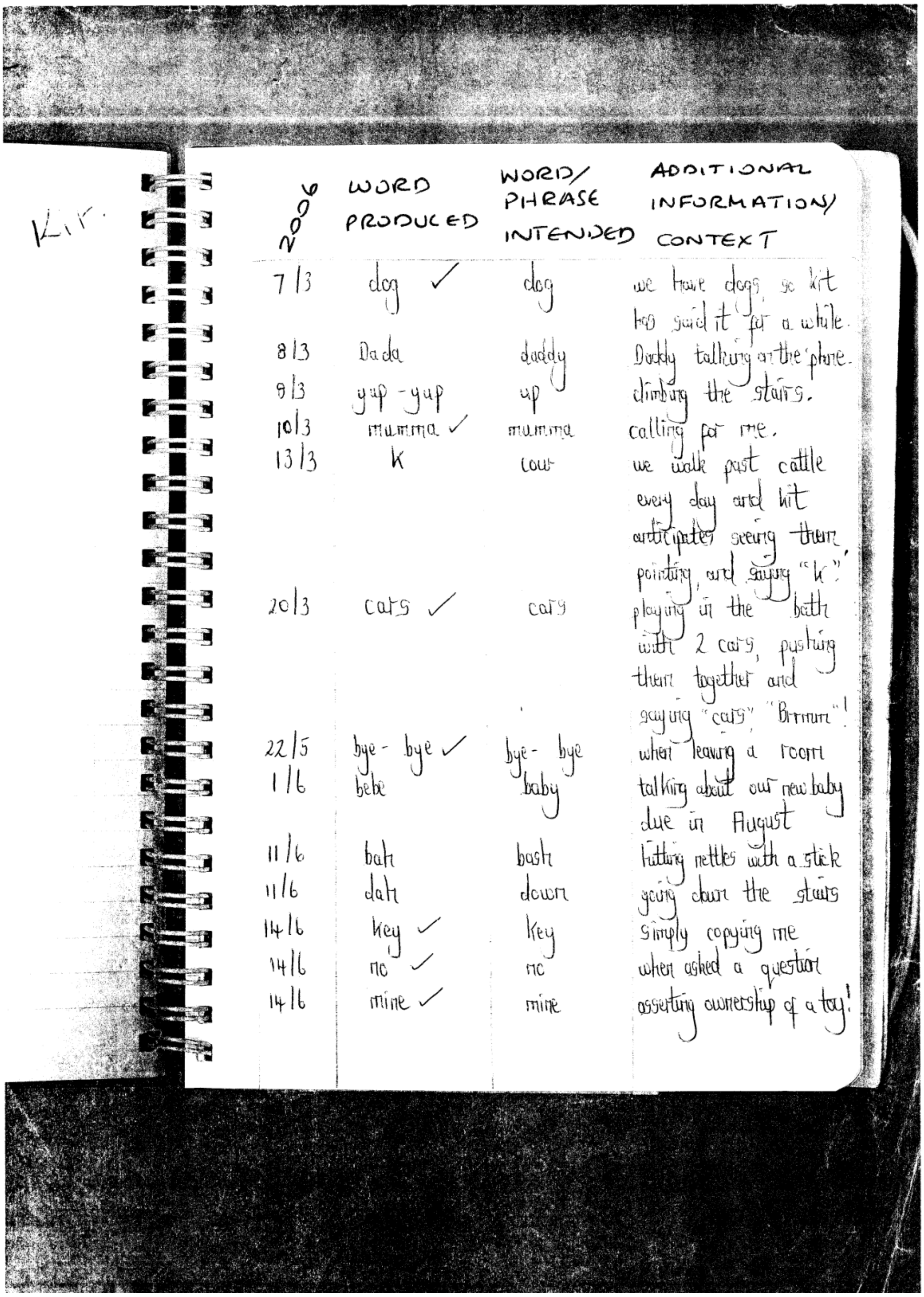
1

2005	WORD PRODUCED	WORD INTENDED	ADDITIONAL DESCRIPTION CONTEXT
early Oct	fesh	fish	in the bath with toy fish
early Oct	endow	window	copying my word when I pointed at the window.
August	Sa	Sea	Pointing to the sea
mid Oct	Buc	Book	Showing him a book
Oct	a / da	that	he's pointing to some
Oct	Ka	Cat	
"	Kah	Car	When he sees a car or looking out of wind
Nov	Bab / Dab	Banana	
mid Nov	Beh	Bear	
30/11/05	Des	Toast	Pointing at toaster
1/12	kōh	Clock	
Nov	Beb	Ball	
Nov	Gar	(dark) light in room	
9 Dec 05	Ma	moon	pointing at moon copying me.
15 Dec	Beh	baby	~~copying~~ repeating word whilst looking picture
"	Ket	Cat	
"	Ker / Beh	rabbit	looking at pictures
	Deh	dog	

2

21/12/05	Word made	Intended	Context
21/12	Guh	Duck	Reading book
23/12/05	Sta	Star	Drawing
23/12/05	Klah	Clock	Pointing to clock
28/12/05	Plō	flower	copying me looking at picture
3/1/06	Moo.	Moon	Book
4/1/06	Bik	Bike	
	He's trying to speak in sentences		
	The intonation is right.		
14/1/06	ba	ball	
Jan 06	ff	fish	
	ô	hot	when we point to radiator
Feb 06	Mer	Moon	Point to moon in sky and book - copying me saying it
	noo noo	banana	
	More	More	Asking for more food, play etc.
	koi kar	race car	copying myself
	Moo	Cow Moo	
	baa	Sheep baa	
	ba ba	bye bye goodbye	When waving
	ahwigh	alright	after copying
	ber	bird	
	ball	ball	Points to object himself
	na	no	when we ask him questions

Appendix 5b: KB



Kit.

2006	WORD PRODUCED	WORD/PHRASE INTENDED	ADDITIONAL INFORMATION/CONTEXT
7/3	dog ✓	dog	we have dogs, so Kit has said it for a while.
8/3	Dada	daddy	Daddy talking on the 'phone.
9/3	yup - yup	up	climbing the stairs.
10/3	mumma ✓	mumma	calling for me.
13/3	K	cow	we walk past cattle every day and Kit anticipates seeing them, pointing, and saying "K"!
20/3	cars ✓	cars	playing in the bath with 2 cars, pushing them together and saying "cars", "Brrmm"!
22/5	bye - bye ✓	bye - bye	when leaving a room
1/6	bebe	baby	talking about our new baby due in August
11/6	bah	bash	hitting nettles with a stick
11/6	dah	down	going down the stairs
14/6	key ✓	key	simply copying me
14/6	no ✓	no	when asked a question
14/6	mine ✓	mine	asserting ownership of a toy!

Appendix 5c: LB

2006	Word Produced	Word Intended	Additional context
21/1/06	Uunk	Drink	
22/1/06	Mummum	mummy	
22/1/06	Dadada	daddy.	
9/3/06	Understands the meaning of – building, music, swimming, telephone, television, picture, bird, raisins,		
26/3	milk	milk	heard by granny
17/4	Uh oh	uh oh	when he drops/spills something
18/4	Bep	Bird/garden	
5/5	Nananana	Banana	
5/5	yehyehyeh	yes.	
5/6	Buh	Big	
5/6	Daddeee	Daddy	
5/6	Mumma	mummy.	(for 6 weeks Thomas has been having bad teething pain around now)
16/6	mememememe	me.	
1/7	ca	car	
16/8	bee-bow	bingbong	doorbell.
18/8	hooh	hook	
18/8	yayayayaya	banana	
18/8	mummmm	mummy	

2006	Word Produced	Word/Phrase Intended	Any other context
21/8	Boo	ball.	
21/8	egh	egg	
25/8	hole	hole	
25/8	haht	hat	
25/8	eh	egg	
31/8.	home	home	
31/8.	Bo	milk	(bottle)
4/9	Brow	Brown	
4/9	yahyo	playdoh	
5/9	goo	juice	
8/9	bow	bowl	
8/9	Oh	'O'	the letter
9/9	eee	ear	
9/9	aye	eye	
9/9	baba	byebye	
9/9	haht	heart	playdoh shapes
9/9	mooo	moon	playdoh shapes
14/9	hay	high	
14/9	bo	milk cup.	probably bottle
17/9	dahdoo	dubble u	'w'
17/9	buh	bugsbunny	also 'b'
17/9	hoooo	Sue	also 'b'

Appendix 6a: FG/GG

GG

20/1/06 Daurn - Eryn (u) or v? Was the 'r' pronounced as in your native Bristol accent? ✓
21/7/06 dooes - nose/toes doos or doze?
On holiday coclat. Is the target word two syllables or three? Do you pronounce the 2nd 'o' in 'chocolate'? (3)
17/9/06 I no - I know. Is this a lexical distinction? ✓

FG

3/8/06 Assuming that 'apple' is the target, is word realised (apfle) or 'affle'?
9/8/06 poopoo - (pooboo) or 'booboo'
9/8/06 Tellytubbies - (ub)ies' or 'ubbies'? 1 syllable ies another syllable
On holiday. chocolate. Same query as for Niamh on number of target syllables. (3)
20/9/06 happened - 'apened' or 'appened'?
28/9/06 carrot - car at? ca rat
7/10/06 Is the target 'don't like'? yes
2/11/06 Is 'pants' the word intended? yes

Appendix 6b: NB

NB

①	03-Mar-06	pees	please	– final sound as in 'peace'? Update! – As in "(Garden)! peas"
②	Beg Apr 06	isfh, isfh	fish	– 's' – s or z sound? Definite 'h' aspirant after the 'f'
③	End Apr 06	joose	juice	– 'j' as in French 'je'? 'se' (as above) s or z sound?
④	Beg Oct 06	wa-kick	rocket	'a' vowel = 'o' sound as in rocket/watch or 'a' as in 'wax'? or long 'a' as in 'ah'?
⑤	End Oct 06	wats	watch	
⑥	End Oct 06	waps	watch	

(see below: ②③)

① As in "PEAS" (Garden peas!) Now says "PEACE", occasionally "PLEASE"

② Wasn't meant to be an "F" BUT a "C" ie. ISCH, ISCH (I seem to remember it more like 'FISH' without the "F")

③ (Again poor handwriting!) Meant to be YOOSE (ie. 'Y' not 'J' for JOOSE)

④ WA-KICK: "~~a" AS IN WAX~~ "o" SOUND AS IN ROCKET/WATCH ✓ (would have been more like WOR-KICK really)

⑤ WATS + ⑥ WAPS] "a" as in watch

(COLD=TOLD FEB07)

Appendix 6c: QB

QB 18/1/05

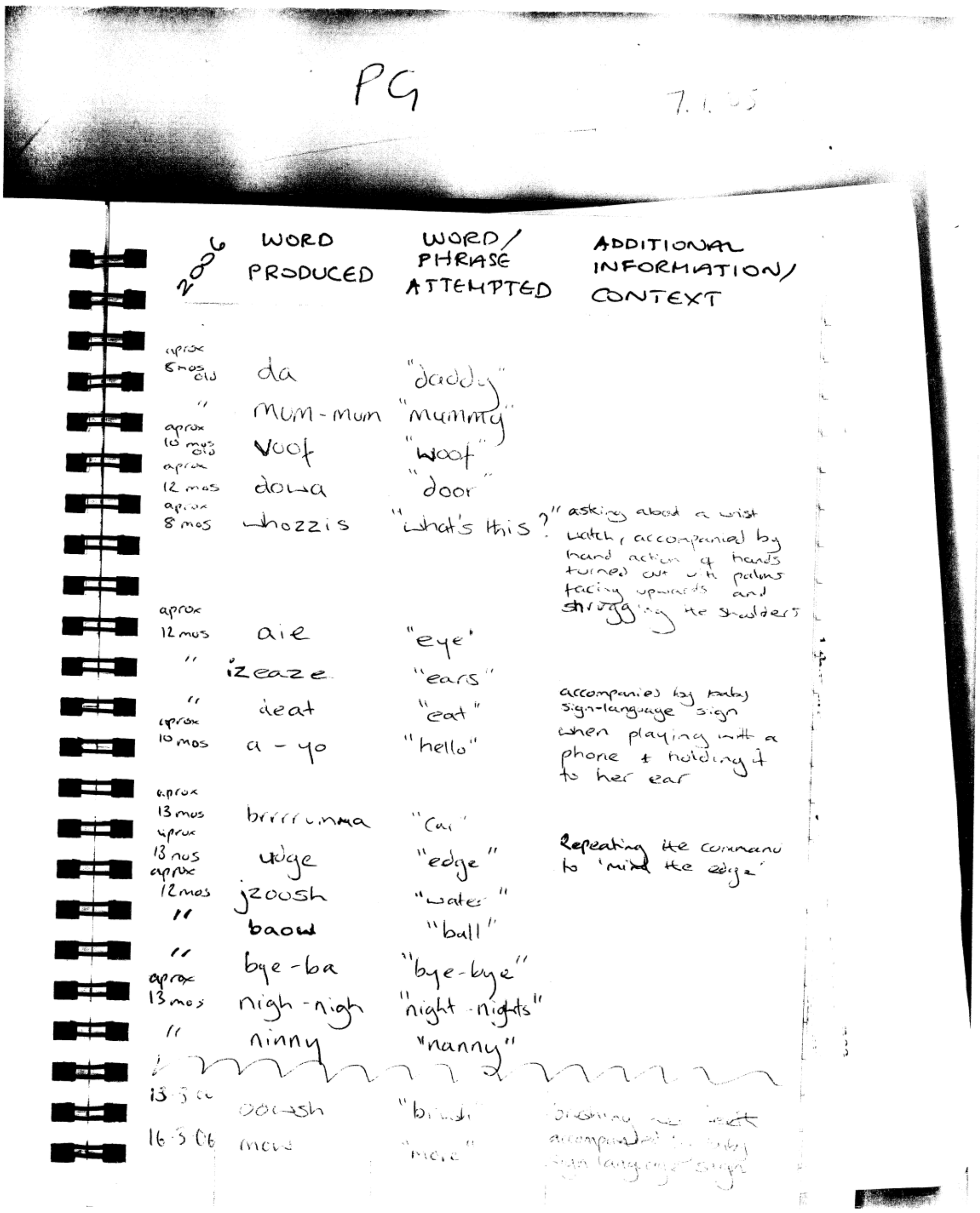
Date	Target word	Produced	Query	Response
12-Apr-06	washing machine	washee-r	Was the 'r' sounded, as in *red?*	No, it was the 'r' at the end of a word sort of rhymed with 'heavier'
20-Apr-06	tomato	martis	Was the 's' an 's' or a 'z' sound?	's'
22-Apr-06	orange	orij	Was the 'j' like the French 'j'?	yes, I think so
01-May-06	apple	abel	Was the 'a' long as in the name *Abel* or short as in *apple* ?	short
01-May-06	chocolate	fthlolot	Was the 'th' hard as in *thick* or soft as in *this?*	} these two I found difficult to write down - so I guessed how to record them *
01-May-06	clock	fthlock	Was the 'th' hard as in *thick* or soft as in *this?*	}
06-May-06	lady	layle	Rhyming with *pail,* or said as 'layley', rhyming with *lady?*	rhyming with lady
12-May-06	Della	Bella	Was the target here *Della* or *Bella* ?	Can't remember, (but we knew 3.0 called Belle
18-May-06	light	let/lite	Was the vowel in 'lite' long as in *Pete* ?	I think it was 'let' not long.
29-May-06	pisa	pizza	Was the 's' an 's' or a 'z' sound?	's'
09-Jun-06	cheese	dees	Was the 's' an 's' or a 'z' sound?	's'
12-Apr-06	chocolate		Do you say this as 2 (choc-late) or 3 syllables (choc-o-late)?	2
12-Apr-06	batteries		Do you say this as 2 or 3 syllables?	2
10-Jun-06	camera		Do you say this as 2 or 3 syllables?	Can't remember
27-Sep-06	us	us	Do you say the 's' as an 's' or 'z'?	s

They both sounded a bit like spitting - I would have to say it to you so you could work out how to record it

* chocolate was sort of flotlot
clock - similar to above but lots of spitting sound

This is all to the best of my memory

Appendix 7



PG 7.1.05

2006	WORD PRODUCED	WORD/ PHRASE ATTEMPTED	ADDITIONAL INFORMATION/ CONTEXT
aprox 8 mos old	da	"daddy"	
"	mum-mum	"mummy"	
aprox 10 mos old	voof	"woof"	
aprox 12 mos	dowa	"door"	
aprox 8 mos	whozzis	"what's this?"	asking about a wrist watch, accompanied by hand action of hands turned out with palms facing upwards and shrugging the shoulders
aprox 12 mos	aie	"eye"	
"	izeaze	"ears"	
"	deat	"eat"	accompanied by baby sign-language sign
aprox 10 mos	a - yo	"hello"	when playing with a phone & holding it to her ear
aprox 13 mos	brrrrumma	"car"	
aprox 13 mos	udge	"edge"	Repeating the command to 'mind the edge'
aprox 12 mos	jzoosh	"water"	
"	baow	"ball"	
"	bye-ba	"bye-bye"	
aprox 13 mos	nigh-nigh	"night-nights"	
"	ninny	"nanny"	
13.5.06	oowsh	"brush"	brushing her teeth
16.5.06	mow	"more"	accompanied by baby sign language sign

Appendix 8

AG	13.07.05	love you	lu loo	23.08.05	lu blue	01.03.06	**love you**	
AG	13.07.05	baby	baba	06.10.05	**baby**			
AG	13.07.05	Mummy	mama	20.09.05	**Mummy**			
AG	13.07.05	Daddy	dada	20.09.05	**Daddy**			
AG	13.07.05	moo	mooo					
AG	13.07.05	look	ook					
AG	13.07.05	hair	air					
AG	13.07.05	cat	at					
AG	13.07.05	bird	b b					
AG	13.07.05	duck	d d					
AG	13.07.05	Harriet	arrot					
AG	13.07.05	night night	na na					
AG	13.07.05	banana	narna	01.03.06	bunana			
AG	14.07.05	shoes	shoosh	01.03.06	**shoes**			
AG	14.07.05	Reece	eesh	19.09.05	**Reece**			
AG	18.07.05	butterfly	butter	09.11.05	buberbly	23.11.05	bubberbly	
AG	18.07.05	Winnie the Pooh	pooooh					
AG	19.07.05	food	fooo					
AG	19.07.05	go	doe					
AG	26.07.05	cuddle	dudoo	01.03.06	**cuddle**			
AG	02.08.05	aeroplane	alla					
AG	03.08.05	eyes	ayes					
AG	04.08.05	birds	bers					
AG	04.08.05	horse	orse					
AG	06.08.05	apple	appa					
AG	11.08.05	ball	baule	12.09.05	**ball**			
AG	14.08.05	thank you	dadoo	17.11.05	gagoo			
AG	18.08.05	biscuit	bibit	12.09.05	bisk	08.10.05	bisit	**biscuit**
AG	20.08.05	please	clees	01.03.06	peas			
AG	20.08.05	bus	busss					
AG	25.08.05	books	booksk					
AG	25.08.05	ears	eye ers	23.09.05	ears			
AG	25.08.05	Eva	ee a/ee va					
AG	26.08.05	catch	datch					
AG	26.08.05	back	dat	16.09.05	bat	01.10.05	**back**	
AG	28.08.05	purple	purpool					
AG	29.08.05	Andy	Annie	23.09.05	Addy			
AG	29.08.05	Grandad	danda					
AG	30.08.05	Tracey	chasey					
AG	04.09.05	knock knock	**knock knock**					
AG	06.09.05	spider	pider					
AG	08.09.05	listen	sen					
AG	09.09.05	spoon	poon					
AG	09.09.05	yoghurt	ogurt	02.10.05	gogurt			
AG	09.09.05	stairs	dares					
AG	09.09.05	get out	et out					
AG	09.09.05	pasta	pasa					

AG	10.09.05	garden	darden				
AG	10.09.05	door	**door**				
AG	16.09.05	mouth	wouf				
AG	16.09.05	Elysia	sisa	23.10.05	sisia	01.03.06	lisia
AG	16.09.05	nose	no				
AG	19.09.05	toast	toes	29.09.05	tose		
AG	19.09.05	all gone	all don				
AG	19.09.05	Stu (Uncle Stuart)	shoe				
AG	20.09.05	finished	fished				
AG	20.09.05	George	dorge				
AG	20.09.05	Laura	warwa				
AG	20.09.05	fish	fiss	06.10.05	bish	01.03.06	**fish**
AG	20.09.05	shut	sut				
AG	22.09.05	lucky	ucky				
AG	22.09.05	floor	law	14.10.05	bloor		
AG	22.09.05	knee	**knee**				
AG	23.09.05	dark	dart				
AG	23.09.05	Sarah	**Sarah**				
AG	23.09.05	elephant	effa	01.10.05	efant	15.10.05	effant
AG	23.09.05	flower	fower	06.10.05	bowber	18.10.05	blowber
AG	23.09.05	box	**box**				
AG	24.09.05	feather	dedder/bezzer				
AG	24.09.05	clap	plap				
AG	24.09.05	tickle	tittle				
AG	24.09.05	pretty	wissy	01.03.06	pitty		
AG	25.09.05	dirty	dirdy				
AG	25.09.05	that way	dat way	13.10.05	at way	01.03.06	**that way**
AG	25.09.05	away	way				
AG	25.09.05	Iain	een				
AG	25.09.05	wiggle	iggle				
AG	25.09.05	beautiful	booful				
AG	26.09.05	bunny rabbit	bub bub				
AG	26.09.05	dinner	**dinner**				
AG	26.09.05	wet	wats	24.10.05	**wet**		
AG	26.09.05	off	**off**	24.10.05	**off**		
AG	26.09.05	trousers	towers				
AG	26.09.05	one	**one**				
AG	26.09.05	four	**four**				
AG	26.09.05	six	sits				
AG	26.09.05	better	butter				
AG	26.09.05	bath	baff				
AG	26.09.05	story	morey				
AG	27.09.05	car	**car**				
AG	27.09.05	button	busson				
AG	28.09.05	Alfie	Affie				
AG	28.09.05	Maretta	metta				
AG	29.09.05	work	wak	01.03.06	**work**		
AG	29.09.05	Bella	**Bella**				
AG	01.10.05	moon	moo				
AG	01.10.05	telephone	ephone	23.10.05	eplone		

AG	01.10.05	Amelia	me la	29.10.05 melia		
AG	02.10.05	animals	amals			
AG	02.10.05	sister	sita			
AG	02.10.05	brother	budda			
AG	02.10.05	clean	keen	06.12.05 **clean**		
AG	02.10.05	water	waffer	07.10.05 **water**		
AG	02.10.05	drink	gink			
AG	03.10.05	road	row			
AG	03.10.05	gate	date	01.11.05 date		
AG	03.10.05	Tabitha	baba			
AG	03.10.05	Nicky	nitney			
AG	03.10.05	Adam	adder			
AG	05.10.05	John	bum			
AG	05.10.05	Auntie Alison	antie			
AG	05.10.05	squirrel	sciggle			
AG	06.10.05	Fimbles	bimbles			
AG	06.10.05	happy	appy			
AG	06.10.05	Daddy work	Daddy wak			
AG	06.10.05	paper	peeper			
AG	06.10.05	piglet	picklit			
AG	07.10.05	breakfast	bekbast			
AG	07.10.05	jelly	jergley			
AG	08.10.05	glue	blue			
AG	08.10.05	oh no	**oh no**			
AG	09.10.05	picture	**picture**			
AG	09.10.05	where are they?	where way			
AG	10.10.05	nursery	mersry			
AG	10.10.05	cupboard	cubba	20.11.05 cubid		
AG	11.10.05	porridge	padd	01.03.06 **porridge**		
AG	11.10.05	bless you	bess shoe			
AG	11.10.05	pardon me	pardon			
AG	11.10.05	Sophie	fophie			
AG	11.10.05	cream	keen			
AG	11.10.05	medicine (3)	medson	12.11.05 mesan		
AG	12.10.05	tea	**tea**			
AG	12.10.05	bib	bi			
AG	12.10.05	bin	bee			
AG	13.10.05	grape	great			
AG	13.10.05	wash them	wash em			
AG	13.10.05	kitchen	titchen			
AG	14.10.05	Carol	darol			
AG	14.10.05	bed	**bed**			
AG	14.10.05	in the box	it box			
AG	14.10.05	melon	melum			
AG	15.10.05	tractor	practor			
AG	15.10.05	bubbles	**bubbles**			
AG	15.10.05	cow	tow			
AG	17.10.05	sorry	sowwy			
AG	17.10.05	honey	uney			
AG	17.10.05	Teletubbies	bedda buddies	18.10.05 bellubbies	06.12.05 tubitities	

AG	17.10.05	that one	at one	
AG	17.10.05	pocket	pockick	
AG	20.10.05	mirror	mimmor	24.11.05 me a
AG	20.10.05	up	**up**	
AG	20.10.05	buggy	**buggy**	
AG	20.10.05	down	dow	
AG	20.10.05	coat	coke	
AG	20.10.05	wait	wake	29.10.05 **wait**
AG	21.10.05	birthday	bersaday	06.12.05 bursay
AG	23.10.05	Aaliyah	leah	
AG	23.10.05	what happened?	appen	
AG	24.10.05	loud	**loud**	
AG	24.10.05	socks	gocks	
AG	24.10.05	rain	**rain**	
AG	24.10.05	tree	**tree**	
AG	25.10.05	hedgehog	etchog	
AG	25.10.05	blue	boo	27.10.05 boo
AG	27.10.05	earring	earie	
AG	27.10.05	bottle	botta	
AG	27.10.05	pink	**pink**	
AG	28.10.05	hoover	oofer	
AG	29.10.05	marmite	martmite	
AG	29.10.05	careful	fareful	20.11.05 dareful
AG	29.10.05	Ilana	nana	
AG	29.10.05	Karrie	darrie	
AG	30.10.05	help	elp	
AG	03.11.05	that's alright	that's right	
AG	03.11.05	sit down	**sit down**	
AG	03.11.05	Ollie	**Ollie**	
AG	03.11.05	shake	shate	
AG	04.11.05	right	**right**	
AG	05.11.05	star	sar	
AG	05.11.05	that's it	at's it	
AG	05.11.05	apron	apon	
AG	07.11.05	teddy bear	te bear	25.11.05 te bear
AG	07.11.05	frog (froggy)	goggy	
AG	09.11.05	finger	giger	01.03.06 **finger**
AG	09.11.05	giraffe	raffe	
AG	09.11.05	face	ace	
AG	09.11.05	arm	**arm**	
AG	09.11.05	leg	egg	
AG	09.11.05	sheep	**sheep**	
AG	15.11.05	noise	**noise**	
AG	15.11.05	cucumber	cucuber	
AG	15.11.05	bump	bum	
AG	16.11.05	candle	dandle	
AG	16.11.05	steps	deps	
AG	16.11.05	pop	**pop**	
AG	17.11.05	stop	dop	
AG	19.11.05	cup of tea	dupatea	

AG	20.11.05	open it	opit		
AG	20.11.05	milk	**milk**		
AG	23.11.05	stop it	**stop it**		
AG	23.11.05	tomorrow	myo		
AG	24.11.05	sign (sing and sign)	sigh		
AG	24.11.05	here we are	here e are		
AG	05.12.05	guinea pig	gi big		
AG	05.12.05	rabbit	babit		
AG	05.12.05	finish	finis	01.03.06	**finish**
AG	05.12.05	good girl	good ger		
AG	05.12.05	stamp your feet	stam stam fee		
AG	05.12.05	show you	show oo		
AG	05.12.05	piano	ano		
AG	05.12.05	Tallulah	tullah		
AG	05.12.05	Millie	Billy		
AG	05.12.05	Roy	boy		
AG	05.12.05	Eliza	lila		
AG	06.12.05	all clean	**all clean**		
AG	06.12.05	all done	**all done**		
AG	06.12.05	have it	a sit		
AG	06.12.05	splash	plash		
AG	06.12.05	swing	sing		
AG	06.12.05	slide	side		
AG	06.12.05	downstairs	down dairs		
AG	06.12.05	bike	**bike**		
AG	06.12.05	feet	**feet**		
AG	06.12.05	Balamory	mamorley		
AG	08.12.05	don't like it	like it (shaking head)		
AG	08.12.05	house	ouse		
AG	08.12.05	dolly	**dolly**		
AG	09.12.05	dummy	**dummy**		
AG	09.12.05	sleep	leep		
AG	11.12.05	toilet	torlick		
AG	01.03.06	new	**new**		
AG	01.03.06	more	**more**		
AG	01.03.06	this	**this**		
AG	01.03.06	broken	**broken**		
AG	01.03.06	Elysia's	lissi/lisia's		
AG	01.03.06	want	**want**		
AG	01.03.06	change	**change**		
AG	01.03.06	hand	**hand**		
AG	01.03.06	there	**there**		
AG	01.03.06	nappy	**nappy**		
AG	01.03.06	hello	**hello**		
AG	01.03.06	gorgeous	gorgus		
AG	01.03.06	Uncle Andy's	Clandy's		
AG	01.03.06	mine	my		
AG	01.03.06	have to	hasa		
AG	01.03.06	shop	**shop**		
AG	01.03.06	mushrooms	mushroom		

AG	01.03.06	Piggy and Spike	Piggy bike						
AG	01.03.06	carrot	**carrot**						
AG	01.03.06	clothes	**clothes**						
AG	01.03.06	fairy	**fairy**						
AG	01.03.06	heavy	**heavy**						
AG	01.03.06	school	**school**						
AG	01.03.06	hot	**hot**						
AG	01.03.06	touching	**touching**						
AG	01.03.06	biscuits	**biscuits**						
BB	11.'05	banana	bab/dab	02.'06	noo noo				
BB	11.'05	bear	beh						
BB	30.11.05	toast	das	08.06	toe	11.'06	toe(t)	11.06	**toast**
BB	01.12.05	clock	kōh	23.12.05	kloh				
BB	09.12.05	moon	ma	03.01.06	moo	02.'06	mer	14.03.06	ma
BB	15.12.05	baby	beh	05.06	**baby**				
BB	15.12.05	cat	ket	08.'06	cah	09.'06	**cat**		
BB	15.12.05	rabbit	ket/beh						
BB	15.12.05	dog	deh						
BB	21.12.05	duck	guh	02.'06	duh				
BB	23.12.05	star	sta						
BB	28.12.05	flower	flō	08.06	fower/**flower**				
BB	04.01.06	bike	bik	02.'06	bih	04.'06	bah	05.06	bye
BB	14.01.06	ball	ba	02.'06	**ball**				
BB	01.'06	fish	ff	05.'06	ff	08.'06	fif fif	11.06	fis
BB	01.'06	hot	ô	bg 03.06	ô/oo	14.03.06	who(t)		
BB	02.'06	more	**more**						
BB	02.'06	race car	koi kar						
BB	02.'06	moo	**moo**						
BB	02.'06	baa	**baa**						
BB	02.'06	bye bye	ba ba	03.06	ba ba				
BB	02.'06	alright	alwigh						
BB	02.'06	bird	ber						
BB	02.'06	no	na						
BB	02.'06	Grandpa	ger ger						
BB	02.'06	pig	pih						
BB	beg 02.06	peas	peese						
BB	beg 03.06	snake	sss						
BB	14.03.06	juice	juish						
BB	14.03.06	post	pose [s]						
BB	14.03.06	bee	be						
BB	14.03.06	socks	sess						
BB	14.03.06	balloon	boon	04.'06	bloon				
BB	14.03.06	quack quack	wha wha	05.'06	wa wa				
BB	14.03.06	man	ma						
BB	14.03.06	broccoli	broc						
BB	04.'06	hammer	ammer	05.'06	ammer				
BB	04.'06	door	door door	14.06.06	**door**				
BB	04.'06	miaow/cat	(mi)aow						
BB	04.'06	shoe	shu/du						
BB	04.'06	cup	ka						

BB	04.'06	book	bih	08.'06	buh	08.'06	buh oo
BB	04.'06	badger	ba				
BB	04.'06	cocoon	cu cu				
BB	05.'06	please	pees	14.06.06	b/peds		
BB	05.'06	cot	ko				
BB	05.'06	apple	abble				
BB	05.'06	wee wee	**wee wee**				
BB	05.'06	rain	ray				
BB	05.'06	bin	**bin**				
BB	05.'06	arm	am				
BB	05.'06	fire	wire/fye	05.06	**fire**		
BB	05.'06	rice	rye				
BB	05.'06	happy	appy				
BB	05.'06	day	**day**				
BB	05.'06	mice	my				
BB	05.'06	garden	gar				
BB	05.'06	egg	**egg**				
BB	05.'06	goat	goak				
BB	05.'06	cake	k	08.'06	**cake**		
BB	05.'06	daisy	daidy				
BB	05.'06	mayonnaise	mayonai				
BB	end 05.06	dolphin	dolpha/**dophin**				
BB	06.'06	fly	**fly**				
BB	06.'06	nut	nuh				
BB	06.'06	iron	ia				
BB	06.'06	gone	**gone**				
BB	06.'06	Kate	ki/cake	08.'06	cake		
BB	14.06.06	Asher	**Asher**	08.'06	iya		
BB	16.06.06	spider	pider				
BB	16.06.06	that	dat				
BB	08.'06	pen	**pen**				
BB	08.'06	thumb	fum				
BB	08.'06	milk	milh	12.'06	mulk		
BB	08.'06	done	**done**				
BB	08.'06	mine	**mine**/mone				
BB	08.'06	plant	parnt				
BB	08.'06	farm	**farm**				
BB	08.'06	farmer	**farmer**				
BB	08.'06	digger	**digger**				
BB	08.'06	potty	pottle				
BB	08.'06	sick	**sick**				
BB	08.'06	scissors	**scissors**				
BB	08.'06	yawn	**yawn**				
BB	08.'06	walrus	war-roh				
BB	08.'06	Robin	roh roh				
BB	08.'06	water	warder	01.09.06	**water**		
BB	08.'06	tea	**tea**				
BB	08.'06	bus	bud/**bus**				
BB	08.'06	nee nar	naw naw				
BB	08.'06	owl	ow				

BB	08.'06	in	**in**		
BB	08.'06	biscuit	bickie		
BB	08.'06	hen	**hen**		
BB	08.'06	run	**run**		
BB	08.'06	fart	farh	01.09.06	**fart**
BB	08.'06	bone	**bone**		
BB	08.'06	bridge	**bridge**		
BB	end 08.06	phone	**phone**		
BB	end 08.06	cereal	será		
BB	beg 09.06	pushchair	pu chy		
BB	beg 09.06	sit	**sit**		
BB	beg 09.06	on	**on**		
BB	beg 09.06	badge	bage/**badge**		
BB	09.'06	shampoo	**shampoo**		
BB	09.'06	porridge	potty		
BB	09.'06	spoon	foam	11.06	foon
BB	09.'06	some	sam		
BB	09.'06	plane	pane		
BB	11.'06	sunset	**sunset**		
BB	11.'06	sunrise	sunri		
BB	11.'06	firework	**firework**		
BB	11.'06	bagel	badel		
BB	11.'06	train	tain		
BB	11.'06	warm	**warm**		
BB	11.'06	room	**room**		
BB	11.'06	stick	sick		
BB	end 11.06	flamingo	famgo		
BB	end 11.06	gloves	guv(f)		
BB	end 11.06	red	**red**		
BB	end 11.06	yellow	yewo/**yellow**		
BB	end 11.06	spaghetti	getti		
BB	end 11.06	Christmas	qui mis	12.'06	Chri
BB	12.'06	pyramid	**pyramid**		
CB	15.11.05	bye bye	**bye bye**		
CB	15.11.05	Mummy	mama/mum mum		
CB	15.11.05	Daddy	dada		
CB	15.11.05	pee po	**pee po**		
CB	15.11.05	there	daa	31.01.06	dere
CB	15.11.05	down	daan		
CB	15.11.05	shoe	shu shu		
CB	15.11.05	fish	shish		
CB	15.11.05	cat	ca	31.01.06	gat
CB	15.11.05	hello	e-o		
CB	15.11.05	hair	air		
CB	15.11.05	baby	bebe		
CB	17.11.05	digging	gigging		

CB	20.11.05	yoghurt	dadurt	31.01.06	yoblob	23.01.07	**yoghurt**
CB	20.11.05	shredder	dedder				
CB	20.11.05	plane	bane				
CB	27.11.05	more	maw	31.05.06	**more**		
CB	27.11.05	out	**out**				
CB	27.11.05	curtain	durden				
CB	27.11.05	wee/willie	wee wee				
CB	27.11.05	no	**no**				
CB	27.11.05	cheese	keys	12.12.05	tees	26.02.06	**cheese**
CB	10.12.05	glasses	garssish				
CB	10.12.05	bin	**bin**	26.02.06	binna		
CB	10.12.05	cupboard	cagud				
CB	10.12.05	bowl	**bowl**				
CB	12.12.05	thank you	angu	26.02.06	ank u		
CB	12.12.05	ball	bawl	16.04.06	**ball**		
CB	12.12.05	car	dar	23.12.05	bar	12.03.06	gar
CB	12.12.05	grapes	gus				
CB	12.12.05	all gone	orl gone				
CB	12.12.05	yeah/yes	**yeah**				
CB	12.12.05	bib	**bib**				
CB	12.12.05	cup	cur cup	06.01.06	gup	16.04.06	cuf
CB	13.12.05	bed	**bed**				
CB	13.12.05	dirty	d-te				
CB	14.12.05	spoon	boon	08.'06	boon	12.'06	**spoon**
CB	14.12.05	clock	gock				
CB	15.12.05	melon	memo				
CB	18.12.05	apple	**apple**	06.'06	yapple		
CB	18.12.05	light	gight				
CB	23.12.05	neighbours	na:bur				
CB	23.12.05	pear	bear				
CB	24.12.05	snowman	moman				
CB	25.12.05	chair	jair				
CB	25.12.05	kiwi	**kiwi**	06.04.06	wiwi		
CB	25.12.05	bread	bau				
CB	28.12.05	purple	burble	31.01.06	burble		
CB	28.12.05	bubble	**bubble**				
CB	28.12.05	deer	**deer**				
CB	28.12.05	cough	goff				
CB	03.01.06	sitting down	singin dan				
CB	03.01.06	ready steady go	dedy dedy go				
CB	03.01.06	bus	**bus**				
CB	03.01.06	bike	**bike**				
CB	03.01.06	banana	nana				
CB	06.01.06	sticky	stiddy				
CB	06.01.06	door	dor				
CB	06.01.06	coat	goat	09.04.06	goat/doat		
CB	06.01.06	gloves	gov				
CB	06.01.06	hat	gat	09.04.06	yat		
CB	06.01.06	what's that?	wot wot				
CB	06.01.06	boots	boo				

CB	08.01.06	lorry	gorry					
CB	08.01.06	knee	nee					
CB	08.01.06	leg	geg					
CB	08.01.06	pretty	gitty					
CB	08.01.06	pardon me	momo me					
CB	12.01.06	chin	tin					
CB	12.01.06	that one	**that one**					
CB	20.01.06	coming	dumming	12.03.06	**coming**			
CB	23.01.06	blue	boo	16.04.06	bue			
CB	25.01.06	hands	hans					
CB	25.01.06	arms	ams					
CB	26.01.06	loud flush	loud fush					
CB	26.01.06	four	**four**					
CB	29.01.06	water	doter	12.03.06	ditar	14.03.06 **water** (once)	09.04.06	daughter
CB	29.01.06	tea	**tea**	16.04.06	**tea**			
CB	29.01.06	birdie	burbee	21.02.06	**birdie**			
CB	29.01.06	TV	wee wee					
CB	31.01.06	again	gain					
CB	31.01.06	man	**man**					
CB	31.01.06	up	**up**					
CB	31.01.06	star	sdar					
CB	31.01.06	horse	orsh	01.'07	**horse**			
CB	31.01.06	doggie	**doggie**	06.'06	goggie			
CB	31.01.06	duck	**duck**					
CB	31.01.06	sultana	naanaa					
CB	31.01.06	mouth	mau					
CB	31.01.06	milk	milsh	12.'06	**milk**			
CB	31.01.06	rabbit	dabit					
CB	31.01.06	hedgehog	eg og					
CB	31.01.06	Eeyore	ee or					
CB	31.01.06	big	**big**					
CB	31.01.06	push	puss					
CB	04.02.06	hiding	haiding					
CB	04.02.06	tractor	dakta	09.04.06	dactor			
CB	04.02.06	van	**van**					
CB	04.02.06	bag	**bag**					
CB	04.02.06	knife	**knife**					
CB	04.02.06	fork	**fork**/cork	09.04.06	bork			
CB	04.02.06	tub	**tub**					
CB	04.02.06	bubble bath	bubble barf					
CB	04.02.06	honey	unee					
CB	04.02.06	ladder	**ladder**					
CB	09.02.06	crayon	**crayon**					
CB	09.02.06	cutting	guttit					
CB	09.02.06	underneath	nee					
CB	18.02.06	mouse	mouf	26.02.06	**mouse**			
CB	19.02.06	fridge	frid					
CB	19.02.06	rain	**rain**/bain					

CB	19.02.06	green	**green**	16.04.06 bean	06.'06 been/geen	08.'06 reen	23.01.07**gr**
CB	19.02.06	bottle	**bottle**				
CB	19.02.06	butterfly	buerfwy				
CB	21.02.06	marmalade	**marmalade**				
CB	21.02.06	biscuit	biskit				
CB	21.02.06	toast	**toast**/doasd				
CB	21.02.06	fluff	**fluff**				
CB	21.02.06	triangle	tang				
CB	22.02.06	lid	did				
CB	22.02.06	radio	derder	16.04.06 der der			
CB	22.02.06	breakfast	bekfst				
CB	22.02.06	policeman	peacyman				
CB	22.02.06	helicopter	dopter				
CB	22.02.06	shut	dut				
CB	22.02.06	help	elp	26.02.06 **help**			
CB	26.02.06	soggy	saggy				
CB	26.02.06	hole	ole				
CB	26.02.06	indicator	dacter				
CB	26.02.06	work	bok	03.03.06 wok			
CB	26.02.06	pasta	**pasta**				
CB	26.02.06	Owl	**Owl**				
CB	26.02.06	Robin	**Robin**				
CB	26.02.06	Kanga	**Kanga**				
CB	26.02.06	Roo	**Roo**				
CB	26.02.06	please	peas	16.04.06 peas	23.01.07p(l)eace		
CB	03.03.06	stick	st(d)ick				
CB	03.03.06	stones	sone				
CB	03.03.06	both	bos				
CB	03.03.06	nice	**nice**				
CB	03.03.06	laughing	laughin				
CB	03.03.06	running	runnin	18.03.06 runnin			
CB	03.03.06	wet	**wet**				
CB	03.03.06	walk	wok				
CB	03.03.06	here you are	ere ya ar				
CB	03.03.06	here it is	ere tis				
CB	06.03.06	towel	towl				
CB	06.03.06	muddy	**muddy**				
CB	06.03.06	mango	**mango**				
CB	06.03.06	orange	oran				
CB	06.03.06	sorry	sor				
CB	12.03.06	found	bound				
CB	12.03.06	fruit bar	fruit barf	09.04.06 boo barf			
CB	12.03.06	spilt	bilt				
CB	12.03.06	oops a daisy	**oops a daisy**				
CB	12.03.06	a car coming	a gar coming				
CB	14.03.06	tissue	tiss				
CB	14.03.06	fizzy	bitty	09.04.06 bizzy			
CB	14.03.06	Finlay	Ninley	09.04.06 Nin-yee	06.'06 **Finlay**		
CB	14.03.06	stuck	duck				

CB	14.03.06	sleep	beat	12.'06 **sleep**
CB	14.03.06	sleeping	beating	
CB	14.03.06	Marmite	**Marmite**	
CB	14.03.06	open	**open**	
CB	25.03.06	bouncing	bumping	
CB	31.03.06	crocodile	cocdile	
CB	31.03.06	seal	see-al	16.04.06 **seal**
CB	31.03.06	parrot	parrt	
CB	31.03.06	octopus	ocpus	
CB	31.03.06	elephant	enat	
CB	31.03.06	butterflies	butt-fies	
CB	31.03.06	caterpillar	catherpilla	
CB	31.03.06	snail	nainai	
CB	31.03.06	mousie	**mousie**	
CB	31.03.06	horsie	**horsie**	
CB	31.03.06	bear	**bear**	15.04.06 **bear**
CB	02.04.06	carry	caro	
CB	09.04.06	little	dittle	15.05.06 dittle
CB	09.04.06	prunes	boons	
CB	09.04.06	trailer	drayer	
CB	09.04.06	trousers	trayers	
CB	09.04.06	red	bed	31.05.06 **red**
CB	09.04.06	fingers	bingas	
CB	09.04.06	normal	nornal	31.05.06 nornal
CB	16.04.06	noisy	**noisy**	
CB	16.04.06	rugby ball	bumpy ball	
CB	16.04.06	nappy	mappy	28.04.06 **nappy**
CB	16.04.06	kick	gick	
CB	16.04.06	hot cup of tea	ot cuf of tea	
CB	16.04.06	yellow	ye-o	06.'06 yeyo
CB	16.04.06	Cheerios	wo-wos	
CB	16.04.06	sleepsuit	beat soup	
CB	16.04.06	top	dop	
CB	16.04.06	later	**later**	
CB	16.04.06	music	mu-ics	
CB	16.04.06	car keys	gar keys	
CB	16.04.06	nice and warm	**nice and warm**	
CB	16.04.06	jingly jangly	dingly dangly	
CB	16.04.06	soup	**soup**	
CB	16.04.06	tiger	diger	
CB	16.04.06	lion	dion	
CB	16.04.06	mouse and bear	**mouse and bear**	
CB	16.04.06	toucan	**toucan**	
CB	16.04.06	bumble bees	bumbliebees	
CB	16.04.06	compost	bumbus	
CB	16.04.06	steps	deps	
CB	28.04.06	soil	**soil**	
CB	28.04.06	nappy sack	**nappy sack**	
CB	28.04.06	nappy liner	**nappy liner**	
CB	28.04.06	shops	sops	

CB	28.04.06	self	**self**		
CB	28.04.06	soft	**soft**		
CB	10.05.06	library	libee		
CB	10.05.06	cold	**cold**		
CB	10.05.06	sore	**sore**		
CB	10.05.06	finish	ninsh		
CB	10.05.06	follow	**follow**		
CB	10.05.06	chasing	chasin		
CB	10.05.06	biscuits	gikgits		
CB	10.05.06	cake	gake		
CB	15.05.06	empty	epty		
CB	15.05.06	packet	backit		
CB	15.05.06	wipes	ipes		
CB	15.05.06	wipers	ipers		
CB	15.05.06	sofa	**sofa**		
CB	15.05.06	television	te-e-vision		
CB	15.05.06	bubbles	**bubbles**		
CB	15.05.06	lawn mower	lawner		
CB	31.05.06	boat	**boat**		
CB	31.05.06	ship	**ship**		
CB	31.05.06	brown	**brown**		
CB	31.05.06	sunglasses	sungarses		
CB	31.05.06	other	**other**		
CB	31.05.06	room	**room**		
CB	31.05.06	cauliflower	coflower		
CB	31.05.06	like some more	yike some more		
CB	31.05.06	black	back		
CB	06.'06	exercises	necknises		
CB	06.'06	picnic	nic nic		
CB	06.'06	train	tain	08.'06	tain
CB	06.'06	play	pay		
CB	06.'06	another	anahya		
CB	07.'06	driving	diving		
CB	07.'06	as well	a well		
CB	07.'06	snake	nake		
CB	12.'06	Christmas	quissmass		
CB	12.'06	broken	brokend		
CB	12.'06	drunk	drinkend		
CB	12.'06	look at it	look of it		
CB	01.'07	actually	acsually		
CB	01.'07	around	rownd		
CB	01.'07	behind	hind		
CB	01.'07	track	**track**		
CB	01.'07	clip	kip		
CB	01.'07	Porsche	porss		

DB	12.11.05	do it	**do it**				
DB	16.11.05	tittie	tittit				
DB	17.11.05	hello	awaw				
DB	22.11.05	kick	tih (hard end)	01.07.06	**kick**		
DB	23.11.05	clock	doh (hard end)				
DB	23.11.05	tea cup	tea				
DB	05.12.05	go	doe				
DB	11.12.05	yes	**yes**	20.12.05	yeh		
DB	24.12.05	cat	da	02.05.06	bat	10.05.06	ba
DB	25.12.05	cat – stairs	da-dairs				
DB	29.12.05	light	ite				
DB	02.01.06	bye	die	31.01.06	die		
DB	03.01.06	Mummy	nani/mami				
DB	25.01.06	juice	juz	06.02.06	**juice**		
DB	28.01.06	shoes	shuz	06.02.06	**shoes**		
DB	02.02.06	track	tak				
DB	05.02.06	steps	deps				
DB	15.02.06	door	doo				
DB	20.02.06	down	dow	19.03.06	doon		
DB	02.03.06	teeth	tee				
DB	03.03.06	tree	tee				
DB	18.03.06	dance	dars	24.03.06	dats		
DB	19.03.06	chair	**chair**				
DB	24.03.06	get up	du				
DB	27.03.06	hat	da	20.05.06	eya		
DB	27.03.06	Pat	da	04.05.06	**Pat**		
DB	30.03.06	eyes	deyes	20.05.06	**eyes**		
DB	02.04.06	slide	dise				
DB	06.04.06	choo choo/train	**choo choo**				
DB	07.04.06	ball	baw				
DB	07.04.06	wall	waw				
DB	07.04.06	book	bu				
DB	09.04.06	bot bot	bo bo				
DB	13.04.06	football	bo baw				
DB	15.04.06	nappy	bappy				
DB	24.04.06	man	**man**				
DB	25.04.06	don't touch	no dutch				
DB	25.04.06	kiss	tiss				
DB	25.04.06	Anne	am				
DB	25.04.06	banana	nana				
DB	26.04.06	Daddy	**Daddy**				
DB	26.04.06	boy	**boy**				
DB	02.05.06	bear	baa				
DB	02.05.06	baby	babby	26.05.06	**baby**		
DB	02.05.06	dog	dok	02.06.06	**dog**		
DB	04.05.06	spoon	boon				
DB	04.05.06	wee	ee				
DB	04.05.06	Eve	ee				
DB	10.05.06	telly	tawi	01.07.06	teyi		
DB	10.05.06	bat	ba	23.05.06	**bat**		

DB	12.05.06	woof	foof				
DB	12.05.06	car	tar				
DB	12.05.06	cricket	ticke	05.07.06	tickit		
DB	17.05.06	beer	bee				
DB	17.05.06	Oosh (nickname)	shoosh				
DB	17.05.06	Owee (nickname)	**Owee**				
DB	17.05.06	buggy	bubby				
DB	20.05.06	hands	eyats				
DB	21.05.06	helicopter	tocta	02.06.06	topter		
DB	22.05.06	up	ap				
DB	23.05.06	say moo	su moo				
DB	23.05.06	house	oush				
DB	23.05.06	sea	**sea**				
DB	26.05.06	missed	**missed**				
DB	26.05.06	wet	we	02.06.06	wat	01.07.06	wat
DB	26.05.06	biscuit	bic bit				
DB	02.06.06	fish	shish				
DB	02.06.06	wing	win				
DB	02.06.06	haircut	airtut				
DB	18.06.06	sock	tok				
DB	18.06.06	park	parp	01.07.06	**park**		
DB	18.06.06	hole	**hole**				
DB	18.06.06	walk	**walk**				
DB	18.06.06	pig	pik	01.07.06	**pig**		
DB	01.07.06	egg	**egg**				
DB	01.07.06	rabbit	abbit				
DB	01.07.06	that one	ap one				
DB	01.07.06	fox	box				
DB	01.07.06	Shay	**Shay**				
DB	01.07.06	Mark	**Mark**				
DB	01.07.06	gone	don				
DB	01.07.06	other	upo				
DB	01.07.06	chicken	chiten				
DB	01.07.06	mice	**mice**				
DB	01.07.06	moon	**moon**				
DB	01.07.06	sleep	seep				
DB	01.07.06	lorry	owi				
DB	01.07.06	wash	**wash**				
DB	01.07.06	hand	**hand**				
DB	01.07.06	big	**big**				
EB	17.11.05	hello	erro	18.04.06	eh yo	20.06.06	allo
EB	17.11.05	Daddy	dada	22.01.06	**Daddy**		
EB	23.11.05	paper	tater				
EB	23.11.05	this	diss				
EB	15.12.05	up	uh				
EB	26.12.05	down	dow				
EB	01.01.06	upstairs	uh stah				
EB	07.01.06	more	maa				
EB	09.01.06	up there	uh dere				
EB	20.01.06	teddy	deddy				

EB	26.01.06	star	dar
EB	30.01.06	shut	tut
EB	02.02.06	Mummy	Mummy
EB	10.02.06	muzzy	tazzy
EB	12.02.06	door	**door**
EB	16.02.06	bubble	blubble
EB	17.02.06	chocolate	choc choc
EB	24.02.06	sock	chock
EB	02.03.06	car	tar
EB	04.03.06	Dipsy	sisty
EB	06.03.06	Malley	wowee
EB	17.03.06	bath	paaa
EB	19.03.06	no	mope
EB	20.03.06	pink	pint
EB	20.03.06	work	wuk
EB	20.03.06	welly	wevvy
EB	23.03.06	oh dear	uh dear
EB	26.03.06	soap	tope
EB	27.03.06	Pepi	pippi
EB	27.03.06	pepper	pappa
EB	30.03.06	Grandpa	pumpa
EB	01.04.06	wee wee	wee wee
EB	02.04.06	Ruth	wooof
EB	02.04.06	Carter	catter
EB	03.04.06	one more	one muh
EB	15.04.06	yes	yesss
EB	16.04.06	please	pease
EB	18.04.06	fit it	six it
EB	18.04.06	DVD	DDD
EB	18.04.06	Edie	**Edie**
EB	05.'06	sweep	seep
EB	05.'06	Josie	tosie
EB	beg 06.06	car park	car cark
EB	beg 06.06	home	hom
EB	beg 06.06	gate	**gate**
EB	15.06.06	crumbs	hums
EB	15.06.06	crisps	fisps
EB	17.06.06	milk	ulk
EB	17.06.06	spaghetti bolognaise	etti naise
EB	29.06.06	sleep	seep
EB	29.06.06	teeth	teess
EB	02.07.06	toothbrush	toobrusss
EB	02.07.06	yellow	yayoh
EB	04.07.06	flower	fower

FG	16.11.05	clap, clap, clap	ah, ah, ah				
FG	20.12.05	hello	ahooh				
FG	14.01.06	Chris	ssss	10.07.06	ssss		
FG	20.01.06	Mummy	ma ma	20.05.06	**Mummy**		
FG	14.02.06	no	nooooh				
FG	14.02.06	Daddy	da da	21.05.06	**Daddy**		
FG	07.03.06	baby	ba ba				
FG	10.04.06	garden	da-den				
FG	11.04.06	shoes	dooes	06.07.06	does	04.10.06	**shoes**
FG	20.04.06	doggie	dobbee	02.05.06	**doggie**/dobbee	02.07.06	dog ee
FG	20.04.06	night night	nigh nigh				
FG	20.04.06	La La	**La La**				
FG	02.05.06	Niamh	beee	23.06.06	eeee	01.07.06	meee
FG	06.05.06	ready steady go	dabee dabee doe				
FG	06.05.06	nose	uh uh	10.07.06	ooos		
FG	07.05.06	again	ah				
FG	10.05.06	oh dear	oh da	03.06.06	**oh dear**		
FG	17.05.06	Piglet	igget	16.06.06	iglet		
FG	01.06.06	Eeyore	eh ah	26.06.06	eeerrr	28.10.06	ears
FG	03.06.06	sock	ohk				
FG	03.06.06	get down	dow	26.08.06	et own		
FG	16.06.06	Tigger	igger				
FG	16.06.06	Dipsy	ipsy				
FG	19.06.06	Po	dow				
FG	22.06.06	uh oh jungo!	uh oh ungla				
FG	22.06.06	Liam	**Liam**				
FG	22.06.06	where	waa	26.08.06	wer		
FG	28.06.06	1, 2, 3	one, ooo, eee				
FG	06.07.06	cow	ow	26.08.06	**cow**		
FG	06.07.06	meow	eow				
FG	07.07.06	hot	ah	26.08.06	ot		
FG	10.07.06	hat	at				
FG	16.07.06	bee	deee				
FG	16.07.06	flower	wa wa	26.08.06	dower		
FG	30.07.06	car	ar	26.08.06	**car**		
FG	30.07.06	bus	busss	17.09.06	**bus**		
FG	03.08.06	apple	apfle	07.10.06	**apple**		
FG	03.08.06	cat	**cat**				
FG	04.08.06	quack quack	wack wack				
FG	04.08.06	biscuit	bibit	26.08.06	bibbit		
FG	09.08.06	poo poo	poo boo				
FG	09.08.06	wee wee	**wee wee**				
FG	09.08.06	bum bum	**bum bum**				
FG	09.08.06	CBeebies	bee bees				
FG	09.08.06	(Telly)tubbies	ubbies	07.10.06	ubbies		
FG	26.08.06	rabbit	wabbit				
FG	26.08.06	wet	**wet**				
FG	26.08.06	chocolate (3)	choc-late				
FG	26.08.06	yes	yeh				
FG	26.08.06	bath	ath				

FG	26.08.06	shower	ower			
FG	26.08.06	wet wipes	wet ripes			
FG	26.08.06	nice	nicesss			
FG	26.08.06	Spot	**Spot**			
FG	26.08.06	nappy	**nappy**			
FG	26.08.06	bin	**bin**			
FG	26.08.06	bike	**bike**			
FG	26.08.06	keys	keyss			
FG	26.08.06	tea	**tea**			
FG	26.08.06	get away	et away			
FG	01.09.06	num nums	**num nums**			
FG	03.09.06	go away	o way			
FG	03.09.06	banana	nana			
FG	06.09.06	trousers	two cherk	12.09.06 chow chow		
FG	07.09.06	Fimbo	mimbo			
FG	12.09.06	bear	ba	07.10.06 bar		
FG	14.09.06	my turn	me durn			
FG	17.09.06	lorry	orry			
FG	20.09.06	what happened?	apened			
FG	28.09.06	carrot	ca rat			
FG	28.09.06	plane	ane			
FG	01.10.06	bird	eerd			
FG	03.10.06	baddies	**baddies**			
FG	04.10.06	coat	**coat**			
FG	07.10.06	don't like	no like			
FG	07.10.06	mine	min			
FG	07.10.06	cake	dake			
FG	20.10.06	kitchen	itchen			
FG	20.10.06	chippy	ippy			
FG	24.10.06	pants	bants	02.11.06 pant		
FG	28.10.06	mouth	modth			
FG	28.10.06	ears	eeyore			
FG	28.10.06	head	ead			
FG	28.10.06	eyes	**eyes**			
FG	02.11.06	noise	nose			
FG	02.11.06	toilet	toelet			
FG	02.11.06	potty	**potty**			
GG	21.11.05	boo	doo	23.12.05 **boo**		
GG	11.12.05	hello	ahooh	20.12.05 ah ooh		
GG	21.12.05	ta	ah			
GG	02.01.06	no	uh	20.01.06 aaah	14.02.06 noooh	**no**
GG	16.01.06	Eryn	da ooo	20.01.06 daurn	23.06.06 eenoh	whereyn
GG	26.01.06	vrroom	umumum			
GG	26.01.06	bang bang	ah ah	24.10.06 **bang bang**		
GG	28.01.06	bye bye	da yah	02.08.06 bi bi		
GG	24.02.06	night night	nigh nigh	21.06.06 **night night**		
GG	07.03.06	baby	baba			
GG	13.03.06	Liam	ee	19.06.06 Lee am	21.07.06 Leam	
GG	01.04.06	banana	nana			
GG	01.04.06	garden	da-en	12.04.06 da-den	20.06.06 darden	

GG	01.04.06	shoes	dooes		
GG	15.04.06	La La	**La La**		
GG	15.04.06	Po	dough		
GG	22.04.06	mouth	ah		
GG	22.04.06	nose	dooh	21.07.06 doos	
GG	26.05.06	sock	ahk	21.06.06 ock	
GG	02.06.06	get down	get dow	26.08.06 et down	
GG	16.06.06	Luca	doca	14.09.06 uca	
GG	20.06.06	Piglet	igglet		
GG	20.06.06	Tigger	igger		
GG	20.06.06	Eeyore	ee or		
GG	22.06.06	1, 2, 3	one, doo, eee	10.09.06 won, dwo, dee	
GG	23.06.06	Daddy	Daaden	02.08.06 **Daddy**	10.08.06 dawen
GG	23.06.06	Mummy	**Mummy**		
GG	16.07.06	poor Mummy	ma mummy		
GG	18.07.06	car	ar	30.07.06 ar	16.09.06 **car**
GG	21.07.06	cow	ow		
GG	21.07.06	meow	eow		
GG	21.07.06	Mackenzie	Mac		
GG	21.07.06	hat	at	26.08.06 at	
GG	21.07.06	hot	ot	26.08.06 ot	
GG	21.07.06	toes	doos		
GG	30.07.06	bus	**bus**	16.09.06 **bus**	
GG	30.07.06	neenow	**neenow**		
GG	30.07.06	Chris	iss		
GG	01.08.06	oh dear	oh da		
GG	01.08.06	apple	abble		
GG	01.08.06	orange	**orange**	06.09.06 worwange	
GG	09.08.06	wee wee	**wee wee**		
GG	09.08.06	bum bum	**bum bum**		
GG	09.08.06	poo poo	**poo poo**		
GG	10.08.06	yes	yeh	05.10.06 eeh	
GG	10.08.06	help	elp		
GG	26.08.06	wet	**wet**		
GG	26.08.06	where's the rabbit?	wer wabbit		
GG	26.08.06	chocolate (3)	coclat		
GG	26.08.06	shower	ower		
GG	26.08.06	Charlie	**Charlie**		
GG	26.08.06	wet wipes	**wet wipes**		
GG	26.08.06	bin	**bin**		
GG	26.08.06	bike	**bike**		
GG	26.08.06	nappy	appy		
GG	26.08.06	flower	wower		
GG	26.08.06	Spot	**Spot**		
GG	26.08.06	raining	raino	11.09.06 rainee	
GG	26.08.06	keys	**keys**		
GG	26.08.06	tea	**tea**		
GG	01.09.06	Phoebe	beebee	14.09.06 beebee	
GG	10.09.06	four	**four**		
GG	10.09.06	five	ive		

GG	10.09.06	six	ix	
GG	10.09.06	seven	**seven**	
GG	10.09.06	eight	**eight**	
GG	10.09.06	nine	dine	
GG	10.09.06	ten	**ten**	
GG	12.09.06	twinkle twinkle little star	inkle inkle ittkle ar	
GG	12.09.06	baa baa black sheep	aa, aa, ck, weep	
GG	16.09.06	lorry	orry	
GG	17.09.06	Christian	tristian	
GG	20.09.06	I know	I no	
GG	20.09.06	what happened?	wat ened	
GG	20.09.06	my turn	**my turn**	
GG	20.09.06	minute	minate	
GG	28.09.06	Danny	**Danny**	
GG	28.09.06	Ben	**Ben**	
GG	01.10.06	choppa choppa	**choppa choppa**	
GG	01.10.06	plane	ane	
GG	02.10.06	carrot	arrot	
GG	04.10.06	door	oor	
GG	04.10.06	bird	ird	
GG	04.10.06	cat	**cat**	
GG	04.10.06	yellow	ellow	
GG	07.10.06	bear	baa	
GG	09.10.06	boy	b<u>oo</u>y	
GG	09.10.06	milk	mulk	
GG	13.10.06	bubble	pabul	20.10.06 babul
GG	15.10.06	girl	garl	
GG	15.10.06	football	utbul	
GG	17.10.06	what's that?	was dat	
GG	17.10.06	that one	vat won	
GG	20.10.06	cake	dake	22.10.06 dake
GG	21.10.06	book	**book**	
GG	22.10.06	fall down	oll down	
GG	24.10.06	turning	tur	
GG	24.10.06	rabbit	**rabbit**	
GG	24.10.06	house	ouse	
GG	28.10.06	pants	bants	02.11.06 bants
GG	28.10.06	Dad	**Dad**	
GG	02.11.06	noisy	nosey	
GG	02.11.06	toilet	toilot	
GG	02.11.06	potty	**potty**	

HB	07.02.06	Mummy	muummee				
HB	07.02.06	Daddy	dada	24.03.06	Daddee		
HB	07.02.06	tractor	tat-tar	13.03.06	tat-tar		
HB	07.02.06	bye bye	ba bi				
HB	07.02.06	moo/cow	mumm				
HB	07.02.06	empty	e tee				
HB	07.02.06	quack quack	kac kac				
HB	07.02.06	muslin	muh-li	25.06.06	musley		
HB	07.02.06	nursery (2)	nuh-nee	12.05.06	nursey		
HB	07.02.06	cheers	chs				
HB	07.02.06	cheese	cheez				
HB	07.02.06	apple	apa				
HB	07.02.06	pear	per				
HB	07.02.06	banana	narna				
HB	07.02.06	teddy	tiddee				
HB	07.02.06	star	saa				
HB	07.02.06	William	Willeee	12.05.06	Willah		
HB	07.02.06	hiya	I yer				
HB	07.02.06	baby	babeee				
HB	07.02.06	chocolate (2)	koclart				
HB	07.02.06	Krispies	kisies				
HB	07.02.06	blueberry	bubee				
HB	07.02.06	ball	baw	03.07.06	bawl		
HB	07.02.06	upstairs	usair				
HB	07.02.06	that one	mat-ma				
HB	07.02.06	horse	ours				
HB	07.02.06	car	caa	01.05.06	tar		
HB	07.02.06	aeroplane	erpaey				
HB	07.02.06	teeth	teeethth				
HB	07.02.06	toast	towss				
HB	07.02.06	night night	ny ny				
HB	07.02.06	up	uup	30.07.06	op		
HB	07.02.06	bib	bi				
HB	07.02.06	glasses	garsa				
HB	07.02.06	yoghurt	agart	25.06.06	**yoghurt**		
HB	07.02.06	neigh	neee				
HB	07.02.06	open it	ope ii	03.07.06	oper dit		
HB	07.02.06	eat it	y ii				
HB	10.02.06	clock	coc				
HB	13.02.06	plate	poey	13.04.06	payte		
HB	13.02.06	berry	bewwee				
HB	13.02.06	milk	mul	01.05.06	mulk		
HB	13.02.06	light	nye				
HB	13.02.06	potato	tay-ow				
HB	13.02.06	bean	bee				
HB	13.02.06	helicopter	ho-ter				
HB	13.02.06	Dizzy	di-hee	18.04.06	dissee		
HB	25.02.06	biscuit	ti-tic				
HB	25.02.06	drink	ding	18.04.06	dink	03.07.06	bink/dink

HB	25.02.06	mouth	moww	13.04.06	moww	05.12.06	mowf	
HB	25.02.06	sneeze	seeze					
HB	25.02.06	onion	owow	12.05.06	oniah			
HB	13.03.06	horsie	arsee					
HB	13.03.06	hello	ullow	13.04.06	hullow			
HB	13.03.06	trailer	layler					
HB	13.03.06	nose	know					
HB	13.03.06	clip clop	ci-coe					
HB	24.03.06	pasta	papher	18.04.06	patha			
HB	24.03.06	butter	bupper					
HB	24.03.06	track	tatt					
HB	24.03.06	gate	date					
HB	24.03.06	sheep	tsheet	18.04.06	sheet			
HB	24.03.06	please	teese	13.04.06	teese	13.06.06	peese	
HB	13.04.06	bubble	bubbawl					
HB	13.04.06	Apple Tree Farm	app-ee-faa					
HB	13.04.06	hair	ahr					
HB	13.04.06	cow	koowww					
HB	13.04.06	cake	cayke					
HB	13.04.06	close	clowse					
HB	13.04.06	rabbit	wubit					
HB	13.04.06	sorry	fwowwy					
HB	13.04.06	gently	detlee					
HB	13.04.06	thank you	ta-doo	12.05.06	dattou	13.06.06	tak you	tank ou
HB	13.04.06	get down	gedow	12.05.06	detdow			
HB	13.04.06	flower	fowler					
HB	13.04.06	hot cross bun	ho-bu-bar					
HB	13.04.06	hot cross bun	ho-ba-baa					
HB	13.04.06	Bob the Builder	Bobba					
HB	13.04.06	taxi	tacksee					
HB	13.04.06	petrol	pet-thol					
HB	13.04.06	chew	too					
HB	13.04.06	kiss	tiss	30.07.06	tiss			
HB	13.04.06	rubbish	wubbish					
HB	13.04.06	shoe	showw					
HB	13.04.06	boots	boot-ths					
HB	18.04.06	digger	deeder					
HB	18.04.06	picture	pitchure					
HB	18.04.06	head	hea					
HB	18.04.06	juice	doose					
HB	18.04.06	face	thace					
HB	18.04.06	upside down	ut-thy-dow	05.12 06	ut-thy			
HB	18.04.06	page	paythe					
HB	23.04.06	bump	bup					
HB	23.04.06	bite	bidte					
HB	23.04.06	kick	kiy					
HB	23.04.06	push	puss					
HB	23.04.06	pushchair	puthair					
HB	23.04.06	steady	seaddee					
HB	27.04.06	sticker	seedar	03.07.06	sicker			

HB	27.04.06	socks	thox	05.12.06	thox
HB	27.04.06	keys	teys		
HB	27.04.06	raisins	weyser		
HB	01.05.06	cat	tat		
HB	01.05.06	satsuma	thsatsuda		
HB	01.05.06	bicycle	byssell		
HB	01.05.06	peach	peats		
HB	01.05.06	spider	sider		
HB	01.05.06	fish	fith		
HB	01.05.06	Thomas	Tadass		
HB	06.05.06	tomatoes	matoes		
HB	06.05.06	cucumber	wuwuda/dudada		
HB	06.05.06	more	mor		
HB	06.05.06	strawberry	fawby	25.06.06	fawby
HB	12.05.06	lorry	wowwy		
HB	12.05.06	Grandad	Daidad		
HB	12.05.06	I want to	A do deh		
HB	12.05.06	giraffe	warff		
HB	13.06.06	cream on	peem on		
HB	13.06.06	Louie	Woowee		
HB	21.06.06	transporter	fu-for-ther		
HB	21.06.06	broken	boker	07.07.06	boker
HB	21.06.06	help me	howl pee		
HB	25.06.06	smoothie	foovey		
HB	25.06.06	like it	**like it**		
HB	25.06.06	apple juice	apper doose		
HB	25.06.06	book	**book**		
HB	25.06.06	play dough	pay do	04.08.06	pay dough
HB	25.06.06	I dropped it	ah bopped it		
HB	25.06.06	swimmin'	fimmin		
HB	25.06.06	washing machine	wassy seen		
HB	03.07.06	van	ban		
HB	03.07.06	I'm sleeping	ah feepin		
HB	03.07.06	Where's Daddy gone?	der daddy-dohn		
HB	03.07.06	seagull	thegul		
HB	03.07.06	sea	ssea		
HB	03.07.06	beach	beats		
HB	03.07.06	scissors	**scissors**		
HB	03.07.06	broccoli	boccley		
HB	03.07.06	shorts on	sortzon		
HB	03.07.06	accident	axcsnent		
HB	03.07.06	swing	fing		
HB	03.07.06	garlic bread	garlic bed		
HB	03.07.06	spoon	foon		
HB	03.07.06	hiding	haidin		
HB	03.07.06	tap on	papon		
HB	07.07.06	again	den		
HB	07.07.06	lunch	nunch		
HB	07.07.06	cuddle	tuddle		
HB	07.07.06	music	dusi(c)		

HB	07.07.06	put it on the table	puh-ih-pable					
HB	07.07.06	broken it	boker dit					
HB	30.07.06	bee	bebuzz					
HB	30.07.06	what's that?	wassat					
HB	30.07.06	ice cream	Ipeam					
HB	30.07.06	another one	nunna one	18.08.06	anunna one	05.12.06	nother one	
HB	30.07.06	policeman	peesema					
HB	04.08.06	brick	bic					
HB	04.08.06	can't do it	carn woo it					
IG	12.12.05	cat	ka	27.12.05	kak			
IG	26.12.05	Mummy	mama					
IG	02.01.06	quack	kak					
IG	19.01.06	Daddy	dada	01.10.06	**Daddy**			
IG	03.02.06	yes	ess	27.07.06	ess			
IG	10.02.06	here you are	e-ya					
IG	13.02.06	Cass	gas					
IG	15.02.06	car	**car**	29.07.06	**car**	15.09.06	**car**	
IG	28.04.06	dolly	doh-ee	29.06.06	**dolly**	06.11.06	**dolly**	
IG	17.05.06	Grandad	gog gog	24.06.06	ga ga	07.08.06	ga ga gan da	0
IG	17.05.06	rabbit	a-bit					
IG	20.05.06	Lizzie	is					
IG	24.06.06	tractor	ca ca	11.10.06	tactor			
IG	01.07.06	helicopter	cock-cor	11.10.06	cock tor			
IG	05.07.06	Cassian	ca coo	01.11.06	Cac hian			
IG	06.08.06	spoon	boo-aer	07.11.06	pen			
IG	07.08.06	more	mowa					
IG	07.08.06	Nanny	**Nanny**					
IG	07.08.06	Lettie	le-twn	07.11.06	**Lettie**			
IG	15.09.06	horse	hor					
IG	15.09.06	pig	pee					
IG	15.09.06	Pat	paa	07.11.06	**Pat**			
IG	30.09.06	money	myeee					
IG	01.10.06	I want more bread	I wan more bed					
IG	02.10.06	Jess	**Jess**					
IG	08.10.06	puppy	**puppy**					
IG	08.10.06	hair	**hair**					
IG	08.10.06	door	**door**					
IG	08.10.06	bag	baag					
IG	09.10.06	now	**now**					
IG	09.10.06	done	**done**					
IG	09.10.06	boat	booat					
IG	09.10.06	back	baak					
IG	11.10.06	horsie	horhey					
IG	11.10.06	hello	**hello**					
IG	01.11.06	Granny	grayee					
IG	01.11.06	apple	**apple**					
IG	01.11.06	cup	**cup**					
IG	01.11.06	hat	haat					
IG	02.11.06	line up	lie up					
IG	02.11.06	juice	joose [z]					

IG	06.11.06	jump	**jump**		
IG	07.11.06	cucumber	cum an		
IG	07.11.06	hand	han		
IG	07.11.06	finger	bingal		
IG	07.11.06	nose	no		
IG	07.11.06	beard	be-ar		
IG	07.11.06	head	**head**		
IG	07.11.06	pen	pen na		
IG	07.11.06	paper	pap ayh		
IG	07.11.06	here	**here**		
IG	07.11.06	fork	fuck		
IG	07.11.06	raisins	ray an		
IG	07.11.06	thank you	ta too		
IG	07.11.06	down	dower		
IG	07.11.06	yellow	lellow		
JG	29.11.05	hello	her-o		
JG	29.11.05	boys	baz		
JG	29.11.05	night night	nah nah		
JG	29.11.05	Mummy	mum-mum	02.07.06	**Mummy**
JG	29.11.05	Daddy	dah-dah	02.07.06	**Daddy**
JG	29.11.05	Freddie	ey-ee		
JG	10.12.05	more	**more**		
JG	27.12.05	milk	mik	09.05.06	mik
JG	13.01.06	one more	mon more		
JG	13.01.06	hiya	**hiya**		
JG	01.02.06	woof woof	**woof woof**		
JG	19.04.06	duck	duc		
JG	21.04.06	bird	bir		
JG	21.04.06	bath	bat		
JG	09.05.06	sheep	shee		
JG	09.05.06	beaker of milk	beak mik		
JG	11.05.06	here you are	hereyoure		
JG	12.05.06	bye	**bye**		
JG	18.05.06	Tigger	**Tigger**		
JG	23.05.06	spoon	poon		
JG	23.05.06	breakfast	be be		
JG	23.05.06	poo	**poo**		
JG	23.05.06	no more	na more		
JG	02.06.06	nappy	na-hee		
JG	01.07.06	spider	bidey		
JG	01.07.06	car	**car**		
JG	07.'06	down	dow		
JG	07.'06	house	hows		
JG	07.'06	horse	hors		
JG	07.'06	choo choo	**choo choo**		
JG	07.'06	ball	**ball**		
JG	07.'06	Julia	ujuia	09.'06	**Julia**
JG	08.'06	baa baa black sheep	baa baa		
JG	08.'06	how I wonder	howIwonder		
JG	08.'06	happy birthday to you	happy to you		

JG	09.'06	Daddy's car	Daddy car		
JG	09.'06	Julia's car	**Julia's car**		
JG	09.'06	Julia's book	**Julia's book**		
JG	09.'06	go bounce	**go bounce**		
JG	09.'06	ham	**ham**		
JG	09.'06	school	skoo	beg 11.06	kool
JG	09.'06	fork	hork		
KB	07.03.06	dog	**dog**		
KB	08.03.06	Daddy	dadda		
KB	08.03.06	up	yup-yup		
KB	10.03.06	Mumma	**Mumma**		
KB	13.03.06	cow	k		
KB	20.03.06	cars	**cars**		
KB	22.05.06	bye bye	**bye bye**		
KB	01.06.06	baby	bebe		
KB	11.06.06	bash	bah		
KB	11.06.06	down	dah	21.11.06	**down**
KB	14.06.06	key	**key**		
KB	14.06.06	no	**no**		
KB	14.06.06	mine	**mine**		
KB	16.06.06	tea	**tea**		
KB	16.06.06	teddy	tiddy		
KB	03.07.06	bye bye car	**bye bye car**		
KB	04.07.06	bye bye Dadda	**bye bye Dadda**		
KB	06.06.06	hello	halla		
KB	19.07.06	please	peese		
KB	21.07.06	pool	pul	10.08.06	**pool**
KB	04.08.06	ball	**ball**		
KB	05.08.06	blue	bue		
KB	10.08.06	Nanny	nanna		
KB	13.08.06	red car	reh car		
KB	06.09.06	knee	**knee**		
KB	21.09.06	house	hou		
KB	23.09.06	tree	chee		
KB	24.09.06	Kit	ki	18.10.06	**Kit**
KB	26.09.06	cheese	chee		
KB	28.09.06	hat	hah	02.10.06	**hat**
KB	28.09.06	poo	**poo**		
KB	29.09.06	cold	col(d)		
KB	29.09.06	Nanna	**Nanna**		
KB	30.09.06	book	boo(k)		
KB	30.09.06	postman	pah-tah		
KB	30.09.06	digger	dig-dig		
KB	01.10.06	door	**door**		
KB	05.10.06	night night	nigh-nigh		
KB	08.10.06	biscuit	bid-gi(t)		
KB	15.10.06	me	**me**		
KB	18.10.06	shoe	**shoe**		
KB	18.10.06	wall	**wall**	22.10.06	**wall**
KB	18.10.06	Bertie	tee		

KB	19.10.06	gone	gor	01.12.06	**gone**		
KB	22.10.06	cool	**cool**				
KB	22.10.06	tall	**tall**				
KB	01.11.06	tractor	chactah				
KB	02.11.06	stick	stii				
KB	07.11.06	goal	**goal**				
KB	07.11.06	more	**more**				
KB	09.11.06	garden	tarten				
KB	09.11.06	tick tock	tic(k)-ta(k)				
KB	14.11.06	pig	**pig**				
KB	14.11.06	help	hel(p)				
KB	16.11.06	rain	ray				
KB	21.11.06	kick	**kick**				
KB	21.11.06	bike	by				
KB	30.11.06	roll	**roll**				
KB	30.11.06	moon	**moon**				
KB	02.12.06	milk	muk				
KB	02.12.06	yes	yah				
KB	03.12.06	wee wee	**wee wee**				
KB	04.12.06	another	nother				
KB	05.12.06	Humphrey	hoo-ha				
KB	06.12.06	Harvey	ha-hee				
KB	06.12.06	hair	**hair**				
KB	06.12.06	whoosh	**whoosh**				
LB	21.01.06	drink	uunk				
LB	22.01.06	Mummy	mummum	05.06.06	mumma	18.06.06	mum mum mummee
LB	22.01.06	Daddy	dadada	05.06.06	daddeee		
LB	18.04.06	bird/garden	bep				
LB	05.05.06	banana	nanananan	18.08.06	yayayaya		
LB	05.05.06	yes	yehyehyeh	23.11.06	yesh		
LB	05.06.06	bug	buh	02.10.06	buh		
LB	16.06.06	me	memememe				
LB	01.07.06	car	ca				
LB	16.07.06	bing bong	bee-bow				
LB	18.08.06	hook	hooh	27.11.06	**hook**		
LB	21.08.06	ball	boo	25.10.06	boorl		
LB	21.08.06	egg	eh	25.08.06	eh	23.11.06	eck
LB	25.08.06	hole	**hole**	23.11.06	**hole**		
LB	25.08.06	hat	haht				
LB	31.08.06	home	**home**				
LB	31.08.06	bottle	bo	14.09.06	bo		
LB	04.09.06	brown	brow				
LB	04.09.06	playdoh	yahyo				
LB	05.09.06	juice	goo				
LB	08.09.06	bowl	bow				
LB	09.09.06	bye bye	ba ba	24.10.06	bu bye	12.11.06	**bye bye**
LB	09.09.06	heart	harht				
LB	09.09.06	moon	mooo	27.11.06	**moon**		
LB	14.09.06	high	hay				
LB	17.09.06	W (alphabet)	dahdoo				

LB	17.09.06	Bugs Bunny	buh			
LB	17.09.06	Sue	hoooo			
LB	17.09.06	wee wee	**wee wee**			
LB	25.09.06	happy	happeee			
LB	25.09.06	hand	**hand**			
LB	25.09.06	please	peeees [z]			
LB	25.09.06	poppy	**poppy**			
LB	25.09.06	Diane	ya ya			
LB	25.09.06	Simba	hum hah			
LB	25.09.06	thank you	hah dad			
LB	25.09.06	tip out	teee toh	28.10.06	titto	
LB	25.09.06	bar	baah			
LB	29.09.06	hanger	hanna			
LB	29.09.06	shoe	hoo			
LB	29.09.06	heel	heeee			
LB	02.10.06	big	beeeg			
LB	02.10.06	onion	anna	20.10.06	aaarn	
LB	02.10.06	ham	**ham**			
LB	02.10.06	butter	bubba			
LB	02.10.06	monkey	mee-ha	20.10.06	meeha	
LB	02.10.06	Pocoyo	dada	23.11.06	Da Da	
LB	02.10.06	snake	sssss			
LB	02.10.06	butterfly	buh	20.10.06	buh	27.11.06 butter
LB	05.10.06	Marmite	marma	06.11.06	mami	
LB	05.10.06	Elmer	**Elmer**			
LB	05.10.06	Eeyore	Eeyor			
LB	06.10.06	here	heah			
LB	06.10.06	seat	seeet			
LB	06.10.06	beast	beeest			
LB	06.10.06	beer	**beer**			
LB	15.10.06	hoover	hooah			
LB	15.10.06	Auntie Allison	Ada			
LB	15.10.06	Uncle John	ugah			
LB	15.10.06	bottle	bo			
LB	20.10.06	house	hof			
LB	20.10.06	Andy	**Andy**			
LB	20.10.06	on	aaarn	23.11.06	**on**	
LB	20.10.06	off	uff	23.11.06	arf	28.11.06 af
LB	20.10.06	pumpkin	meeha			
LB	20.10.06	no	nooo			
LB	20.10.06	blue	boooo			
LB	20.10.06	red	yeh	05.11.06	yacht	
LB	20.10.06	hippo	hubbah	27.11.06	hippoo	
LB	24.10.06	Oscar	Agah	28.10.06	Oggie	
LB	24.10.06	Theo	Heeho	28.10.06	Heeo	
LB	24.10.06	dark	dak			
LB	24.10.06	light	eyat			
LB	25.10.06	man	**man**			
LB	26.10.06	meatballs	mitboos			
LB	26.10.06	apple	appul			

LB	26.10.06	bank	bats	
LB	26.10.06	shower	ower	
LB	27.10.06	fish	isht	
LB	27.10.06	Granny	anny	
LB	27.10.06	Ray	rah	
LB	28.10.06	open	ober	
LB	28.10.06	purple	pupel	
LB	28.10.06	white	yat	
LB	31.10.06	honey	huneee	
LB	31.10.06	Homebase	humbis	
LB	31.10.06	black	baht	
LB	05.11.06	soup	hoopee	
LB	05.11.06	bear	buh	
LB	06.11.06	bath	baah	
LB	06.11.06	Julia	Donah	
LB	06.11.06	mango	mano	
LB	12.11.06	hello	hehro	
LB	12.11.06	yellow	rehro	
LB	12.11.06	hi	**hi**	
LB	12.11.06	salty	houbee	
LB	12.11.06	Emily	emeee	
LB	12.11.06	wash	woʒ	
LB	14.11.06	orange	ngng	
LB	14.11.06	the gym	beebee	
LB	14.11.06	more	**more**	
LB	14.11.06	bang	bahn	
LB	14.11.06	lights	ya ychts	
LB	23.11.06	new way	noo wah	
LB	23.11.06	school	hoooo	
LB	23.11.06	star	**star**	
LB	23.11.06	Thomas	umash	
LB	23.11.06	Natasha	shsh	
LB	23.11.06	up	**up**	
LB	23.11.06	down	darn	27.11.06 **down**
LB	27.11.06	Asda	Asha	
LB	27.11.06	upstairs	upstes [s]	
LB	27.11.06	train	tren	
LB	27.11.06	oh dear	**oh dear**	
LB	27.11.06	tape measure	mesh mesh	
LB	27.11.06	balloon	baboon	
LB	27.11.06	arrow	aroh	
LB	27.11.06	help	hep	
LB	27.11.06	woof woof	ouff ouff	
LB	28.11.06	circle	saggoh	
LB	28.11.06	pop up	papap	
LB	28.11.06	run off	run af	
LB	28.11.06	pocket	pohy	

NB	03.'06	please	peas		
NB	03.'06	thank you	hunk-koo	beg 11.06 hank you	
NB	03.'06	Ruby	ooo-bee	beg 04.06 boobee	ooobee oo-bee
NB	03.'06	hello	ay-yo	mid 09.06 hel-lo	
NB	beg 04.06	there she is	daresheez		
NB	beg 04.06	blue	boo		
NB	beg 04.06	fish	isch isch		
NB	end 04.06	Balamory	ay-yat-or-eee	beg 05.06 ala-or-ee	
NB	end 04.06	happy birthday to you	abby-birday-oo-oo		
NB	end 04.06	juice	yoose		
NB	beg 05.06	down	own (rhyme with 'noun')	26.10.06 **down**	
NB	beg 05.06	bye bye	**bye bye**		
NB	beg 05.06	Daddy	addy	beg 06.06 daddee	
NB	beg 05.06	Mummy	mummeee	mid 06.06 mummee	**Mummy**
NB	beg 05.06	no	no no no		
NB	beg 06.06	where('s)	air	beg 10.06 air	
NB	beg 06.06	bubble	bub-baw		
NB	beg 06.06	moon	moo		
NB	mid 06.06	hooray	hoo-ay		
NB	mid 06.06	spider	pyeder	beg 07.06 di-der	
NB	mid 06.06	want the bubbles	wan-bub-baw		
NB	mid 06.06	bubbles	bub-baw		
NB	mid 06.06	turtle	tar-taw		
NB	end 06.06	tomato	er-mar-ho		
NB	end 06.06	hippo	hip-bow		
NB	beg 07.06	cup of tea?	cub ow dee?		
NB	beg 07.06	tiger	di-ger		
NB	beg 07.06	finished	ee-ish		
NB	mid 07.06	teeth	tee		
NB	mid 07.06	Alex	al-ec		
NB	end 07.06	ice cream	ise-reem/eyech-deem		
NB	end 07.06	ice cream	ise deem		
NB	end 07.06	again	a-dain/dain/gain		
NB	end 07.06	yes	yeh		
NB	beg 08.06	elephant	eh-hunt		
NB	beg 08.06	Susie	shu-shie		
NB	beg 08.06	apple	ah-paw		
NB	beg 08.06	dinosaur	dine-odower		
NB	mid 08.06	don't want to do it	doe-wan-tit		
NB	mid 08.06	don't like it	doe-like-tit/doe-like-ik		
NB	mid 09.06	zebra	beb-rah		
NB	beg 10.06	what's that called?	wa-dat-cawl?		
NB	beg 10.06	rocket	wor-kick		

NB	beg 10.06	where are the rice cakes?	air ice-take?		
NB	beg 10.06	triceratops	tri-hera-pops		
NB	mid 10.06	sorry	orree		
NB	mid 10.06	I've knocked it over	ock-ik-over		
NB	mid 10.06	this way	iss way		
NB	26.10.06	fallen down	fallin down		
NB	end 10.06	light on	light orn		
NB	end 10.06	watch Mummy	wats/waps Mummy		
NB	end 10.06	tunnel	hun-nawl		
OG	20.01.06	who's that?	wooszat		
OG	20.01.06	what's that?	watzat		
OG	20.01.06	Mum	**Mum**		
OG	20.01.06	hello	edo		
OG	31.01.06	Aaron	ara	30.09.06 aarol	
OG	23.03.06	ta	**ta**		
OG	23.03.06	yeah	yer		
OG	19.04.06	dog	dor		
OG	22.04.06	Nan	na		
OG	22.04.06	Dad	da		
OG	03.06.06	teddy	**teddy**		
OG	03.06.06	no	**no**		
OG	03.06.06	Daddy	**Daddy**		
OG	06.06.06	bus	ba		
OG	15.06.06	bye	**bye**		
OG	18.06.06	bum	**bum**		
OG	18.08.06	bath	bar		
OG	18.08.06	oh no	o no		
OG	18.08.06	door	dor	30.09.06 **door**	
OG	18.08.06	goal	**goal**		
OG	21.08.06	mine	my	01.10.06 **mine**	
OG	21.08.06	wet	wer	30.09.06 **wet**	
OG	25.08.06	gone	gon		
OG	25.09.06	airplane	airpain		
OG	30.09.06	Charley	char	02.10.06 diday	05.10.06 char
OG	30.09.06	Brooke	Broe		
OG	30.09.06	all gone	**all gone**		
OG	30.09.06	juice	**juice**		
OG	30.09.06	hat	at		
OG	30.09.06	bye bye	**bye bye**		
OG	01.10.06	fish	**fish**	15.10.06 **fish**	
OG	01.10.06	duck	du	15.10.06 dar	
OG	01.10.06	shoe	shooz		
OG	01.10.06	more	mor		
OG	01.10.06	all wet	al wet		
OG	01.10.06	baby	**baby**	31.10.06 bayie	
OG	01.10.06	night night	**night night**		
OG	01.10.06	again	gen		
OG	02.10.06	spoon	boon		
OG	02.10.06	poo	**poo**		
OG	02.10.06	wee	**wee**		

OG	02.10.06	hot	ott	
OG	03.10.06	clock	got	
OG	05.10.06	what	wat	
OG	12.10.06	yes please	yer peaz	16.11.06 er peaz
OG	15.10.06	banana	nana	
OG	15.10.06	phone	bone	
OG	15.10.06	brush	**brush**	
OG	15.10.06	ball	**ball**	
OG	15.10.06	quack quack	wack wack	
OG	16.10.06	boo	**boo**	
OG	16.10.06	bow	**bow**	
OG	21.10.06	four	**four**	24.11.06 **four**
OG	22.10.06	wow	**wow**	
OG	22.10.06	five	fir	
OG	22.10.06	six	shick	24.11.06 **six**
OG	23.10.06	sweet	weet	
OG	27.10.06	nice	**nice**	
OG	27.10.06	help	elp	25.11.06 elp
OG	27.10.06	dry	**dry**	
OG	27.10.06	tomato	marla	
OG	29.10.06	grape	**grape**	
OG	29.10.06	rain	wain	
OG	29.10.06	raining	waining	26.11.06 raning
OG	29.10.06	biscuit	bickit	
OG	29.10.06	ready	rvery	
OG	29.10.06	bottle	bott	
OG	31.10.06	song	**song**	
OG	31.10.06	ham	**ham**	
OG	31.10.06	move	moo	29.12.06 moo
OG	01.11.06	woof woof	woo woo	
OG	01.11.06	meow	**meow**	
OG	01.11.06	small	mall	
OG	16.11.06	Noddy	**Noddy**	
OG	16.11.06	train	**train**	
OG	16.11.06	morning	orning	20.11.06 **morning**
OG	17.11.06	toast	toas	
OG	20.11.06	Fifi	**Fifi**	
OG	20.11.06	flower	**flower**	
OG	23.11.06	boy	**boy**	
OG	24.11.06	two	**two**	
OG	24.11.06	nine	**nine**	
OG	25.11.06	help me	elp me	
OG	26.11.06	pouring	poring	
OG	26.11.06	mind	mine	
OG	27.11.06	feet	**feet**	
OG	01.12.06	hand	**hand**	
OG	01.12.06	yellow	**yellow**	
OG	01.12.06	Mummy	**Mummy**	
OG	02.12.06	three	fee	
OG	04.12.06	colour	car	

OG	04.12.06	pen	**pen**
OG	12.12.06	okay	**okay**
OG	12.12.06	what's happening?	wat apning
OG	13.12.06	come	**come**
OG	16.12.06	animal	anmal

QB	06.04.06	Mummy	**Mummy**	01.05.06	mumma	06.07.06	**Mummy**		
QB	06.04.06	cat	dat	04.05.06	dat	30.05.06	dat	06.09.06	t/sat
QB	06.04.06	hat	at	09.06.06	at	01.08.06	**hat**		
QB	06.04.06	Holly	obby (soft 'b')	30.05.06	obby	09.06.06	orry	13.06.06	olly
QB	06.04.06	nunight	nunigh	09.06.06	**nunight**				
QB	06.04.06	Bob	**Bob**						
QB	06.04.06	more	mih	12.06.06	**more**				
QB	06.04.06	down	dow/**down**	01.05.06	dow	09.06.06	**down**		
QB	06.04.06	broccoli	bodee	01.05.06	broli	14.06.06	brocli		
QB	06.04.06	cheese	deess	07.04.06	teess	01.08.06	**cheese**		
QB	06.04.06	hot	ot	09.06.06	ot	01.08.06	**hot**		
QB	06.04.06	toast	dose						
QB	06.04.06	sky	die						
QB	06.04.06	heavy	ery						
QB	06.04.06	apple	abbul	01.05.06	abbel	07.06.06	**apple**		
QB	06.04.06	banana	narna	27.09.06	**banana**				
QB	06.04.06	door	**door**						
QB	06.04.06	milk	mot/tch	01.05.06	moot	11.05.06	mot	mook	mulk **milk**
QB	06.04.06	bike	bat/tch	03.06.06	bite	24.06.06	**bike**		
QB	06.04.06	car	dah						
QB	06.04.06	choo-choo	doo-doo						
QB	06.04.06	Daddy	**Daddy**	01.05.06	dadda	19.09.06	**Daddy**		
QB	06.04.06	ball	baw	01.05.06	baw	01.08.06	**ball**		
QB	06.04.06	cuddle	duddle	09.06.06	duddle				
QB	06.04.06	shoe(s)	schus						

			none				
QB	06.04.06	gnome	(rhymes with 'phone')	09.06.06	**gnome**		
QB	06.04.06	fish	wish	09.06.06	wish	13.08.06	**fish**
QB	06.04.06	bath	barp/bart	26.04.06	barsh		
QB	06.04.06	doggie	doddie	02.08.06	**doggie**		
QB	06.04.06	miaow	mow				
QB	06.04.06	duck	dut	01.05.06	dut	24.06.06	**duck**
QB	06.04.06	raining	redin/raidin/rainin	09.06.06	rainin		
QB	06.04.06	bubble	**bubble**				
QB	06.04.06	teeth	dees				
QB	06.04.06	feet	weet	09.06.06	weet		
QB	06.04.06	quack quack	wa-wa	09.06.06	wak-wak		
QB	06.04.06	neigh	**neigh**				
QB	06.04.06	woof	oof	09.06.06	oof		
QB	06.04.06	star	dar	09.06.06	dar		
QB	06.04.06	teddy	deddy	09.06.06	**teddy**		
QB	06.04.06	owl	ow	27.04.06	own (rhymes with 'gown')	09.06.06	ow
QB	06.04.06	clock	fthlock (exaggerated 'th')	01.05.06	fthlock	09.06.06	flock

QB	06.04.06	gone	don	01.05.06	don	19.09.06	**gone**	
QB	07.04.06	drink	dis	02.07.06	dis	13.08.06	dink	
QB	07.04.06	bib	bit	09.06.06	**bib**			
QB	07.04.06	Maisy	maitit	10.04.06	maisit	01.05.06	**Maisy**	**Maisy**/maitit
QB	07.04.06	Noddy	nonny	10.05.06	nonny	10.06.06	**Noddy**	
QB	07.04.06	bucket	bu-tit	01.05.06	budet	09.06.06	**bucket**	
QB	07.04.06	grapes	rits	09.06.06	rits	20.07.06	rapes	
QB	07.04.06	goodbye	bu-bye					
QB	07.04.06	baby	**baby**	01.05.06	babba			
QB	07.04.06	bin	**bin**					
QB	07.04.06	bee	**bee**					
QB	07.04.06	round and round	roun roun					
QB	07.04.06	book	boot	09.06.06	boot	30.07.06	**book**	
QB	07.04.06	bottle	bot-bot	01.05.06	bottock	06.06.06	**bottle**	
QB	07.04.06	balloon	boon	07.08.06	**balloon**			
QB	08.04.06	bed	bet	09.06.06	**bed**			
QB	08.04.06	Ampanman	amman					
QB	08.04.06	man	mam	28.07.06	**man**			
QB	09.04.06	pram	pam					
QB	09.04.06	park	bart	09.06.06	bart	01.08.06	**park**	
QB	10.04.06	pig	p/bits	09.06.06	wig	10.07.06	**pig**	
QB	10.04.06	phone	rone	09.06.06	rone	11.07.06	**phone**	
QB	12.04.06	on	**on**					
QB	12.04.06	mouse	mas/mous/**mouse**	09.06.06	mas			
QB	12.04.06	shake it	she-tit	09.06.06	shet it			
QB	12.04.06	cluck cluck	fthluck fthluck					
QB	12.04.06	chocolate (2)	fthlolot	09.06.06	dodock	10.06.06	dok dok	
QB	12.04.06	batteries	battees/batis					
QB	12.04.06	swing	win	12.06.06	wing			
QB	12.04.06	noise	nos/**noise**	24.04.06	**noise**			
QB	12.04.06	cup	du	01.05.06	du	09.06.06	dup	
QB	12.04.06	spoon	boon	09.06.06	boon			
QB	12.04.06	heart	art					
QB	12.04.06	water	or wer/aw-wa	09.06.06	orwa	26.08.06	**water**	
QB	12.04.06	washing machine	washee-er	09.06.06	washer			
QB	12.04.06	knife	nice	09.06.06	nice			
QB	12.04.06	ticket	didit					
QB	14.04.06	Grandad	wadat	09.06.06	radat			
QB	14.04.06	box	bot	17.05.06	bot			
QB	15.04.06	bread	ret(d)	09.06.06	bed			
QB	16.04.06	train	tane	09.06.06	tain	27.08.06	**train**	
QB	16.04.06	bus	**bus**					
QB	19.04.06	mango	manan	11.07.06	**mango**			
QB	19.04.06	horsie	orzy	09.06.06	orsie			

QB	20.04.06	arm	am/ars					
QB	20.04.06	tomato	martis	20.05.06	martow	27.09.06	**tomato**	
QB	20.04.06	sock	sot	01.05.06	sot	09.06.06	**sock**	
QB	20.04.06	dish	dis					
QB	20.04.06	CD	DD	02.08.06	**CD**			
QB	22.04.06	orange	orij	18.05.06	orin	09.06.06	orin	
QB	22.04.06	mess	**mess**					
QB	22.04.06	chicken	diddin	09.06.06	diddin	01.08.06	**chicken**	
QB	22.04.06	chair	dare	09.06.06	dere	06.07.06	tair	
QB	22.04.06	saucer	cicer					
QB	24.04.06	upstairs	u-stairs	09.06.06	ustairs			
QB	24.04.06	boy	**boy**					
QB	25.04.06	rabbit	radit	23.05.06	radit			
QB	26.04.06	dinner	**dinner**					
QB	26.04.06	up	**up**					
QB	27.04.06	tortoise	totes					
QB	27.04.06	Eddie	**Eddie**					
QB	27.04.06	elephant	eris	09.06.06	eris	11.07.06	e-phant	
QB	29.04.06	hello	a-wo/a-llo	01.05.06	allo	09.06.06	**hello**	
QB	29.04.06	sun	**sun**					
QB	01.05.06	red	**red**					
QB	01.05.06	money	**money**					
QB	01.05.06	Asher	ada	08.05.06	adda	02.07.06	**Asher**	
QB	01.05.06	light	lat	18.05.06	let/**light**	10.06.06	**light**	
QB	01.05.06	monkey	money	04.06.06	**monkey**			
QB	01.05.06	tummy	mummy	13.05.06	money	11.07.06	**tummy**	
QB	01.05.06	paper	bidat	18.05.06	bayba	09.06.06	beba	**paper**
QB	02.05.06	Jack	dack					
QB	02.05.06	Serina	rina					
QB	02.05.06	outside	side/sad	09.06.06	side			
QB	02.05.06	sand	san	02.07.06	san			
QB	02.05.06	snake	nate	09.06.06	nate			
QB	02.05.06	lorry	loww(rr)y	09.06.06	lolly			
QB	04.05.06	cat's gone	dat don					
QB	04.05.06	cow	dow	09.06.06	dow			
QB	04.05.06	Elvis	Elris					
QB	04.05.06	Archie	Artie					
QB	06.05.06	lady	layly	06.06.06	**lady**			
QB	08.05.06	helicopter	o-do	10.07.06	ellicoter			
QB	09.05.06	post	bose					
QB	09.05.06	monster	mo-ter	09.06.06	monter			
QB	09.05.06	ready	rery	30.05.06	**ready**			
QB	09.05.06	hand	an	06.07.06	an	13.08.06	han	
QB	09.05.06	hoorah	ray					
QB	10.05.06	Noddy on	nonny on					
QB	11.05.06	Della	Bella					

QB	12.05.06	ring	rin				
QB	12.05.06	pen	b/**pen**	09.06.06	ben		
QB	12.05.06	stone	tone	09.06.06	done		
QB	12.05.06	sea	**sea**	05.06.06	**sea**		
QB	12.05.06	airplane	airpane				
QB	12.05.06	boat	**boat**				
QB	13.05.06	shopping	shoddin				
QB	13.05.06	please	p/bees	27.09.06	**please**		
QB	13.05.06	shorts on	sho-don				
QB	13.05.06	button	**button**				
QB	14.05.06	frog	rod	25.07.06	fog		
QB	15.05.06	I love you	lud oo	07.06.06	a lob u		
QB	18.05.06	yellow	lellow	03.06.06	lellow		
QB	18.05.06	pasta	da-da	09.06.06	dada		
QB	18.05.06	careful	de-dol	27.07.06	carefaw		
QB	20.05.06	toes	**toes**				
QB	20.05.06	wet	**wet**				
QB	20.05.06	rice	**rice**				
QB	20.05.06	puppet	**puppet**				
QB	20.05.06	clown	down				
QB	20.05.06	dancing	da-sin	09.06.06	dansin		
QB	20.05.06	Milo	wa wow	09.06.06	wawo		
QB	23.05.06	happy	abby	25.07.06	**happy**		
QB	23.05.06	six	**six**				
QB	23.05.06	seven	seden				
QB	23.05.06	Tyzer	tyser	13.06.06	tyser	04.08.06	**Tyzer**
QB	23.05.06	bear	**bear**				
QB	23.05.06	lion	lan	02.08.06	**lion**		
QB	23.05.06	again	den				
QB	23.05.06	splash	bas	09.06.06	bash		
QB	24.05.06	hanger	anna				
QB	24.05.06	drum	dum				
QB	24.05.06	lift	lit				
QB	25.05.06	minute	**minute**				
QB	27.05.06	peaches	beeshes				
QB	27.05.06	spin	pin				
QB	27.05.06	kettle	dedel	11.07.06	keddle		
QB	28.05.06	shadow	**shadow**				
QB	28.05.06	deer	**deer**				
QB	28.05.06	bouncy	ba-si				
QB	28.05.06	birdy	**birdy**				
QB	29.05.06	pizza	pissa				
QB	29.05.06	worm	wum				
QB	30.05.06	steady	deady				
QB	30.05.06	gosh	dosh				
QB	30.05.06	over	ower				
QB	01.06.06	letter	**letter**				
QB	01.06.06	sugar	suda				
QB	01.06.06	sheep	ship	24.06.06	ship		

QB	01.06.06	bath-time	ba-time	09.06.06	bardtime				
QB	01.06.06	snack	nack	05.07.06	nack				
QB	03.06.06	talking	talkin	10.07.06	talkin				
QB	04.06.06	tap	**tap**						
QB	04.06.06	swimming	wimmin	07.06.06	wimmin				
QB	05.06.06	cactus	dacdus						
QB	05.06.06	paddle	**paddle**						
QB	05.06.06	in there	nair						
QB	05.06.06	moon	**moon**						
QB	05.06.06	fly	ry						
QB	06.06.06	olive	olib						
QB	06.06.06	all day	aw day						
QB	06.06.06	digger	didder	14.06.06	**digger**				
QB	06.06.06	song	son						
QB	06.06.06	bang	ban						
QB	07.06.06	early	**early**						
QB	07.06.06	yes	ses						
QB	07.06.06	Daddy's	Daddy	14.06.06	Daddy	12.12.06	**Daddy's**		
QB	07.06.06	spider	pider						
QB	07.06.06	wee wee	**wee wee**						
QB	07.06.06	Tyzer's swinging	Tyser wing						
QB	07.06.06	2, 3, 4	do, tee, vor						
QB	07.06.06	been	**been**						
QB	07.06.06	leg	led						
QB	07.06.06	oh God	oh dod						
QB	07.06.06	shop	**shop**	02.07.06	**shop**				
QB	07.06.06	ice cream	ize deem						
QB	09.06.06	cereal	lilul	04.08.06	**cereal**				
QB	09.06.06	circle	certel	12.08.06	**circle**				
QB	09.06.06	bag	**bag**						
QB	09.06.06	beans	bean						
QB	09.06.06	bum	**bum**						
QB	09.06.06	cream	deam	02.07.06	deem				
QB	09.06.06	garden	darden	29.07.06	**garden**				
QB	09.06.06	hair	air						
QB	09.06.06	keys	dees						
QB	09.06.06	kiss	diss						
QB	09.06.06	Melly	menny						
QB	09.06.06	mouth	mous						
QB	09.06.06	music	musit	02.07.06	moosic	25.07.06	**music**		
QB	09.06.06	Nana	**Nana**						
QB	09.06.06	pea	**pea**						
QB	09.06.06	pear	bair						
QB	09.06.06	pigeon	piddin	02.07.06	piddin				
QB	09.06.06	window	widow	09.07.06	widow				
QB	09.06.06	willy	wiwwy						
QB	09.06.06	slide	side	15.06.06	lide	02.07.06	lide	27.09.06	side
QB	09.06.06	spade	pade						
QB	09.06.06	tail	**tail**						

QB	09.06.06	tree	tee				
QB	09.06.06	Tallulah	lullah				
QB	10.06.06	higher	igher	12.06.06	igher		
QB	10.06.06	neck	**neck**				
QB	10.06.06	camera	dama				
QB	10.06.06	hairy	airy				
QB	10.06.06	flies	rise				
QB	10.06.06	touch	tuts	02.07.06	tuts		
QB	11.06.06	nectarine	rectin	28.07.06	**nectarine**		
QB	11.06.06	tongue	dun				
QB	12.06.06	draught	darf				
QB	12.06.06	chess	dess				
QB	12.06.06	castle	darsel	24.06.06	**castle**		
QB	12.06.06	chin	din				
QB	12.06.06	towel	town				
QB	12.06.06	brush	bush				
QB	12.06.06	t-shirt	dee shirt				
QB	12.06.06	trousers	dowser				
QB	12.06.06	sticky	dicky				
QB	12.06.06	watch	wash				
QB	12.06.06	house	ouse	02.07.06	ouse	01.08.06	**house**
QB	12.06.06	table	tebel				
QB	12.06.06	nappy	nabby	02.07.06	**nappy**		
QB	13.06.06	windy	widi				
QB	13.06.06	shower	sawa	02.07.06	sower		
QB	13.06.06	kite	dite				
QB	13.06.06	Charlie	dali	02.07.06	dali		
QB	13.06.06	Mick	**Mick**				
QB	13.06.06	shell	s(h)ell				
QB	13.06.06	Mummy's	Mummy				
QB	13.06.06	head	ead				
QB	13.06.06	eyebrow	eyebow				
QB	14.06.06	shoes on	shoodon				
QB	14.06.06	woodlouse	woobub				
QB	15.06.06	ant	an	02.07.06	an		
QB	15.06.06	eat	**eat**				
QB	15.06.06	I see you	**I see you**				
QB	16.06.06	driving	davin				
QB	16.06.06	mice	**mice**				
QB	20.06.06	seaside	**seaside**				
QB	24.06.06	coffee	doffee				
QB	24.06.06	sandpit	sandpip				
QB	24.06.06	cake	dake	04.08.06	**cake**		
QB	26.06.06	drawing	dorin	02.07.06	dorwin		
QB	28.06.06	big	**big**				
QB	28.06.06	running	runnin	02.07.06	**running**		
QB	30.06.06	push	bush	02.07.06	**push**		
QB	02.07.06	light on	**light on**				
QB	02.07.06	off	**off**				

QB	02.07.06	toys	**toys**			
QB	02.07.06	funny	**funny**			
QB	02.07.06	sunny	**sunny**			
QB	02.07.06	this one	i-one			
QB	02.07.06	Nicky	**Nicky**			
QB	02.07.06	Freddy	reddy			
QB	02.07.06	Zippy	sippy			
QB	02.07.06	toilet	toilok	04.08.06 **toilet**		
QB	02.07.06	glasses	darses			
QB	02.07.06	caterpillar	pillar	07.07.06 tatapillar		17.07.06 **caterpillar**
QB	02.07.06	Daddy's at work	Daddy wuk			
QB	02.07.06	walking	**walking**			
QB	02.07.06	bell	**bell**			
QB	02.07.06	later	**later**			
QB	02.07.06	big one	**big one**			
QB	02.07.06	cherry	derry			
QB	02.07.06	sneezed	neez			
QB	05.07.06	telly	delly	08.12.06 **telly**		
QB	05.07.06	turn it off	**turn it off**			
QB	06.07.06	yo-yo	**yo-yo**			
QB	06.07.06	sit on the chair	sit on tair			
QB	06.07.06	do it	**do it**			
QB	06.07.06	shark	shak			
QB	06.07.06	saucepan	sau-pan			
QB	06.07.06	hoppy bunny	ho bunny			
QB	07.07.06	dinosaur	disaur			
QB	10.07.06	people	**people**			
QB	10.07.06	squirrel	skiwo	17.07.06 skiwow		
QB	10.07.06	seagull	**seagull**			
QB	10.07.06	girl	dirl			
QB	10.07.06	strawberry	rawbee			
QB	11.07.06	kettle boiling	keddle boi-ing			
QB	11.07.06	rhino	**rhino**			
QB	11.07.06	sit down	si-down	12.07.06 **sit down**		
QB	11.07.06	close the door	door tose-it			
QB	11.07.06	fingers	widers			
QB	11.07.06	giraffe	i-affe	12.08.06 **giraffe**		
QB	11.07.06	like it (and don't)	**like it**			
QB	11.07.06	crocodile	co-ci-dile/co-cul-dile	15.07.06 co-di-dile		
QB	12.07.06	belly button	**belly button**			
QB	15.07.06	melon	menon			
QB	15.07.06	open	**open**			
QB	17.07.06	ladybird	**ladybird**			
QB	17.07.06	up the ladder	up ladder			
QB	17.07.06	pillow	**pillow**			
QB	17.07.06	other one	ower one			
QB	17.07.06	jump	dump			
QB	19.07.06	barking	**barking**			

QB	20.07.06	snail	**snail**		
QB	20.07.06	egg	**egg**		
QB	25.07.06	happy birthday	happy birday		
QB	25.07.06	tidy up	**tidy up**		
QB	25.07.06	listen music	**listen music**		
QB	25.07.06	Louie	**Louie**		
QB	25.07.06	tent	**tent**		
QB	25.07.06	wash hands	wash ans		
QB	25.07.06	clean it	deen it		
QB	25.07.06	naughty boy	**naughty boy**		
QB	25.07.06	rug	**rug**		
QB	25.07.06	grass	gars		
QB	28.07.06	salami	lami		
QB	28.07.06	lolly	**lolly**		
QB	28.07.06	Katy	**Katy**		
QB	28.07.06	piano	**piano**		
QB	28.07.06	zebra	zeba	13.08.06	zeba
QB	28.07.06	little man	**little man**		
QB	29.07.06	floor	four		
QB	29.07.06	look	**look**		
QB	29.07.06	butterfly	bubify		
QB	01.08.06	breakfast	bekfus		
QB	01.08.06	dirty	**dirty**		
QB	01.08.06	drive	dive	13.08.06	dive
QB	01.08.06	painting	**painting**		
QB	01.08.06	press	**press**		
QB	01.08.06	rug	**rug**		
QB	02.08.06	camel	**camel**		
QB	02.08.06	find the lion	find lion		
QB	04.08.06	fall down	**fall down**		
QB	04.08.06	hippo	**ippo**		
QB	04.08.06	Mummy read it	**Mummy read it**		
QB	04.08.06	robot	**robot**		
QB	04.08.06	make a cake	make cake	15.08.06	**make a cake**
QB	04.08.06	Tellytubbies	**Tellytubbies**		
QB	04.08.06	sandwich	sanbib		
QB	04.08.06	hotdog	otdog		
QB	05.08.06	turn it off	**turn it off**		
QB	12.08.06	sleeping bag	seeping bag		
QB	12.08.06	back	**back**		
QB	12.08.06	rocking	rockin		
QB	12.08.06	Bob the Builder	Bob a builder		
QB	12.08.06	find it	**find it**		
QB	12.08.06	sausage	**sausage**		
QB	12.08.06	puzzle	**puzzle**		
QB	13.08.06	hold hand	hole han		
QB	13.08.06	drive it	dive it		
QB	16.08.06	very loud	**very loud**		
QB	18.08.06	donkey	**donkey**		
QB	20.08.06	happy birthday to you	happy birday to you		

QB	13.09.06	delicious	**delicious**
QB	13.09.06	buildings	**buildings**
QB	19.09.06	make it work	**make it work**
QB	19.09.06	Daddy's gone to work	Daddy gone work
QB	19.09.06	on the train	on ee train
QB	27.09.06	the pig farmer	a pig farmer
QB	27.09.06	take it out of the room	take it outaroom
QB	27.09.06	take Noddy with us	**take Noddy with us**
QB	27.09.06	down the slide	down a side
QB	27.09.06	Get it for me please	**Get it for me please**
QB	27.09.06	cry	fry
QB	27.09.06	crisps	cribs
QB	08.12.06	Go in the kitchen, Daddy!	**Go in the kitchen, Daddy!**
QB	11.12.06	It's gone a bit funny!	**It's gone a bit funny!**
QB	12.12.06	Percy's stuck	**Percy's stuck**
QB	12.12.06	traffic jam	**traffic jam**
QB	12.12.06	Daddy's watching telly	**Daddy's watching telly**
QB	12.12.06	Calm down!	**Calm down!**
QB	16.12.06	It's interesting!	**It's interesting!**
QB	16.12.06	It's incredible!	**It's incredible!**
QB	21.12.06	I came out of an egg	**I came out of an egg**
QB	21.12.06	Bats go upside down	**Bats go upside down**

Bold type indicates correct pronunciation of target word/phrase

(2) (3) denotes number of target syllables in mother’s pronunciation of word