Oxford Handbooks Online

# First Language Acquisition and Phonological Change

Paul Foulkes and Marilyn Vihman

Online Publication Date: Dec 2013

Subject: Linguistics, Forensic Linguistics, Language Acquisition
DOI: 10.1093/oxfordhb/9780199232819.013.001

## Abstract and Keywords

This chapter presents new data from first language studies of acquisition, some of them sociolinguistically informed. We challenge various long-standing ideas about the role of first language acquisition in phonological change, in particular the assumption that cross-generational change reflects errors in first language learning, for which our data provide no support.

Keywords: first language acquisition, cross-generational change, sociolinguistic variation, phonological processes

## Overview

In this chapter we summarize discussions of the role of acquisition in phonological change, from neogrammarians to twenty-first-century textbooks (section 1), before considering varying definitions of 'acquisition', 'phonology' and 'change' (section 2). We then review more closely the few previous studies based on systematic empirical analysis (section 3). In section 4 we present new empirical data from our own research in developmental phonology and sociophonetics. We believe this is the largest dataset yet assembled to address the issue. The analyses both lead to the conclusion that patterns of child phonology differ in several respects from patterns typically found in change, and thus that developmental errors are not a prime influence on change.

## 1 Introduction

One of the longest-standing maxims of linguistic thought is that children's language provides a source for language change. In a very early discussion, Schleicher (1861 [1971: 19]) notes parallels between children's errors and diachronic change in a range of languages. For example, his 3-year-old son Ernst:

> sometimes changed gutturals into labials, e.g. in *schnapen* for *Schnaken* ['crane fly'], *schimpen* for *Schinken* ['ham']. The same sound changes of the gutturals in individual Indo-European languages are well known.

Similar generalizations are made by Grammont (1902: 61), who concludes:

> [t]outes les modifications fonétiques, morfologiques ou sintaxiques qui caractérisent la vie des langues apparaissent dans le parler des enfants. ['[a]ll the phonetic, morphological and syntactic changes that characterize the life of languages are found in the speech of children.']

Grammont discusses changes in French, citing examples of similar patterns in the speech of one child. For example, dissimilation in *néni* for *fini* ['finished'] parallels historical developments such as Latin *finire* ◊ Old French *fenir* ['to finish'].

While Schleicher and Grammont stop short of imputing direct causality, explicit comments on the role of children in effecting change date back at least to Paul (1886: 34; translation from Weinreich et al. 1968: 108). He argues:

> the processes of learning language are of supreme importance for the explanation of changes … they represent the most important cause of these changes.

Various explanations have been offered for the apparent role of acquisition in change. Sweet (1888) and Sully (1896) suggest that change results from imperfect learning. Sweet blames this on organic differences in children's vocal tracts relative to adult ones, as well as laziness and carelessness in children's speech. For morphological change, Müller (1890) ascribes the loss of irregular paradigmatic forms to children's natural tendency to simplify. Similarly, Meillet (1951:74) claims that each child creates the language a new, also highlighting the role of linguistic exposure in the child's environment:

> Pour chaque individu, le langage est … une recréation totale faite sous l'influence du milieu qui l'entoure. ['For every individual, language is … a total recreation effected under the influence of the surrounding environment.']

The lines of reasoning that characterized discussion of acquisition and change in those days echo in more recent work. Generative linguists readily adopted the view that imperfect learning is a cause of change. For example, following Meillet, Halle (1962: 66) hypothesizes that the child 'constructs his own optimal grammar by induction from the utterances to which he has been exposed'. The child may arrive at a different grammar from that of adults, since a set of utterances may be generated by more than one grammar. Kiparsky (1965: 4) continues this reasoning:

> Imperfect learning is due to the fact that the child does not learn a grammar directly but must recreate it for himself on the basis of a necessarily limited and fragmentary experience with speech. It is in no way surprising that the grammar should change in the process of transmission across generations of speakers.

Similar comments continue to be expounded in contemporary textbooks. For instance, Fromkin, Rodman & Hyams (2011: 528) state:

> A basic cause of change is the way children acquire the language. No one teaches a child the rules of grammar. Each child constructs the rules of her language alone, generalizing rules from the linguistic input she receives.

While the logic of such comments may appear sound, others have signalled scepticism about children's role in change. Saussure (1915 [1974: 149]), for example, reflects on similarities between changes and children's errors, but considers the problem of change 'undented' by a simple comparative approach. He continues:

> what prompts a generation to retain certain mistakes to the exclusion of others that are just as natural is not clear. From all appearances the choice of faulty pronunciations is completely arbitrary, and there is no obvious reason for it. Besides, why did the phenomenon break through at one time rather than another?

Bloomfield (1933: 386), like Saussure, highlights unresolved questions of 'why here?' and 'why now?', arguing: 'no permanent factor … can account for specific changes which occur at one time and place and not at another'. Drachman (1978) likewise concludes: '[t]he role of primary acquisition in language change seems to have been exaggerated'. Whereas Andersen (1973, 1978) took as given that the source of diachronic change or innovation was the child learner, Kiparsky (1988) found the arguments of Drachman (1978) and Vihman (1980; see section 3.1.3) sufficiently persuasive to take issue with Andersen (although not with his own earlier claims). He states that 'empirical study of child phonology gives little support for [the notion of a pervasive role for acquisition in sound change] … The class of typical or potential sound changes does not match the class of typical or potential child language processes' (Kiparsky 1988: 390). Other commentators go even further, completely dismissing the potential role of children. For example, Aitchison (2003: 739) states bluntly that 'babies do not initiate changes'.

Debate on the relationship between acquisition and change, then, has persisted for 150 years – in effect, the lifetime of modern linguistics. However, perhaps surprisingly, it seems that no consensus has emerged. The principal reason for the lack of agreement, in our view, is the scarcity of attempts to assess the validity of the claim empirically (as noted by Jespersen 1922, though little has changed). Although some authors provide examples to illustrate similarities between patterns in child speech and language change, few do so systematically. Instead, most marshal anecdotal or cherry-picked examples, often from a single child. More egregiously, some writers lay out arguments without reference to data. Remarkably few systematic empirical studies have been conducted to explore whether children's 'errors' are genuinely universal, whether these errors do indeed emerge as changes, or whether there are other types of change that do *not* appear in children's speech. Particularly lacking is cross-linguistic evidence to support the assumption that children everywhere make the same mistakes. The few exceptions are reviewed in section 3 (also Baron 1977 and Hooper 1980 on syntactic and morphological change).

A further problem is the lack of unity on what is meant by the actual terms 'acquisition' and 'change'. Few scholars offer any formal definition of their use of these terms. The problem is further compounded by more general debates over the delimitation of 'phonology', especially with respect to its relationship with phonetics (see also Scheer, Hale et al., both this volume).

Before presenting our own empirical data, we first turn in more detail to definitions of terms, as this enables us to draw out various important methodological and theoretical issues that underpin the debate.

# 2 Terms of reference

## 2.1 Acquisition and children

Although few if any commentators explicitly define 'acquisition' (or 'children'), we infer that most refer solely to first language acquisition, and to developmental processes manifested prior to the end of an assumed critical period (Lenneberg 1967). This is therefore the frame of reference we adopt when presenting our data in section 4.

However, it is difficult to evaluate or compare studies without consideration of what the authors consider to be their objects of study. First, we should not treat children as if they form a homogeneous speech community. 'Child' is a very broad demographic category (Aitchison 2003: 738). The linguistic patterns of 2-year-olds differ from those of 3-, 6-, or 12-year-olds. Social influences, motor skills and cognitive capacities vary across the age range. Moreover, variability within and across children must be considered. Children do not learn a language at the same rate or in the same sequence. It also goes without saying that generations of speakers do not arrive in well organized, discrete groups like coach parties of tourists arriving at their destination (Manly 1930). Cross-generational comparison must therefore take account of the fact that any differences will be manifested gradually and perhaps over a long timescale.

Second, we must ask the question: when does acquisition begin and end? We could ask specifically at what age the critical period ends, and even whether it is necessary to assume a critical period (Johnson & Newport 1989, Bialystok & Hakuta 1999, Birdsong 2005). It is certainly clear that language may change over the lifespan (Harrington 2006, Bowie & Yaeger-Dror this volume). To that extent it can be argued that acquisition is not solely restricted to childhood. Might adult language development also shed light on change? To address the question of timescale also demands consideration of *what* is being acquired, which in the case of phonology is not straightforward (see 2.2).

Third, in many societies acquisition of second and further languages is the norm rather than the exception, a process that may well extend into

adulthood. For some individuals there may be learning of second dialects of the initial language. To what extent do L2 or D2 acquisition shed light on change (Iverson & Eckman this volume)?

Consideration of such issues is essential to gather appropriate evidence to fully assess the role of acquisition in change. However, we set such issues aside and concentrate on evidence from infants and young children.

## 2.2 Phonology and phonological

In discussions of acquisition and change, as in linguistics generally, the terms 'phonology' and 'phonological' are used with fluid meanings. For some writers the terms clearly refer to the abstract system of processes and the inventory of contrasts, distinct from phonetic realization (e.g. Blevins 2004: 91; this volume). Naturally there is also variability in the specific issues investigated and terms used, reflecting the theoretical position adopted. In the generative tradition, for instance, Halle (1962) and Kiparsky (1965, 1968) discuss acquisition of transformational rules. Stampe (1969, 1979) sought evidence to support the hypothesis of innateness (see also Donegan & Nathan this volume), while in Optimality Theory discussion of change focuses on reorganizing the constraint hierarchy (Holt this volume).

For other researchers, however, the principal focus may instead be phonetic realization. In his detailed consideration of chain shifts in vowel systems, for example, Labov (2001) discusses phonemic mergers and splits. These are examples where the system of phonological contrasts undergoes reduction or expansion (see further Gordon, this volume). However, Labov also discusses changes in which there is no effect on the *number* of elements in the system, but rather in the orientation and coordination of their associated phonetic patterns (fronting, raising, etc.), sometimes in coordinated patterns that maintain the overall system of contrasts. In such cases the issue of change is arguably phonetic rather than phonological, in a strict sense. Also worthy of comment is the fact that discussions of acquisition and change invariably focus on matters of segmental contrast or realization. Studies of variation and change in suprasegmental features are rare (but see Local 1982) and we are not aware of any comments linking developmental patterns to variation or change in suprasegmental phonology.

We do not highlight these differences in definition or approach in order to align ourselves with any particular position. In addressing the potential influence of acquisition on phonological change, though, it is imperative to delimit appropriate objects of study. Are we to claim that children are responsible for changes at the phonetic level, for those that affect abstract elements and processes, or for both?

## 2.3 Change

What is a sound change? The answer to this question of course depends in part on one's conception of phonology. But what counts as change rather than variation? Again, answers differ through the literature. Many nineteenth-century commentaries on acquisition and change were delivered in the context of discussions of the comparative reconstruction of Proto-Indo-European (PIE). The focus was therefore on differences between states of languages over centuries or even millennia. For example, Schleicher considers parallels between children's errors and the relationship between PIE and modern Germanic, with reference to processes such as Grimm's Law. The changes involved are extreme enough for us to categorize the end points as different, mutually unintelligible languages, in which the change is complete.

By contrast, more recent discussions often refer to ongoing or incomplete processes. Recognizing synchronic variation as an essential stage in the development of change was the first major contribution to historical issues from quantitative sociolinguistics (Weinreich et al. 1968). It is hypothesized that any historically complete change must have progressed through a period of synchronic variation where the old and new forms coexisted (in the speech community if not necessarily in the minds and mouths of individuals).

This conception allows us to consider change from rather different perspectives than did Schleicher and his contemporaries. It is possible to distinguish the linguistic constraints on a given form from the social constraints on its usage. We can identify change not in absolute terms but as statistical shifts whereby an old form reduces in currency relative to an incoming form. We can examine contexts of use to assess whether a form is spreading through the lexicon or grammar. We can also consider differences in usage within subsections of a speech community rather than its entirety. Change may thus be conceptualized as the first adoption of a linguistic form by a subgroup within a community (defined, for example, by social class or age), or as a form appearing in new (socio)linguistic domains (for example, when a traditionally stigmatized form becomes acceptable in formal styles).

It is furthermore important to distinguish *actuation* (or *initiation*, *innovation*) from *transmission* (or *promulgation*, *spread*, *restructuring, propagation*) through both the speech community and the grammar. *Actuation* refers to the initial appearance of a new form, for example, a phonetic variant previously unrecorded in the language. Efforts to explain actuation have generally been experimental (e.g. Ohala 1989, Foulkes 1997), grounded on the principle that vocal tracts and perceptual systems are essentially universal. Observing consistent patterns of variation in pronunciation and perception can therefore shed light on how such variations may emerge and eventually become phonologized (see further Yu this volume).

Most commentaries on the role of acquisition in change limit discussion to actuation: children's forms that differ from those of adults are cited as variants that may, in time, crystallize as long-term change. But in order to explain change fully we must also address the issue of *transmission*: how, when and why is an innovation adopted by other speakers such that it gains a permanent foothold in the language? It is therefore not enough simply to list new forms used by particular children: we also need to establish how and why other speakers might adopt them. Furthermore, it may take a long time for historical changes to reach completion. For example, Labov (2001: 419) estimates that the current stable variation of English (ing) has taken over a thousand years to emerge and settle (also Keller 1994: 159). Therefore, we must ask not only how phonological patterns for one generation differ from those of the previous generation, but also how successive generations transmit the change in the same direction. Sociolinguistic studies, in particular, offer insights into transmission processes (Tagliamonte & D'Arcy 2009, D'Arcy this volume).

## 2.4 Summary

In consideration of the issues raised in section 2, it is clear that drawing conclusions from previous commentaries is problematic. Studies may, explicitly or implicitly, have quite different conceptions of the key issues and adopt different methods to explore links between acquisition and change. We now turn to previous empirical approaches.

# 3 Empirical studies of acquisition and phonological change

## 3.1 Developmental studies

A systematic comparison of developmental patterns and regular sound changes has been carried out by three studies, which we summarize briefly.

### 3.1.1 Greenlee & Ohala (1980)

Greenlee & Ohala (1980) adapt Ohala's well-known approach to adult speakers, focusing on the physical constraints imposed by the perceptual system and vocal tract. They identify patterns in child language that may be explained with reference to natural dynamic properties of the vocal tract, aerodynamics, or varying perceptual responses to ambiguous signals. Such patterns are shown in some cases to parallel patterns found in change, and thus could constitute innovations that ultimately lead to change. For example, [n] and [l] show close acoustic similarity, and children do confuse them. Synchronic alternations and historical changes between /n/ and /l/ are also fairly common.

Greenlee & Ohala refrain from identifying children as a cause of change, arguing that the underlying physical causes are effectively the same as those of adults, who therefore might themselves be responsible for innovations. It should be noted, however, that this line of reasoning is flawed in one crucial respect: the vocal anatomy and physiology of a child are not scale models of those of adults (Lieberman, Crelin & Klatt 1972). For example, the child's tongue is large in relation to the size of the oral cavity (Stark 1980; Kent 1981), making palatal contact in the articulation of dentals or alveolars a more likely outcome for the young child than for the adult. Greenlee & Ohala also leave unanswered (as does Blevins 2004) the question of asymmetric sound changes, where two sounds are perceptually similar yet change invariably involves developments in one direction. For instance, cross-linguistic patterns almost always show /θ/ developing into /f/ and not vice versa (see also Foulkes 1997 on /f/ > /h/).

### 3.1.2 Locke (1983)

Locke (1983) is primarily interested in establishing similarities between child production and adult phonology, supported by some quantitative analyses but also by selected examples of similarities and differences between developmental processes and cross-linguistic patterns of change and allophony (including final devoicing, final deletion, and cluster reduction). Locke notes the temptation to ascribe the origins of change to children, but declines to take an interpretable position on the matter:

> It is clear that sound change ultimately involves both children and adults, and that many of the historically confirmed cases of phonological change are remarkably like the transient developmental changes of childhood. But … relatively little is known about the relative contributions to sound change of children and adults … My own view is that the child is both an agent of sound change and a victim of sound change.
>
> (1983: 116)

Locke also notes a number of cases where child data are not mirrored by sound change (fronting of consonants) or vice versa (lenition of stop to fricative, where children are more likely to do the reverse).

### 3.1.3 Vihman (1980)

Vihman (1980) focuses on three common developmental processes, especially in the first year of word use: consonant harmony, long word reduction, and consonant cluster reduction, comparing them to possible parallel cases among well-established sound changes. Prefiguring her conclusions, she asserts at the outset that

> though many disparate parallels may be found, some of the most common or typical child language processes are either virtually non-existent or totally different in detail in adult synchronic processes and in sound change.
>
> (1980: 305)

Vihman provides a quantitative analysis of word forms from 11 children learning English, Spanish, Czech, Slovenian or Estonian. The sample is based on the availability of a full word-list for the child, whether from a diarist parent (including Vihman herself for two children acquiring Estonian), or from transcribed data based on recordings undertaken as part of a research project. The children's ages ranged from about 1 year, for first word use, to 2;6.

Consonant harmony, although not a universal of child language as sometimes claimed (Smith 1973), affected an average of 14% of the words produced by 13 children included in an earlier study (Vihman 1978, based only on target words presenting the challenge of a $C_1 \ldots C_2$ sequence) and as much as one-third of those words for some children. The process is rarely found in adult grammars, however, and must therefore be rare as a diachronic process (Drachman 1978).

Long-word reduction occurred in the word production of all 11 children included in Vihman's 1980 sample (see further Echols & Newport 1992, Vihman 1996: 201ff.). The analysis applied only to words of more than two syllables – a challenge for the child that is relatively rare in English but frequent in Spanish, for example. Omission of syllables is common in child speech (affecting a mean of 56% of the long words attempted in Vihman's sample, with a range from 26% to 90%) and is also widely reported in sound change. The details differ in acquisition compared with the historical record, however. In the case of the children, although the number of long words attempted was relatively small, the overall tendencies are clear (where

percentages are used to compare stressed and unstressed syllables across languages of differing accentual patterns). First, the stressed syllable was very rarely omitted. Second, the final syllable was typically retained even when unstressed (78% of all 3- and 4-syllable words) – a fact that can now be safely ascribed to the final-syllable lengthening that is characteristic of both adult and child production (Snow 1998, Vihman, DePaolis & Davis 1998). Third, the children's data show that in the case of long-word reduction it is the full syllable, not only the vowel, that is generally lost (e.g., Estonian *muusika* > [mu:si]).

Since the loss, especially of unstressed syllables, is well documented in the history of languages, we can consider how these patterns compare with those reported as sound changes. For this purpose Vihman (1980) consulted historical grammars for Germanic (Prokosch 1939), Slavic (Shevelov 1964) and Spanish (Menéndez-Pidal 1949), and a personal collection of Western Finnic cognates. Some factors affecting historical syllable loss are relative distance from the stressed syllable (possibly based on alternating stresses), syllable weight and vowel quality: none of these were features of the process of long-word reduction seen in the 11 children. On the other hand, final vowels are highly likely to be lost, at least in initial-stress languages like the Germanic languages and Estonian, again in contrast with the child data, regardless of stress pattern. Finally, in virtually every case in the historical record it is not full syllables that are lost but only the vowel (Latin *septimana* 'week' > Old Spanish *sedmana* > Modern Spanish *semana*).

Cluster reduction is again a prominent feature of child word production, typically until age 3 or later (Grunwell 1982). The children in Vihman's sample reduced 52–100% of the clusters present in words they attempted (mean 80%). A few patterns are again readily identifiable within the observed cases of cluster reduction. Where a cluster comprises stop+liquid (in either order), the stop – a sound type produced in children's first words, cross-linguistically, while liquids are rarely seen in those words (Menn & Vihman, 2011) – was far more likely to be retained. Similarly, in cluster reduction fricatives or nasals were likely to be retained when followed by a liquid, while stops were more likely to be retained from target stop+fricative clusters and even more so from fricative+stop clusters.

The only clusters more likely to be preserved as a whole than reduced are combinations of nasal+stop. Voicing is crucial here: a voiceless obstruent is likely to be retained in the face of cluster reduction while a voiced obstruent is likely to be lost, leaving the nasal (Braine 1974 discusses the perceptual reasons for this asymmetry in child production). The strength hierarchy that emerges from these data conforms closely to the well-established facts of overall order of production for children (mainly based on motor control issues), with stops and nasals – prominent in babble and first words – being followed by fricatives, then liquids (Yeni-Komshian et al. 1980).

As for the historical record, consider the trends observed in the sources mentioned above. For Slavic, where cluster reduction is prominent, patterns of change are quite different from the child data: consonant+liquid tended to be preserved in Common Slavic, although /t,d+l/ was later reduced to /l/ in several Slavic languages; clusters of stop+fricative or nasal were reduced by loss of the stop in Common Slavic. In the history of Spanish, Latin stop+/r/ tended to be preserved initially; voiceless stop+/l/ was palatalized in central dialects and reduced to /ʎ/, while /bl/ was preserved but /gl/ was reduced to /l/. Medially, liquid+stop clusters were preserved while voiced stop+liquid clusters were sometimes reduced to liquid only. Clusters of medial nasal+stop were sometimes reduced to the nasal in Castilian, sometimes with palatalization of the nasal.

In Western Finnic the few examples of cluster reduction are all medial. Loss of /n/ before /s/, with or without compensatory vowel lengthening, occurs here as in many other languages. Older loan words in Finnish and Estonian from Russian or German consistently show loss of the first consonant of any word-initial cluster, regardless of consonantal type (e.g. Russian *gramota* 'reading and writing' > Estonian *raamat* 'book', Finnish *raamattu* 'bible'; German *Spiegel,* Estonian *peegel* 'mirror', German *Frau* 'wife, woman', Finnish *rouva* 'Mrs.', etc.).

Finally, in Germanic, though cluster reduction is uncommon, liquids tend to be retained in cases of fricative+liquid or liquid+nasal while the nasal tends to be lost in cases of nasal+fricative (as in Finnic) or stop+nasal. Summarizing, then, liquids appear highly favoured in all four families, fricatives are retained more frequently than nasals, and position in the cluster is sometimes relevant, especially initially. Each of these tendencies contradicts the observed child patterns.

Vihman (1980) disregarded many processes reported in adult languages, such as vowel harmony, but this process is rare in child data, most likely because vowel production and planning are less problematic for the developing child than are consonant production and planning (Stoel-Gammon 1992). Similarly, interactions between consonant and vowel (e.g. nasalization, palatalization) play a large role in language change but are rarely reported for child language.

In conclusion, although two of the three processes examined do play a role in both developmental and historical contexts, once we have considered the details of each subtype we find it considerably less tempting to ascribe causality for change to the developing child, at least where the early stages of word production are concerned.

A final point made in Vihman (1980) is worth repeating: whereas contrast is a key principle in adult language, and is therefore often evoked as playing a role in change or resistance to change diachronically, for children the situation is very different. The child speaks largely of the here and now, to familiar interlocutors, whether at home or at nursery; where communication breaks down (from an adult point of view), the child often shifts topics without missing a beat (Vihman 1981), a good indication of their relative indifference to precise lexical (and so phonological) choice. Thus omission of a segment or syllable is unlikely to cause problems. At the same time, if clarity is not an issue for the child, recall certainly is:

> What does pose a problem for the child is the burden placed on his capacities for storage and retrieval of units of information as his vocabulary increases exponentially (by literally hundreds of words a month, in some cases [Vihman 1980: 315]).

Here consonant harmony, for example, plays a useful role in limiting the bits of information per word that the child must retain (Vihman 1978, Menn 1983). The need for such constraints fades as the child's familiarity with phonotactics increases (Storkel, 2001; Edwards, Beckman & Munson, 2004). Although aspects of morphophonemics may take several more years to master, the error types analysed here are typically no longer part of productive phonology after age 3 or 4.

### 3.2 Sociolinguistic studies

Sociolinguistic studies of acquisition are scarce (see Roberts 2002). However, several important issues emerge from these studies, in particular concerning the nature and type of input, and the social context in which learning unfolds.

#### 3.2.1 Input and influence

Weinreich et al. (1968: 145) criticize the simple model of acquisition and change described by Halle (1962) and others (discussed in section 1), because of its reliance on the 'unexamined assumption that the children's grammars are formed upon the data provided by their parents' speech'. The primary input for language learning need not be a sample of the language used between adults. Thus it may be methodologically inappropriate to focus on comparisons between children's speech patterns and those of adults. Children also learn from other children, especially once they begin to interact with peers on a regular basis. Several studies show that children's phonetic and phonological patterns are closely aligned with those of their caregivers early on, but diverge later as the peer group becomes more important (Foulkes et al. 2005, Smith et al. 2007). Young children are also often diverse as a group. A clear example is provided by studies in the new town of Milton Keynes (Kerswill 1995, Kerswill & Williams 2005). A large number of in-migrants to the town created a complex dialect contact situation. Kerswill & Williams tracked the linguistic development of three groups of children and their parents: 4-year-olds, who were still cared for at home, and schoolchildren aged 8 and 12. Analysis of several phonological variables revealed that the 4-year-olds' production patterns closely resembled those of their parents, and reflected the mix of dialects in the community. Older children, however, showed a more homogeneous, levelled dialect, with little influence of minority home dialects. Kerswill (1995) considers whether developmental patterns might lead to change, noting that Milton Keynes children displayed several processes that are also ongoing sound changes in British English. These include vocalization of /-l/, labiodental /r/, and [f, v] for /θ, ð/. Kerswill found that some developmental patterns were common in the youngest children, then gradually disappeared as their speech matured – but re-emerged as dialectal features in pre-adolescents. These studies show that peer influence during adolescence exerts an especially strong effect on linguistic patterns, with non-standard forms transmitted most readily at this stage in life (Weinreich et al. 1968, Labov 2001, Hazen 2002, D'Arcy this volume). Such findings suggest that differences between generations are more likely to be seen during later development than at the earliest stages of acquisition.

More recent studies shed further light on the nature of input, showing that it varies between children and according to social factors such as age and gender (of both child and adult). Hazen (2002) reviews studies of children whose parents speak different dialects, and for whom phonological learning may therefore involve multiple targets. Foulkes et al. (2005) examined consonantal realizations in child-directed speech (CDS) by a group of women from Newcastle, north-east England (see 4.2). The main focus was on forms of intervocalic /p t k/, which are realized locally as voiced, glottalized/laryngealized and lenited stops (typically transcribed [b̰ d̰ g̰]). Local variants occurred in around 90% of tokens in speech between adults, but only 36% of tokens in CDS. Mothers instead preferred plain oral stops, as in standard English. Individual mothers varied in their use of the local variants (occupying the full range – 0–100%). Moreover, variation was observed within CDS as a function of child age. Standard variants decreased across the age range, and were statistically more frequent in CDS to girls. Input also varies according to style of speech. Labov (2001: 420) argues that style variation is crucial for the transmission of sociolinguistic variation. Speech to children varies in formality, with more formal language associated with teaching and discipline, and characterized by greater usage of standard forms. Smith et al. (2007) examined CDS patterns in Buckie, Scotland, and indeed found that mothers used standard forms more in formal interactions, and local variants in less formal ones (play, intimacy).

#### 3.2.2 Social variation in transmission of change

Sociolinguistic studies regularly show that changes are adopted by some subgroups in a society earlier than others. Gender-based differences, for example, are found in almost all societies that have been investigated. Typically, females lead the transmission of changes, and are sometimes a generation ahead of males in their community (Labov 2001: 306). If acquisition were the primary cause of change it would be impossible to explain why this should be. Given essentially the same vocal tracts and general developmental abilities, there is no reason why girls should create or adopt new forms earlier than boys. Similarly, Labov (2001) provides extensive documentation that changes generally originate in the middle of the socioeconomic hierarchy. Milroy (1987) shows that changes are more likely to be transmitted in open social networks, where individuals enjoy physical and social mobility. She further suggests that different social structures may be conducive to transmission of different types of change (Milroy 2007). These facts, too, are inexplicable if we seek causes of change in development. Clearly, social context affects what is learned and when.

Finally, transmission requires interaction in structured social groups, with influence typically flowing from the more socially influential individuals, or groups, to the less so. Aitchison (2003: 739), in dismissing the role of children in promoting change, points out that babies do not form influential social groups. Their speech patterns are thus unlikely to be adopted by other speakers.

### 3.3 Summary

These studies show that there may be significant differences between the features of the target language being acquired and the raw materials upon which acquisition is based. Simple comparison of adult and child forms may therefore not be appropriate for assessing learning or variation in developmental forms as a route to change. Leaving such matters aside, however, we turn now to some new empirical data.

## 4 Data

We present two datasets, from a developmental study and a sociolinguistic investigation. Both are drawn from monolingual children learning British English. Our aim in both cases is to establish a systematic and accountable corpus of child speech. We have gathered our data from transcripts prepared for other purposes, as part of larger projects. Patterns from the corpora have been identified independently of prior expectation about: (i) the sorts of developmental forms that we might find, and (ii) potential parallels with phonological change.

The two datasets differ in several respects. The recordings were collected and analysed using frameworks and methods from different traditions, with different assumptions concerning the phonological targets to be acquired. The developmental data were collected in a longitudinal study comparing late talkers to typically developing children, with no specific attention to either the community or the phonetics of the parents' speech; they reflect a single developmentally based 'moment' for the entire group. The sociolinguistic data were collected to assess the nature and time-course of learning detailed phonetic and phonological patterns, based on previous sociophonetic studies of the adult community (Docherty et al. 1997, Docherty & Foulkes 1999).

Ideally we would like to compare our child data against an inventory of sound changes reported cross-linguistically in a balanced sample of languages (akin to the phoneme inventory information provided by Maddieson 1984). However, no such inventory exists (a fact noted by Ferguson 1990, and the intervening years have not changed the situation; see further Kümmel this volume). We draw on Blevins' (2004) summary of common changes from 99 languages where appropriate. In addition, we note changes commonly reported in the historical phonology literature. We acknowledge that such evidence is not ideal. It may not be based on empirically robust data collection, many of the same examples may have been borrowed across different texts, and data are often pre-selected to illustrate theoretical claims.

## 4.1 Data from a developmental study[1]

The data summarized above from Vihman (1980) covered only the first year or so of word production and focused on three common processes. To complement this, we now review data from the transcribed recordings of a much larger sample of typically developing monolingual English-learners from North Wales (TDs; N = 11, 6 boys) and late talkers (LTs: children who had few words and no word combinations at 24 months; N = 21, 14 boys) from both North Wales and York (Vihman, Keren-Portnoy, Whitaker, Bidgood & McGillion, submitted). The children range in age from 2;4 to 4;2, with most between 3 and 4 years. The 30-minute recording sessions (one for each child, at home, with a familiar adult interlocutor) took place 14 months (± 2) after each child had been transcribed as using about 25 words in a 30-minute session, a developmental point corresponding roughly to the end of the single-word period. All these children are regularly producing longer utterances (mean length of utterance: 2.7 words).

We consider the full range of error types seen in these children. We do not attempt to relate these data in any systematic way to historical data, since, as noted above, no convenient inventory of historical processes is available. Instead, we report all of the error types made by these children, expanding the age range covered by Vihman (1980) while restricting ourselves to English and offering some general comments on similarities to, and differences from, well-attested historical processes.

Whereas the children described in Vihman (1980) were all typically developing, some of the children in the present corpus began to talk late. Since LTs tend to make more phonological errors at a later age, while producing longer sentences and conversing more frequently with interlocutors outside their immediate family, the influence, if any, of 'imperfect learning' is at least as likely to be traceable to them as to the very young children analysed in Vihman (1980).

Whereas Vihman (1980) calculated proportions of errors over words produced for her sample of children within the single-word period, this would be inappropriate for these more advanced children. To establish overall frequency of occurrence, however, one can assume that each instance of an error type occurred in a different utterance (although this is not strictly true). Accordingly, for example, the 108 instances of stopping of /ð/ by TDs can be taken to have occurred (at most) in 108/1100 (11*100-utterance samples), or 9.82% of the utterances produced by TDs. The next most frequent error, consonant deletion (in any position) occurred, in the two samples combined, in 302 utterances, or 9.44% of all utterances produced. About half of the error types occurred in no more than 2% of all utterances produced in either sample.

Table 1 lists the 43 error types identified in the 100-utterance sample of two or more of the 32 children. Error types that occurred no more than once only for any one child are taken to be speech errors and are disregarded, as are error types that occurred more than once yet only sporadically and in the speech of only one child.

Table 1 Error types identified in 100-utterance samples for each of 32 children aged 2;4–4;2, ordered by typically developing children's errors. 'Instances' refers to the raw occurrences of each error; '%' refers to the proportion of each error type observed in relation to all errors identified in the sample; 'children' refers to the number of children who exhibited each error type. C =consonant.

| **Error types** | **Typically developing (N = 11)** | | | **Late talkers (N = 21)** | | |
|---|---|---|---|---|---|---|
| | **instances** | **%** | **children** | **instances** | **%** | **children** |
| stopping of /ð/ | 108 | 11.46 | 10 | 280 | 12.13 | 19 |
| /C/ deletion | 91 | 9.66 | 11 | 211 | 9.14 | 20 |
| velar fronting | 82 | 8.70 | 5 | 125 | 5.41 | 10 |
| gliding of /r, l/ | 67 | 7.11 | 9 | 168 | 7.28 | 17 |
| 'lisping' or /θ/ for /s/ substitution | 58 | 6.16 | 7 | 115 | 4.98 | 14 |
| Palatalization | 41 | 4.35 | 7 | 128 | 5.54 | 11 |

| | | | | | | |
|---|---|---|---|---|---|---|
| gliding (other) | 37 | 3.93 | 7 | 48 | 2.08 | 7 |
| /C/ insertion | 32 | 3.40 | 8 | 81 | 3.51 | 16 |
| /l/ vocalization | 32 | 3.40 | 6 | 36 | 1.56 | 5 |
| glottal stopping | 30 | 3.18 | 5 | 35 | 1.52 | 8 |
| weak syll. deletion | 26 | 2.76 | 6 | 84 | 3.64 | 15 |
| /Cr/ reduction | 25 | 2.65 | 6 | 61 | 2.64 | 8 |
| /sC/ reduction | 23 | 2.44 | 5 | 58 | 2.51 | 10 |
| /ð/ substitution | 20 | 2.12 | 5 | 26 | 1.13 | 5 |
| Fricativization | 20 | 2.12 | 6 | 71 | 3.07 | 14 |
| Velarization | 20 | 2.12 | 4 | 71 | 3.07 | 10 |
| affricate reduction | 16 | 1.70 | 5 | 64 | 2.77 | 11 |
| /CC/ reduction (other) | 15 | 1.59 | 5 | 53 | 2.30 | 15 |
| Nasalization | 15 | 1.59 | 2 | 48 | 2.08 | 8 |
| Affricativization | 14 | 1.49 | 3 | 54 | 2.34 | 9 |
| /Cl/ reduction | 14 | 1.49 | 3 | 39 | 1.69 | 8 |
| nasal-/l/ alternation | 14 | 1.49 | 3 | 21 | 0.91 | 5 |
| Lateralization | 13 | 1.38 | 3 | 15 | 0.65 | 1 |
| syllable insertion | 12 | 1.27 | 2 | 27 | 1.17 | 8 |
| /C/ harmony | 11 | 1.17 | 3 | 39 | 1.69 | 10 |
| Blending | 11 | 1.17 | 3 | 19 | 0.82 | 4 |
| /v/ substitution | 11 | 1.17 | 4 | 9 | 0.39 | 1 |
| /CC/ deletion | 9 | 0.96 | 2 | 11 | 0.48 | 2 |
| Metathesis | 9 | 0.96 | 3 | 16 | 0.69 | 5 |
| palatal fronting | 9 | 0.96 | 2 | 13 | 0.56 | 2 |
| contiguous assimilation | 8 | 0.85 | 1 | 18 | 0.78 | 3 |
| glide stopping | 8 | 0.85 | 3 | 9 | 0.39 | 3 |
| /l/ stopping | 7 | 0.74 | 2 | 7 | 0.30 | 2 |
| stopping of /s/ | 7 | 0.74 | 2 | 39 | 1.69 | 6 |
| /θ/ substitution | 7 | 0.74 | 1 | 26 | 1.13 | 6 |
| Labialization | 5 | 0.53 | 0 | 56 | 2.43 | 11 |
| Glottalization | 4 | 0.42 | 1 | 13 | 0.56 | 2 |
| stopping of /z/ | 4 | 0.42 | 0 | 17 | 0.74 | 3 |
| nasal stopping | 2 | 0.21 | 0 | 26 | 1.13 | 7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| stopping of /f/ | 2 | 0.21 | 1 | 46 | 1.99 | 5 |
| stopping of /ʃ/ | 2 | 0.21 | 1 | 3 | 0.13 | 1 |
| Degliding | 1 | 0.11 | 0 | 9 | 0.39 | 2 |
| stopping of /v/ | 0 | 0.00 | 0 | 14 | 0.61 | 4 |
| TOTAL | 942 | 99.98 | | 2,309 | 100.02 | |

It is apparent that in the spontaneous running speech of these children very few error types account for more than a small proportion of the errors – and some of the more common ones may reflect parental usage (e.g., stopping of /ð/), although an attempt was made to take dialect differences into account. The LT sample is not quite twice as large but accounts for well over twice the errors. Nevertheless, each error type accounts for only a small proportion of the total, and the ordering of error-type use for the LTs is only marginally different from that of the TDs.

Consonant deletion is the second most common process, evidenced in some form by all but one child; this includes both initial and final positions. In Table 2 we provide examples of the error types that we discuss, drawing, in each case, on the TD child who made the error most frequently.

Table 2 Examples of errors (child age in year;months;days)

| Example | Child | Age | Target | Production |
|---|---|---|---|---|
| (1) final /-C/ deletion | Owen | 3;0.5 | *like* | [laɪ] |
| (2) initial /C-/ deletion | Owen | 3;0.5 | *yellow* | [ɛləʊ] |
| (3) palatalization | Ali | 3;1.10 | *that is beans* | [daçɪçbiːç] |
| (4) palatal fronting | Andy | 3;0.11 | *paintbrush* | [peɪʔbɒs] |
| (5) weak syllable deletion | Jude | 2;6.10 | *Barcelona* | [baθəʊn] (said twice in this form) |
| (6) consonant harmony | Ali | 3;1.10 | *more* | [mɔːm] (/C/ insertion + harmony) |
| (7) /Cr/ reduction | Owen | 3;0.5 | *fried* | [faid] |
| (8) /sC/ reduction | Tomos | | *strawberry* | [dɔːbiː] |
| (9) /Cl/ reduction | Tomos | | *plate* | [pʰeɪʔtʰ] |
| (10) cluster blending | Owen | 3;0.5 | *play* | [feɪ] |
| (11) other cluster reduction | Ali | 3;1.10 | *milk*<br>*stand* | [mɪk]<br>[tad] |

Final consonant deletion (1) occurs for several children, but the incidence is low. Initial consonant deletion (2) affects function words far more than content words, which may reflect adult casual speech usage (but could also be ascribed to misperception of non-salient syllables). No other error type accounts for as much as 10% of the errors identified for the TDs; many, such as consonant insertion, appear to be one-off careless productions: e.g., Martin: *zip* [snɪp] (possibly a lexical error).

Palatalization, which, as noted above, might be expected as a natural consequence of the specific characteristics of the child vocal tract, accounts for 4% of TD errors, and 6% of LT errors. In most cases it is the alveolar sibilants /s, z/ that are palatalized (3). 'Palatal fronting' (i.e., /ʃ/ > [s]), which is more commonly mentioned in the child phonology literature, here accounts for only 1% of the errors in either group (4).

Of the processes detailed for younger children in Vihman (1980), weak syllable deletion is the most common, accounting for 3% of TD errors and 4% of LT errors, occurring in the speech of 21 children (5). The most common occurrence is word-final unstressed syllable omission in words – or any position in phrases. The process is thus different from what we see in first words, but the occurrences are rare.

Consonant harmony, however, is expected only rarely in children of this age (Grunwell 1982), and indeed accounts for just 1% of the errors for the TDs and 2% for the LTs (6). Note that it is difficult, in running speech, to distinguish consonant harmony as a process from speech errors of the kind found in adults (see Jaeger 2005). Virtually all of the errors are single occurrences, rather than the stable lexical use we see in younger children.

Finally, cluster reduction is divided here into a number of distinct processes (7–11). All of these error types combined account for 9% of TD and 10% of LT errors. The type of reduction is the same as that described by Vihman (1980): retention of the non-liquid – and, in the case of 'other' cluster

reduction, which generally involves nasals, retention of the nasal in most cases.

In summary, taking exhaustive account of all the mispronunciations made by children who are well beyond the single-word stage, we find a wide range of different errors, none used consistently or with great frequency by any of the children. What were pervasive errors for some children at the younger age (consonant harmony, syllable deletion) are now sporadic, with a suggestion of lexical rather than phonological errors in some cases. Where errors are still fairly common at this developmental point (cluster reduction), they agree with the analysis of earlier child errors in being quite different in detail from those found in sound change. None of this appears to offer much support for the hypothesis that change has its roots in mislearning by children.

## 4.2 Data from a sociophonetic study

Data are drawn from the *Emergence of Structured Variation* (*ESV*) corpus, comprising recordings from first-born children from Newcastle (Docherty et al. 2002). The main aim of *ESV* was to track acquisition of sociolinguistic variants. Forty children (20 boys) were recorded in a cross-sectional design at ages 2;0, 2;6, 3;0, 3;6 and 4;0. Ten children were followed longitudinally over the same age range (yielding a further 52 recordings). Recordings ranged from 15 to 45 minutes, involving free play and picture-book tasks with the mother. The original transcriptions focused on words containing /t/ in several phonological and prosodic contexts (Table 3). Auditory transcriptions were supported by acoustic analysis.

Table 3 Phonological contexts included in /t/ analysis

| Context | Definition | Examples |
|---|---|---|
| Initial | word-initial pre-vowel | *teddy, top, table* |
| Medial | V__(#)V, foot-internal | *water, it is* |
| | __l | *little, bottle* |
| | T-to-R contexts | *put a, get on* |
| Final | turn final; excludes consonant clusters | *cat, boat, what?* |

The original transcriptions were reanalysed for this chapter, in order to identify common deviations from adult target forms which might constitute innovations. We also assessed the children's role in transmission, comparing their use of variants known to be participating in ongoing changes.

Since the *ESV* project was interested in variation, we took a sociolinguistically, and phonetically, informed view of phonological targets and considered all variants of /t/ that are found in normal adult speech. Thus we did not consider the target necessarily to be [t]. Previous work had revealed a range of variants associated with particular contexts, varying in voicing, pre-aspiration, glottaling/laryngealization, and place and manner of articulation (Docherty et al. 1997, Foulkes & Docherty 2006). Table 4 summarizes the most frequently encountered phonetic forms in the child corpus.

Table 4 Variants of /t/ found in child corpus

| Context | | Accurate | Inaccurate (examples) |
|---|---|---|---|
| Initial | | t tʰ tˢ | tʃ ʈ ɬ tθ θ s c cʰ k x q h deletion consonant harmony |
| Medial | V__(#)V foot-internal | t tʰ tˢ ɾ d ɖ ʔ | |
| | __l | t tʰ tˢ ɾ d ɖ ʔ | |
| | T-to-R contexts | t tʰ tˢ ɾ d ɖ ʔ ɹ ʊ | |
| turn-final | | t tʰ tˢ ʔ ʰt t̚ | |

A search of sources on sound change revealed a number of common processes that affect /t/ or all voiceless stops. These are summarized in Table 5, and form a set of predicted potential changes to be tested via the dataset.

Table 5 Common sound changes affecting /t/

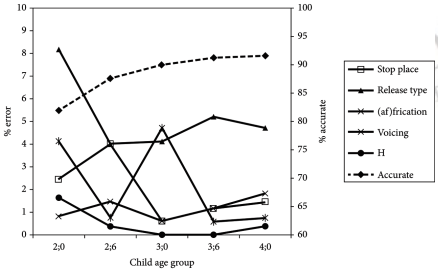
| Type | Source | Language(s) | Notes |
|---|---|---|---|
| 1. voicing/ deaspiration | Lavoie (2001) | Urubu-Kapoor | |
| 2. place change, e.g. /t/ > /k/ | Scheer (this volume) Blevins (2004: 123)<br>Fox (1995: 82) | Hawai'ian<br>Austronesian | rare; mainly occurs where /k/ is lacking in inventory |
| 3. frication/ affrication | Ohala (2005)<br>Lavoie (2001) | Mvumbo<br>West Greenlandic | mainly occurs pre-close vowel or intervocalically |
| 4. /t/ > /h/ | Gillies (2009: 251) | Scottish Gaelic | synchronic mutation |
| 5. deletion | Blevins (2004: 165) | 50 Australian aboriginal lgs | rare in initial position, more common elsewhere |
| 6. glottaling | Fabricius (2000) etc. | English | context sensitive |
| 7. pre-aspiration | Silverman (2003) | Icelandic | mostly in final contexts |
| 8. consonant harmony | Blevins (2004: 230) | ? | rare in sound change |

The first five changes listed in Table 5 were investigated as potential innovations. Glottaling and pre-aspiration are already present in the Newcastle dialect, and participate in ongoing change. They were therefore examined as transmission changes. Consonant harmony was not analysed as it is virtually unknown in change, despite being common in child language.

Examination of transcriptions was quantitative and fully accountable, that is, all tokens of target /t/ were considered (N = 3,804) in the contexts listed in Table 4. 'Accuracy' was judged relative to documented adult variants, again as shown in Table 4. In all cases phonological context was taken into account, since some variants are conditioned by context, and context-free sound changes appear to be unusual in adult languages (Blevins 2004). For example, voicing was not considered for medial /t/, as statistically most adult variants are voiced. Frication/affrication of /t/ is also found for adults, so only certain fricative/affricate forms were considered inaccurate (e.g. [s, x]). Errors defined as 'release type' had [t] produced accurately but the fricative release occurred at a different place of articulation from those used by adults (usually [tʃ]). We concentrate on data from the children in the cross-sectional study. Longitudinal data showed similar patterns.

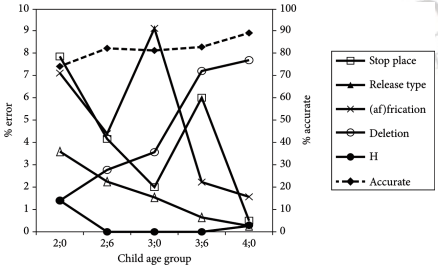
### 4.2.1 Potential innovations

Data are shown in Figures 1–3 (initial, medial and final /t/, respectively; medial contexts are combined for simplicity). In each figure overall accuracy is shown via a dotted line oriented to the right-hand axis. Error types are aligned to the left-hand axis. Data are pooled from eight children at each age.



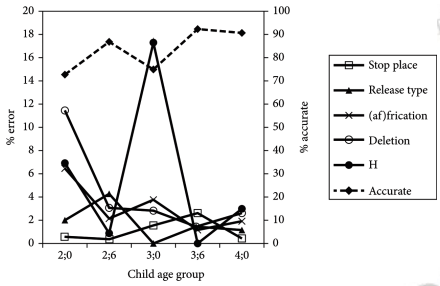

*Click to view larger*

*Figure 1* Accuracy and error types (%) by age group, initial /t/. Accuracy is plotted against the right axis, error types against the left axis.




*Click to view larger*

*Figure 2* Accuracy and error types (%) by age group, medial /t/. Accuracy is plotted against the right axis, error types against the left axis.




*Click to view larger*

*Figure 3* Accuracy and error types (%) by age group, final /t/. Accuracy is plotted against the right axis, error types against the left axis.

Figures 1–3 all show a clear rising trend for accuracy by age. Error types are more frequent for younger children, gradually diminishing to low rates for the oldest children (mostly under 2% per context for the 4;0 group).

In each context we also see peaks in the distribution of some error types (voicing in initial context, affrication and stop place medially, and [h] finally). These peaks are all due to one or two children showing high use of the process. For instance, the peak in final [h] is generated by one boy who contributes 40 of the 56 tokens to the 3;0 group. Moreover, [h] is also lexically restricted for him, with 37 tokens occurring on *what?* Interestingly, patterns for the children in the longitudinal study also showed numerous peaks. We interpret peaks as an indication that the children were experimenting with articulatory strategies at certain points in their development, eventually dispensing with phonetic forms that are not sufficiently good matches to adult usage.

The apparent rising trend in medial deletion can also be ascribed to two high scoring individuals, one each aged 3;6 and 4;0. Both children mostly show deletion in a small set of common words: *get*, *got*, *getting*, *what*, *not*, *it*. Although not previously reported for adults in Newcastle, deletion of /t/ in connected speech has been noted for other English dialects, especially with frequent words (e.g. Fabricius 2000: 85), and we have also since observed both this and final [h] in the speech of Newcastle adults. Deletion may therefore in fact reflect advanced articulatory skills, emerging as the children develop rapid and fluent speech. Turn-final deletion, by contrast, is rare (as in the developmental data, section 4.1) and decreases with age.

For initial /t/ the most frequent error is release type. This mainly comprises realizations transcribed as [tʃ], with 33 of 37 such tokens preceding a close or close-mid vowel /i: e: u: o: ɪ ʊ/. This pattern is indeed predicted as a conditioned sound change. Ohala (2005), for example, hypothesizes that alveolar stops are likely to affricate adjacent to close front vowels. The narrow channel created by the stop closure yields a higher volume velocity of airflow at the stop release, which may generate frication in the post-alveolar region. The release type error is also less frequent in medial and final contexts. This might be explained by the high incidence of initial stress in English words, resulting in greater airflow at word onset and thus a greater likelihood of generating turbulent airflow at stop release. Initial release type errors remain relatively stable across the age range, but are still low in overall frequency (4–5% from 2;6 onwards).

Stop place errors in initial context are generally palatal (16/21 tokens), such as *tiger* [c$^{h}$-]. This pattern appears at odds with what is expected for change: in sound change palatals usually arise via fronting of velars, not retraction of alveolars (Fox 1995: 82, Ohala 2005). However, differences in the shape and size of children's vocal tracts relative to adult ones predict a high incidence of [c] for /t/ (section 3.1.1). /t-/ > [k-] is vanishingly rare (2 tokens in 1016), as predicted in change. In medial context, by contrast, stop place errors are mostly [k] (38/49 errors, with five more transcribed as uvular, all by the same child). All [k/q] tokens occur in the words *little* or *bottle*. This lexically restricted error is common for British children and might reflect lexical variants used in CDS. (We do not attribute the retraction of /t/ to the final /l/, since in Newcastle coda /l/ is not velarized and no other /-l/ words are affected.)

In summary, these data, like those considered in 4.1, offer little support for the hypothesis that child errors are a likely source of innovations. The observation of peaks is difficult to reconcile as an indication of new forms emerging that might eventually pervade the whole dialect. They seem far too restricted, with respect to both individuals and time windows, to have much chance of being adopted and transmitted. Lexically restricted patterns such as [k] in *little*, *bottle* might in principle indicate a lexical diffusion change, but in this case such forms are common for British English-speaking children and are not usually acceptable adult forms. Finally, with the exception of initial [tʃ-], error patterns in the data appear to be counter to known patterns of change.

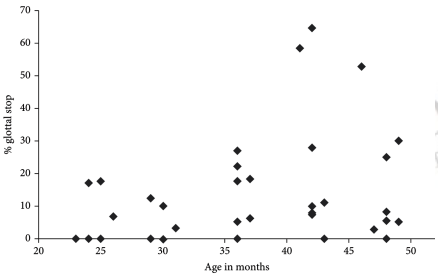
### 4.2.2 Transmission changes

Both turn-final glottaling and pre-aspiration are sound changes in progress in Newcastle, with both statistically more common for females. Pre-aspiration is reported in detail in Foulkes & Docherty (2006). Overall there is considerable variability in the frequency of pre-aspiration for both children and mothers. Usage by younger children shows a statistically significant correlation with that of their mothers. Older children, however, produce pre-aspiration at high rates, whether or not their mothers do so. Moreover, girls produce more pre-aspiration than boys at 3;6 and 4;0.

A comparable pattern is found for glottaling. Final glottal stops are rare in Newcastle, and are especially attracted to tag questions (Docherty et al. 1997). It was not possible to assess systematically whether tags affected the child data, but since tags are discourse features we would only expect to see them in the speech of older children. In the cross-sectional data 13.5% of all turn-final /t/ were realized as glottals, with considerable variation between children (0–85% if we include children in the longitudinal sample). When examined by age group (Figure 4), the rate of glottaling increases significantly in line with age (Pearson's $r = 0.354$, df = 38, $p = 0.025$, 2-tailed), although much of this effect is due to the three high-scoring older children (all boys). Longitudinal data also show an overall rising trend, however. The gender pattern is not the same as that found for adults. Boys used more glottals than girls (18.9% versus 7.7% overall), and in all age groups except at 2;6.

In sum, for both pre-aspiration and glottaling the children appear to be accelerating ongoing changes. Note that the higher usage by older children, and

for pre-aspiration the emerging gender differentiation, indicate that the forms have been acquired as learned sociolinguistic variants, not as the result of error by immature speakers.




*Click to view larger*

*Figure 4* Glottal stop usage (%) by age group, final /t/. 8 speakers per age group. (Note that some data points are wholly overlapped.)

### 4.2.3 Summary

As was the case with the data presented in section 4.1, we see little evidence for errors as the source of change. We do see, however, that older children are participating in changes in progress.

## 5 Conclusion

We have reviewed previous commentaries on child language as a source of change, highlighting the fact that there has been little consensus and remarkably few systematic attempts to address the issue empirically. We therefore assembled two large datasets to assess impartially whether error data are suggestive of change. We acknowledge that these datasets do not settle the debate definitively, being limited to a small set of phonological units and processes in one language. We also concur with Bloomfield (1933): no single explanation is likely to satisfy all nuances of what is a very complex question.

However, our conclusion is that early errors are highly unlikely to lead to change. Errors diminish with time, and some early processes disappear by around age 3. Others appear and disappear sporadically, and are limited to particular individuals. Initiation changes, if ascribed to vocal tract dynamics or perceptual factors, are no more likely to be the responsibility of children than of adults. It is also imperative to acknowledge the extent of variation between individuals learning the same language, especially at younger ages, a fact largely ignored by previous commentators. For a new generation to recast a grammar would appear unlikely when members of that generation take so many different paths to acquire it (see further Vihman et al. 1994).

Children's role in transmitting changes in progress is more readily demonstrable. But it is to the performance of older rather than younger children that we must look, and it is more profitable to conceptualize child patterns as learned features than as errors. Understanding the social context in which learning takes place is crucial, to explain why certain individuals influence others linguistically, and why linguistic variants confer some sort of social or communicative advantage to language users.

The answers to many other questions about change remain partial. To what extent are innovations the product of vocal tract dynamics, and to what extent the product of forces internal to the grammar (cf. Jones, this volume)? In transmission, what factors are necessary for, or conducive to, new forms being transmitted? Finally, for both innovation and transmission, we can only echo Saussure and Bloomfield: '*why here*?, *why now*?'

## References

Aitchison, Jean (2003). 'Psycholinguistic perspectives on language change', in Brian D. Joseph and Richard D. Janda (eds) *Handbook of Historical Linguistics*. Oxford: Blackwell, 736–43.

Andersen, Henning (1973). 'Abductive and deductive change', *Language* 49: 765–93.

Andersen, Henning (1978). 'Perceptual and conceptual factors in abductive innovations', in Jacek Fisiak (ed.), *Recent Developments in Historical Phonology*. The Hague: Mouton, 1–22.

Baron, Naomi S. (1977). *Language Acquisition and Historical Change*. Amsterdam: North-Holland.

Bialystok, Ellen & Hakuta, Kenji (1999). 'Confounded age: Linguistic and cognitive factors in age differences for second language acquisition', in David Birdsong (ed.), *Second Language Acquisition and the Critical Period Hypothesis*. Mahwah, NJ: Erlbaum, 161–81.

Birdsong, David (2005). 'Interpreting age effects in second language acquisition', in Judith F. Kroll & Annette M. B. De Groot (eds), *Handbook of Bilingualism: Psycholinguistic Approaches*. Oxford: Oxford University Press, 109–27.

Blevins, Juliette (2004). *Evolutionary Phonology: The Emergence of Sound Patterns*. Cambridge: Cambridge University Press.

Bloomfield, Leonard (1933). *Language*. London: George Allen & Unwin.

Braine, Martin D. S. (1974). On what might constitute learnable phonology. *Language* 50: 270–99.

Docherty, Gerard J. & Foulkes, Paul (1999). 'Newcastle upon Tyne and Derby: instrumental phonetics and variationist studies', in Paul Foulkes & Gerard J. Docherty (eds), *Urban Voices: Accent Studies in the British Isles*. London: Arnold, 47–71.

Docherty, Gerard J., Foulkes, Paul, Dodd, Barbara & Milroy, Lesley (2002). *The Emergence of Structured Variation in the Speech of Tyneside Infants*. Final report to the United Kingdom Economic and Social Research Council, grant R000 237417.

Docherty, Gerard J., Foulkes, Paul, Tillotson, Jennifer & Watt, Dominic J. L. (2006). 'On the scope of phonological learning: issues arising from socially structured variation', in Louis Goldstein, Douglas H. Whalen, and Catherine T. Best (eds), *Laboratory Phonology 8*. Berlin: Mouton de Gruyter, 393–421.

Drachman, Gabarell. (1978). 'Child language and language change: a conjecture and some refutations', in Jacek Fisiak (ed.), *Recent Developments in Historical Phonology*. The Hague: Mouton, 123–44.

Echols, Catharine H. & Newport, Elissa L. (1992). 'The role of stress and position in determining first words', *Language Acquisition* 2: 189–220.

Edwards, Jan, Beckman, Mary E., & Munson, Ben (2004). 'The interaction between vocabulary size and phonotactic probability effects on children's production accuracy and fluency in novel word repetition', *Journal of Speech, Language, and Hearing Research* 47: 421–36.

Fabricius, Anne (2000). *T-Glottalling Between Stigma and Prestige: A Sociolinguistic Study of Modern RP*. PhD dissertation, Copenhagen Business School.

Ferguson, Charles A. (1990). 'From esses to aitches: identifying pathways of diachronic change', in William A. Croft, Suzanne Kemmer and Keith Denning (eds), *Studies in Typology and Diachrony*. Amsterdam: John Benjamins, 59–78.

Foulkes, Paul (1997). 'Historical laboratory phonology: investigating /p/ > /f/ > /h/ changes', *Language and Speech* 40: 249–76.

Foulkes, Paul & Docherty, Gerard J. (2006). 'The social life of phonetics and phonology', *Journal of Phonetics* 34: 409–38.

Foulkes, Paul, Docherty, Gerard J. & Watt, Dominic J. L. (2005). 'Phonological variation in child directed speech', *Language* 81: 177–206.

Fox, Anthony T. C. (1995). *Linguistic Reconstruction. An Introduction to Theory and Method*. Oxford: Oxford University Press.

Fromkin, Victoria, Rodman, Robert & Hyams, Nina (2011). *An Introduction to Language* (9th edn). Boston: Wadsworth.

Gillies, William (2009). 'Scottish Gaelic', in Martin Ball and Nicole Muller (eds), *The Celtic Languages* (2nd edn). London: Routledge, 230–304.

Grammont, Maurice (1902). 'Observations sur le langage des enfants', in *Mélanges linguistiques offerts à M. Antoine Meillet*. Paris: Klincksieck, 115–31.

Greenlee, Mel & Ohala, John J. (1980). 'Phonetically motivated parallels between child phonology and historical sound change', *Language Sciences* 2: 283–301.

Grunwell, Pamela (1982). *Clinical Phonology*. London: Croom Helm.

Halle, Morris (1962). 'Phonology in generative grammar', *Word* 18: 54–72.

Harrington, Jonathan (2006). 'An acoustic analysis of 'happy-tensing' in the Queen's annual Christmas broadcasts', *Journal of Phonetics* 34: 439–57.

Hazen, Kirk (2002). 'The family', in Jack K. Chambers, Peter Trudgill & Natalie Schilling-Estes (eds), *The Handbook of Language Variation and Change*. Oxford: Blackwell, 500–25.

Hooper, Joan Bybee (1980). 'Child morphology and morphophonemic change', in Jacek Fisiak (ed.) *Historical Morphology*. The Hague: Mouton, 157–87.

Jaeger, Jeri J. (2005). *Kids' Slips: What Young Children's Slips of the Tongue Reveal about Language Development*. Mahwah, NJ: Lawrence Erlbaum.

Jespersen, Otto (1922). *Language. Its Nature, Development and Origin*. London: George Allen & Unwin.

Johnson, Jacqueline S. & Newport, Elissa L. (1989). 'Critical period effects in second language learning: the influence of maturational state on the acquisition of English as a second language', *Cognitive Psychology* 21: 60–99.

Keller, Rudi (1994). *On Language Change: the Invisible Hand in Language*. London: Routledge.

Kent, Raymond D. (1981). 'Articulatory-acoustic perspectives on speech development', in Rachel E. Stark (ed.), *Language Behavior in Infancy and Early Childhood*. New York: Elsevier/North-Holland, 105–26.

Kerswill, Paul (1995). 'Children, adolescents and language change', *Working Papers in Linguistics* 2, Department of Linguistic Science, University of Reading, 201–22.

Kerswill, Paul & Williams, Ann (2005). 'New towns and koineization: linguistic and social correlates', *Linguistics* 43: 1023–48.

Kiparsky, Paul (1965). *Phonological Change*. PhD dissertiation, MIT.

Kiparsky, Paul (1968). 'Linguistic universals and linguistic change', in Emmon W. Bach and Robert T. Harms (eds), *Universals in Linguistic Theory*, London: Holt, Rinehart & Winston, 171–202.

Kiparsky, Paul (1988). 'Phonological change', in Fritz Newmeyer (ed.), *The Cambridge Survey of Linguistics*, Vol. 1. Cambridge: Cambridge University Press, 363–415.

Labov, William (2001). *Principles of Linguistic Change. Volume 2: Social Factors*. Oxford: Blackwell.

Lavoie, Lisa (2001). *Consonant Strength: Phonological Patterns and Phonetic Manifestations*. New York: Garland.

Lenneberg, Eric (1967). *Biological Foundations of Language*. New York: Wiley.

Lieberman, Philip, Crelin, Edmund S., & Klatt, Dennis H. (1972). 'Phonetic ability and related anatomy of the newborn and adult human, Neanderthal man, and the chimpanzee', *American Anthropologist* 84: 287–307.

Local, John (1982). 'Modelling intonational variability in children's speech', in Suzanne Romaine (ed.), *Sociolinguistic Variation in Speech Communities*. London: Edward Arnold, 85–103.

Locke, John L. (1983). *Phonological Acquisition and Change*. New York: Academic Press.

Maddieson, Ian (1984). *Patterns of Sounds*. Cambridge: Cambridge University Press.

Manly, J. M. (1930). 'From generation to generation', in Niels Børgholm, Aage Brusendorff & Carl A. Bodelsen (eds), *A Grammatical Miscellany Offered to Otto Jespersen on his 70th Birthday*. London: George Allen & Unwin, 287–9.

Meillet, Antoine (1951). *Linguistique Historique et Linguistique Générale*, vol. 2. Paris: Klincksieck.

Menéndez-Pidal, Ramón (1949). *Manual de Grámatica Histórica Española* (8th edn). Madrid: Espasa-Calpe.

Menn, Lise (1983). 'Development of articulatory, phonetic, and phonological capabilities', in Brian Butterworth (ed.), *Language Production*, vol. 2. London: Academic Press, 3–50.

Menn, Lise & Vihman, Marilyn M. (2011). 'Features in child phonology: inherent, emergent, or artefacts of analysis?' in G. Nick Clements & Rachid Ridouane (eds), *Where Do Phonological Features Come From? The nature and sources of phonological primitives*. Amsterdam: John Benjamins, 261–301.

Milroy, Lesley (1987). *Language and Social Networks* (2nd edn). Oxford: Blackwell.

Milroy, Lesley (2007). 'Off the shelf or under the counter? On the social dynamics of sound changes', in Christopher Cain and Geoffrey Russom (eds), *Managing Chaos: Strategies for Identifying Change in English*. Berlin: Mouton De Gruyter, 149–71.

Müller, Max (1890). *The Science of Language*. New York: Charles Scribner.

Ohala, John J. (1989). 'Sound change is drawn from a pool of synchronic variation', in Leiv E. Breivik & Ernst H. Jahr (eds), *Language Change: Contributions to the Study of its Causes*. Berlin: Mouton de Gruyter, 173–98.

Ohala, John J. (2005). 'Phonetic explanations for sound patterns: Implications for grammars of competence', in William J. Hardcastle & Janet M. Beck (eds), *A Figure of Speech. A Festschrift for John Laver*. London: Erlbaum, 23–38.

Paul, Hermann (1886). *Prinzipien der Sprachgeschichte* (2nd edn). Halle: Niemeyer.

Prokosch, Eduard (1939). *A Comparative Germanic Grammar*. Philadelphia: LSA.

Roberts, Julie (2002). 'Child language variation', in Jack K. Chambers, Peter Trudgill, and Natalie Schilling-Estes (eds), *The Handbook of Language Variation and Change*. Oxford: Blackwell, 333–48.

Saussure, Ferdinand de (1915 [1974]). *Course in General Linguistics*. London: Fontana.

Schleicher, August (1861 [1971]). 'Some observations made on children', in Aaron Bar-Adon and Werner F. Leopold (eds), *Child Language: a Book of Readings*. Englewood Cliffs: Prentice-Hall, 19–20.

Shevelov, George Y. (1964). *A Prehistory of Slavic: The Historical Phonology of Common Slavic*. Heidelberg: Carl Winter, Universitätsverlag.

Smith, Jennifer, Durham, Mercedes & Fortune, Liane (2007). 'Community, caregiver and child in the acquisition of variation in a Scottish dialect', *Language Variation and Change* 19: 63–99.

Smith, Neil V. (1973). *The Acquisition of Phonology: A Case Study*. Cambridge: Cambridge University Press.

Snow, David (1998). 'A prominence account of syllable reduction in early speech development: the child's prosodic phonology of tiger and giraffe', *Journal of Speech, Language, and Hearing Research* 41: 1171–84.

Stampe, David (1969). 'The acquisition of phonetic representation', Papers from the Fifth Regional Meeting of the Chicago Linguistic Society, 443–54.

Stampe, David (1979). *A Dissertation on Natural Phonology*. New York: Garland.

Stark, Rachel E. (1980). 'Stages of speech development in the first year of life', in Grace Yeni-Komshian, James F. Kavanagh & Charles A. Ferguson (eds), *Child Phonology*, vol. 1: Production. New York: Academic Press, 73–92.

Stoel-Gammon, Carol (1992). 'Prelinguistic vocal development: Measurement and predictions', in Charles A. Ferguson, Lise Menn, & Carol Stoel-Gammon (eds), *Phonological Development: Models, Research, Implications*. Timonium, MD: York Press, 439–56.

Storkel, Holly L. (2001). 'Learning new words: Phonotactic probability in language development', *Journal of Speech, Language, and Hearing Research* 44: 1321–37.

Sully, James. (1896). *Studies of Childhood*. New York: D. Appleton.

Sweet, Henry (1888). *A History of English Sounds*. Oxford: Clarendon Press.

Tagliamonte, Sali & D'Arcy, Alex (2009). 'Peaks beyond phonology: adolescence, incrementation, and language change', *Language* 85: 58–108.

Vihman, Marilyn M. (1978). 'Consonant harmony: its scope and function in child language', in Joseph H. Greenberg, Charles A. Ferguson & Edith A. Moravcsik (eds), *Universals of Human Language*. Stanford, CA: Stanford University Press, 281–334.

Vihman, Marilyn M. (1980). 'Sound change and child language', in Elizabeth C. Traugott, Rebecca La Brum and Susan Shepherd (eds), *Papers from the 4th International Conference on Historical Linguistics*. Amsterdam: John Benjamins, 303–20.

Vihman, Marilyn M. (1981). 'Phonology and the development of the lexicon: evidence from children's errors', *Journal of Child Language* 8: 239–64.

Vihman, Marilyn M. (1996). *Phonological Development*. Oxford: Blackwell.

Vihman, Marilyn M., DePaolis, Rory A. & Davis, Barbara L. (1998). 'Is there a 'trochaic bias' in early word learning? Evidence from English and French', *Child Development* 69: 933–47.

Vihman, Marilyn M., Kay, Edwin, Boysson-Bardies, Bénédicte de, Durand, Catherine & Sundberg, Ulla (1994). External sources of individual differences? A cross-linguistic analysis of the phonetics of mothers' speech to one-year-old children. *Developmental Psychology* 30: 652–63.

Vihman, Marilyn M., Keren-Portnoy, Tamar, Whitaker, Chris, Bidgood, Amy & McGillion, Michelle (submitted). 'Late talking toddlers: Relating early phonological development to later language advance'.

Weinreich, Uriel, Labov, William and Herzog Marvin I. (1968). 'Empirical foundations for a theory of language change', in Winfred P. Lehmann and Yakov Malkiel (eds), *Directions for Historical Linguistics: A Symposium*. Austin: University of Texas Press, 95–195.

Yeni-Komshian, Grace H., Kavanagh, J. F. & Ferguson, Charles A. (eds) (1980), *Child Phonology*, vol. 1: Production. New York: Academic Press.

## Notes:

([1]) Our thanks to Amy Bidgood, who carried out much of the error analysis reported in 4.1.

**Paul Foulkes**

Paul Foulkes is Professor in the Department of Language and Linguistic Science at the University of York. He has research interests in phonetics, phonology, sociolinguistics, child language acquisition, and forensic speech science. With Gerry Docherty he is the co-editor of Urban Voices (1999, Arnold), and author of over 40 journal articles and book chapters. The latter include state-of-the-science reviews in handbook volumes on Phonetics, Language & Law, English Linguistics, and Language Emergence.

**Marilyn Vihman**

Marilyn Vihman is a developmental linguist best known for her book, Phonological Development (1996, Blackwell), which will appear in a radically revised second edition in 2014, with updated surveys of research on infant speech perception, segmentation, distributional learning, experimental studies of word learning and other aspects of phonological development. She is also co-editor, with Tamar Keren-Portnoy, of The Emergence of Phonology: Whole Word Approaches, Cross-Linguistic Evidence (2013, CUP), which includes reprints of classics and new empirical studies of phonological development in six languages.