



Second Edition

Marilyn May Vihman

Phonological Development

The First Two Years

WILEY Blackwell

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Praise for *Phonological Development: The First Two Years*

“This open-minded, comprehensive overview of the intersecting components of phonological development is a masterpiece that should shape new directions of research for many years to come. Vihman elucidates the many underlying assumptions, some in conflict with one another, that have guided research on phonological development, and lays out clearly the relevance of individual variability in very young children. Vihman’s work will cause researchers in the disparate areas of perception, production, word learning, variation, and phonological universals to be informed by each other’s results, potentially revolutionizing our understanding of phonological development.”

– Sharon Inkelas, *University of California, Berkeley*

“*Phonological Development: The First Two Years* is essential reading and a primary text for all specialists and students in language development as well as those interested in phonological development in particular. It provides in-depth and up-to-date coverage of all areas of research relevant to understanding phonological development, with comprehensive reviews of both empirical findings and theoretical frameworks. An emphasis is made on the need to relate the development of perception and production, and the study of phonological development to broader areas of language acquisition. Besides eleven chapters, it also contains valuable appendices on protowords and template analyses. To my knowledge it is the most thorough and important book on this topic to date.”

– David Ingram, *Arizona State University*

“Marilyn Vihman’s work unfolds on the center court of child phonology research. This book gives a broad and insightful account of this complex topic – a treatment that is likely to serve, for a long time, as an indispensable reference on the early stages of learning to speak.”

– Björn Lindblom, *Stockholm University*

“This eagerly awaited second edition masterfully updates Vihman’s review of research on earlier themes as well as on several new themes, much of which attests to the profound inspiration of the seminal first edition.”

– Mary Beckman, *Ohio State University*

I dedicate the second edition of this book to my children, Virve-Anneli and Raivo-Erik René, and to my granddaughters, Meelo Eliisabet and Kaisa Amélie: No one has taught me more.

Note on Second Edition

This book provides an extensive overview of research into child language production and perception. It focuses primarily on the first two years of life because, for the majority of children, that includes the whole of the single-word period, when phonological development and change are by far the most rapid, laying the foundation for further language learning. The new edition includes new chapters on development in the first 18 months, segmentation and distributional learning, word learning experiments, and bilingual phonological development; it retains and updates the original chapters on perception, vocal production and the transition into language. Although the new edition has no chapter on prosody, the sections of that chapter that pertain to final lengthening or to speech rhythm in general have been retained in Chapter 6; unfortunately, there is no longer space in a single volume to do justice to the field of prosodic development as a whole. The book also includes one chapter each on formalist and functionalist theoretical models and a new concluding chapter on the link between perception and production and the role of lexical growth in supporting further learning.

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Introduction

Biological Foundations of Language Development
Phonological Development: Goals and Challenges
Methodologies: Data Sources and Theoretical Perspectives
Overview

The first two years of life constitute a period of dramatic change, not least because it is in that period that most children begin to make use of words or phrases of the adult language and to combine them into their first sentences. And indeed the first questions to be asked about phonological development, based on early diary studies, related to infant production of speech in the first two years. How universal is the order of learning of speech sounds, for example, in different language communities and different children, and how, if at all, is babbling related to speech (Jakobson, 1941/68)? And how do infants with bilingual exposure manage so successfully to produce two languages like native speakers (Leopold, 1939)?

Later, with advances in technology, it became possible to ask about speech perception: How do children learn to distinguish between the speech sounds that they hear, for example, and how do they begin to discover words in the rapidly changing speech signal, where words are not marked off by pauses (Jusczyk, 1997)? Perceptual discrimination is remarkably acute in the first months of life, as became clear from the first experimental studies in the 1970s, but these early capacities become increasingly attuned to the particular language or languages to which the child is exposed over the first year. We can then ask, how does this process of attunement support word learning (Werker & Curtin, 2005)? Equally basic is the issue of the relation of

perception to production: How does the infant's early discriminatory skill translate into vocal practice and word formation (Kuhl et al., 2008)?

Additional questions have received attention and analysis only more recently: How important is the 'music' of speech, or speech rhythm or prosody, for phonological development (Mehler et al., 1988; Nazzi, Bertoncini & Mehler, 1998)? And to what extent does word learning itself support advances in knowledge of sounds and sound patterns (Ferguson & Farwell, 1975; Vihman & Keren-Portnoy, 2013)?

The essential mystery of language acquisition, the child's move from having no linguistic system to the beginnings of system, is deeply rooted in the first two years of development. However, to gain insight into that mystery we must look beyond studies of speech perception and vocal production *per se* to consider the findings of research into the developmental changes occurring in parallel in other domains. Before word use is observed, for example, the notion of intentional communication itself must emerge, followed by understanding of the possibility of communicating by vocal means. These pragmatic advances make up one of the strands that prepare the child for language use.

Changes in neuromotor control as well as in attentional mechanisms enable the child to participate more and more actively in social exchanges over the course of the first year. Early perceptual capacities come to be supplemented by increasingly adult-like vocal expression, leading to preparedness in terms of the phonetic prerequisites for word use. The third preparatory strand is increasing representational capacity. This can be understood as referring to advances in working memory, or the ability to maintain more than one item in mind while preparing a vocal or gestural action; these advances build on the child's emergent pragmatic and phonetic skills and social experiences to complete the set of essential precursors to language use.

We will largely restrict ourselves here to the foundational period of language development for several reasons. First, since change is so rapid, close attention is warranted to each of the successive phases of maturation and learning. Second, a wealth of research, deriving mainly from linguistics, psychology and speech science, has addressed these changes in the past several years; the literature available for review is now so considerable that a longer period could scarcely receive adequate coverage in a single volume.

Finally, the age of two is a sensible demarcation point, if only because this is the age at which 'late talking toddlers' are generally identified. These are 2-year-olds who have not yet reached the end of the single-word period – that is, who have fewer than 50 words in production and/or few if any word combinations. These children are considered to be at risk for specific language impairment (SLI), although at least half of them will reach the basic lexical and syntactic developmental milestones by age 2.5 and thus be reclassified as 'typically developing', or '[late-]bloomers' (Fernald & Marchman, 2012). There is good reason to believe that difficulties with phonological and lexical development in the single-word period can account to some extent for later difficulties with overall language development (Vihman, Keren-Portnoy, Whitaker, Bidgood & McGillion, 2013). This is an important finding, underlining both the critical significance of the first two years and the relevance of research in

phonological development for those interested in understanding language development more generally, and also for clinicians and other practitioners who deal with children.

Biological Foundations of Language Development

Some of the motivating questions of the field of phonological development pertain to language development more generally: How can children learn language so quickly, for example? What special skills or resources do they have? Alternative ways of responding to these questions, taking radically different approaches, fall together under the rubric of 'biological foundations'. Here we consider the theoretical divide that is central to the field of linguistics and thus also language development, and take up the related question, what kinds of explanations are available? What sources of information can we draw on, to account for the timing and processes of phonological development?

Chomsky and the origins of the LAD and UG

A common non-specialist view holds that children learn language remarkably quickly and easily. This everyday view was enshrined in linguistic theory with the publication of Noam Chomsky's *Aspects of the Theory of Syntax* (1965), which soon became a key linguistic text, as structuralism was replaced by the theory that grew out of it, generative grammar (Harris, 1993). Chomsky was not centrally concerned with language development, which he has never claimed as a field of expertise. However, given the complexity of the adult linguistic system, for which he could provide ample evidence, he was presumably struck by the paradox of the rapidity and ease with which children – considered rather incompetent in most domains – appeared to 'pick it up', without the benefit of explicit instruction.

Chomsky's first foray into this territory was his review of *Verbal Behavior*, published in 1957 by one of the foremost behavioral psychologists of his day, B. F. Skinner. Based on his work on the effects of conditioning on animals, Skinner saw reinforcement as 'a necessary condition for language learning' (as cited in Chomsky, 1959, p. 36) and specified that acquisition of 'verbal behavior' occurs

when relatively unpatterned vocalizations, *selectively reinforced*, gradually assume forms which produce appropriate consequences in a given verbal community ... *Differential reinforcement* shapes up all verbal forms ... (Skinner, 1957, p. 31, emphasis added)

Chomsky's sharply critical review of Skinner's book has generally been seen as marking the end of behaviorism's acceptance as a potential account of language learning. In particular, Chomsky argued successfully that the idea that specific 'reinforcement' should be a cornerstone of language acquisition was untenable. Chomsky also attacked the idea that frequency ('a very misleading measure of

strength': p. 34) plays any important role in learning. Instead, Chomsky argued in his later work that infants must be born with *foreknowledge of linguistic principles*, or, as he put it, with a 'language-acquisition device' or LAD (Chomsky, 1965). This clever acronym was soon replaced by Universal Grammar (UG: Chomsky, 1967, 1981b), although the basic idea remained the same.

Despite Chomsky's continued dominance or near dominance of linguistics, his rejection of frequency and reinforcement as playing any role in learning has begun to be quietly set aside, in light of current understanding of the role of implicit alongside explicit learning mechanisms (see Bybee & Hopper, 2001; Ellis, 2002a), of 'statistical learning' and its relevance for infants (Saffran, Aslin & Newport, 1996), and of the social context within which vocalizations gain value for the child, an indirect form of 'reinforcement' with no specific pedagogical intent (Bloom & Esposito, 1975; Hsu & Fogel, 2001; Goldstein & Schwade, 2008). We return to these issues in chapters 2–5.

Chomsky's radical claims galvanized researchers interested in child language. It is fair to say that the present highly dynamic field of psycholinguistics largely developed in response to Chomsky's ideas, which both inspired supporters and stimulated sceptics or potential critics. The ideas themselves gradually became linguistic orthodoxy in mainstream linguistics, especially in the United States, but they have now begun to be widely questioned by cognitive linguists and others who adopt an 'emergentist' or 'usage-based' stance, as we will be doing here (Barlow & Kemmer, 2000; Bybee, 2001, 2010; Pierrehumbert, 2003a, 2003b; cf. also the critique from typologists Evans & Levinson, 2010 and the commentaries that follow in *Behavioral and Brain Sciences*, 32).

Analysis of an argument

Before moving to issues more directly concerned with phonological development we will give Chomsky's position a little more attention, since it has been so very influential for such a long time. Chomsky clearly sets out his position in a single sentence:

A consideration of the character of the grammar that is acquired, the degenerate quality and narrowly limited extent of the available data, the striking uniformity of the resulting grammars, and their independence of intelligence, motivation, and emotional state, over wide ranges of variation, leave[s] little hope that much of the structure of the language can be learned by an organism initially uninformed as to its general character ... (1965, p. 58)

This exceptionally complex statement can be more readily understood if divided into its component premises (1–4) and the conclusion that follows:

- 1 a consideration of the character of the grammar that is acquired ... (*premise 1: language is complex*)

- 2 the degenerate quality and narrowly limited extent of the available data (*premise 2: the input speech to which children are exposed constitutes a limited and poorly structured sample for learning*)
- 3 the striking uniformity of the resulting grammars (*premise 3: adult grammars (of a given language) are all much the same – i.e., there is little in the way of individual differences among adults*)
- 4 and their independence of intelligence, motivation, and emotional state, over wide ranges of variation (*premise 4: individual differences among children also make very little difference to acquisition*)

The organism must be initially informed as to its general character ... (*conclusion: some kind of innate 'blueprint' or template must exist or acquisition would not be possible*).

In his later work Chomsky has repeated some or all of these arguments in numerous books and papers, with no significant change in his thinking on this matter. For example, Elbers and Wijnen (1992) cite a similar passage from Chomsky (1981a, p. 356), in which two additional premises are included: '... a rich and complex system of rules and principles [premise 1, Complexity] is attained in a uniform way [premise 3, Uniformity], rapidly [premise 5, Speed of acquisition], effortlessly [premise 6, Ease of acquisition], on the basis of limited and rather degenerate evidence [premise 2, Limited sample]' (Chomsky, 1981, p. 356).

Premises 1, 5 and 6: Complexity of the adult language system, speed and ease of acquisition. In a chapter illustrating the effort that children can be seen to put into the many years of active learning that are actually required to achieve adult-like command and fluency, Elbers and Wijnen (1992) comment as follows:

The only constituents of Chomsky's contention that do not seem to have invited much criticism are the claim that language knowledge consists of 'a rich and complex system of rules' and the claim that language acquisition is effortless ... Yet, it is precisely in the conjunction of these two claims that a confusion of professional and nonprofessional reasoning is evident. The rich-and-complex-system claim [Premise 1] is a professional judgment, based on detailed and extensive linguistic investigation. The no effort claim [Premise 6], however, is a layman's contention, based on casual and superficial impression rather than on careful observation and research. But propositions of such a differing status should not be combined; it seems just as mistaken to hold that development is effortless just because it *seems* effortless as it would be to hold that language itself is simple just because it *seems* rather simple to the ordinary speaker who is not a professional linguist. (pp. 339–340)

Accepting Chomsky's first premise as beyond argument, then, we can go on to look briefly at each of the others.

Premise 2: Limited and poorly structured sample. First, does the speech that children hear actually provide only a 'limited' and 'degenerate' sample of the grammar?

This premise, later elaborated as the ‘poverty of the stimulus’ argument in support of UG (see Pullum & Scholz, 2002), has led to decades of research into infant-directed speech (IDS) and its consequences (for reviews, see Soderstrom, 2007; Gathercole & Hoff, 2007; we discuss the prosody of IDS in ch. 5). The general finding is that talk to children is unlike talk between adults: It involves much shorter sentences along with a much higher rate of repetition of all or parts of utterances. Although it may feature sentence fragments (phrases rather than sentences), it includes few or no false starts or self-corrections, the kind of language use that Chomsky presumably intended by the term ‘degenerate’ but which is more typical of high-level academic discourse than of talk to small children.

Thus, the input, although certainly providing a limited sample, is in many ways tailored for the child, given its adherence to topics that a small child might understand (and, more importantly, its typical orientation toward the child’s own actions and focus of attention) and the necessarily repetitive lexicon of words and phrases that accompany child-rearing routines. And yet, despite all of this, it has proven difficult to find evidence that ‘tailored speech’ is actually necessary for first-language learning.

Premise 3: Uniformity of adult grammars. Next we can ask, are adult grammars ‘uniform’ – that is, the same for all adults in a speech community? This premise has been severely challenged by variationist sociolinguistics, which evolved in the 1960s and 1970s (Labov, 1963, 1980; Weinreich, Herzog & Labov, 1968). The general understanding today is that variation (within and across speakers) is a basic characteristic of language in any speech community (Docherty, Foulkes, Tillotson & Watt, 2008; cf. also the more specific demonstrations of individual differences in grammar among adult native speakers in Street & Dąbrowska, 2010; Dąbrowska, 2012).

What are the consequences of this potential criticism of Chomsky’s premises for our understanding of language development, however? Although Labov, Dąbrowska and others have made it clear by now that we cannot assume that all speakers have ‘the same grammar’, it is pertinent here to ask whether the inter-individual differences have their origins in ‘errors of transmission’ (i.e., from parent to child), also known as ‘imperfect learning’. There has been a line of thinking within generative linguistics that this is the case (e.g., Kiparsky, 1965). The data so far brought to bear on the question have not supported the idea that children’s errors are a factor in language change (yet the notion continues to be maintained and asserted as fact, despite the lack of supporting evidence: e.g., Lightfoot, 1999; Blevins, 2004; Kiparsky, 2008): If they were, then the variability that gives rise to change might be traced back to infant mislearning.

In reality, although children do make errors of many kinds, they come in due course to faithfully reproduce the language they hear around them, shifting from parental models to peer group models as they grow older. (Furthermore, despite the superficial similarity between some developmental and historical processes, the younger children whose language remains incompletely mastered are hardly influential members of a community whose speech patterns could be expected to lead to