

Grammar in mind. But at the same time, they recognize the contributions made by usage-based and functionalist approaches to our understanding of bilingualism, and incorporate them into their analyses throughout the book. The authors don't explicitly call attention to the potential dialogue. They drop a hint, though, in the concluding chapter as to why it is that in the study of bilingualism such a discussion has a better chance of sprouting legs. The reason for this possibility is conjunctural, but worth pursuing nonetheless: that research on bilingualism must attend to a greater diversity of Language Faculty internal and general cognitive domains and mechanisms than is the case in monolingual development, thus allowing for a broader space of potential common ground. This initiative on their part, from within the field of bilingualism, happens to coincide with, or rather be a part of, a wider initiative within cognitive science to open new lines of discussion between generativists and researchers working on problems in language development from other perspectives.

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ANAT NINIO, *Language and the learning curve: A new theory of syntactic development*. Oxford: Oxford University Press, 2006. Pp. 224. ISBN: 978-0-19-929982-9, 978-0-19-929981-2.

Language acquisition researchers have long been burdened by the need to explain how children who begin speaking one word at a time can achieve the complex set of internal abstract rules required for syntax. In this book, Anat Ninio releases us from the thrall of this requirement. Unbeknownst to many students of child language, she tells us, Chomsky's Minimalist Program (Chomsky, 1995) has shifted to a radically lexicalist view of grammar,

requiring not abstract rules, but the ability to use the operation Merge, a process ‘creating a new syntactic unit from the combination of two old ones’, allowing recursion and thus infinitely long sentences (Ninio, 2006: 10). If adults no longer possess abstract rules, children do not need to develop them. In fact, she proposes that children’s initial word-based rules constitute the beginning of a continuous process towards adult competency with a syntax that is lexically driven throughout.

This is a ground-breaking book, where in five concise chapters the author presents strong theoretical claims, and proceeds to back each up with both conceptual analyses and analyses of data. Chapter 1 introduces the reader to how a lexically based approach to language knowledge can be conceptualized, and the distinct advantages this approach offers to understanding the early acquisition of grammar. Chapter 2 grounds language acquisition in the traditional domain of learning, as studied by psychologists for the past fifty years. Ninio suggests that what is known about trajectories of learning across many tasks can be applied to the skill of learning a grammar. Chapter 3 provides theoretical grounding for lexicalism in relation to both Chomsky’s Minimalist Program and current ideas about the lexical specificity of children’s earliest grammatical usage. Chapter 4 addresses the vexed notion of similarity in psychology and linguistics. If semantics cannot form a bridge to syntax, what form of similarity can be proposed? Finally, Chapter 5 links the child’s learning to the environment of both words and speakers.

Ninio begins by relating ‘Dependency’, as defined in dependency grammars, with the Merge process, as defined in Chomsky’s Minimalist Program. In the Merge/Dependency process, what children learn ‘is, at the core, the ability to put two words together so that one specifies the other’s meaning’ (p. 31). Centering on verbs as the critical feature for the construction of sentences, children need to learn each verb’s valency: the specification of the complements needed for the full expression of its meaning. For example, a transitive verb ordinarily requires a subject and an object, while an intransitive verb requires only a subject. Semantic valency expresses the number and type of complements, while syntactic valency indicates the manner in which these arguments are expressed in ‘the correct interpretable form’ (p. 15). The Merge/Dependency process allows the initial development of a set of verbs with their appropriate dependents, yielding early sentences. Applied recursively, this same process contributes to the development of longer utterances. In a simple example, Ninio analyzes the utterance *saw it* as exemplifying ‘the major building block of the Minimalist Program’, the Merge process, where ‘a new syntactic unit is created from two old ones’ (p. 7). Both Merge (a cornerstone of the Minimalist Program) and Dependency (foundational in Dependency grammars) yield asymmetrical units named for their ‘Heads’ or foundational elements. In this case, *saw* is

further specified by the pronoun *it*. Because Dependency grammar may be unfamiliar, the following section yields a useful comparison of Dependency and the Minimalist Program.

While previous researchers have proposed Merge/Dependency as the source of early syntactic development, Ninio explicitly tests this proposal. Chapter 1 also provides a useful integrative review of prior interpretations of early two-word utterances, including telegraphic speech, the ‘pivot-look’ and other forms of distributional analysis. Many utterances described by these processes can more usefully be interpreted as Merge/Dependency pairs. Ninio claims: ‘Given the similarity of form-class distinctions and word order to adult models, it seems likely that children internalize the underpinnings of syntax right from the beginning’ (p. 17).

In Chapter 2, Ninio places language acquisition squarely among other human learning processes. Children learn each syntactic construction (e.g. VO, SVO) one verb at a time, as each verb, with its syntactic and semantic valency, is learned. Learning syntactic structure for a given construction in a given language is subject to transfer effects, so the learning of a particular construction for each verb will have a positive effect on learning that same construction for the next verb, such that verbs in the construction are learned faster and faster. Because of this effect, when cumulative number of verbs expressed in the construction is plotted over time, an accelerating non-linear curve, the Power Law of Learning, results. This effect is most noticeable early in learning, as rate of learning slows down even as learning continues. Ninio provides a strong argument for the ubiquity of this power law by providing mathematical background and historical information regarding learning curves in cognitive psychology.

Ninio’s theory of syntactic development poses a direct challenge to usage-based theories such as those of Tomasello and colleagues (e.g. Tomasello, 2003; Tomasello & Brooks, 1998). Describing Tomasello’s ‘Verb Island hypothesis’ as predicting that ‘syntactic acquisition in its earliest phase is not a typical cognitive learning task, but as having unique features that preclude transfer and practice effects’ (p. 45), she presents analyses (some using Tomasello’s own data) demonstrating such effects. In additional analyses she demonstrates that such effects are not dependent on semantic similarity of verbs subject to transfer. Power law distributions are found to describe individual trajectories for several different structures for individual children over time. In experiments where children were primed with varying numbers of real verbs in a given construction (e.g. transitive), while a nonce verb was presented repeatedly in a different form (e.g. intransitive sentences), participants over two years six months of age demonstrated transfer of the modeled construction to the nonce verb (e.g. Tomasello & Brooks, 1998). In further support of the effects of language experience, she cites McClure & Pine (2002), who found that children learning verbs at

Brown's (1973) Stage II (MLU 2.0–2.49) immediately produced them with more arguments on average than they had produced with verbs learned earlier (at Stage I, MLU 1.0–1.99), suggesting transfer of learning from the verbs learned earlier to those learned at the later period.

In Chapter 3, Ninio demonstrates development toward the lexicalist stance in Chomskian grammar, summarizing the history of linguistic theorizing over the past half century, a feat accomplished in a parsimonious eight pages. The Minimalist Program recognizes that 'mapping from semantics to syntax and *vice versa* is messy, often arbitrary, at the most semi-regular, and under no circumstances deterministic' (p. 77): hence the need to include semantic and syntactic information in the lexicon. 'But once we do that it is but a short step to the elimination of the now-useless phrase-structure rules from the grammar' (p. 77). Regardless of theoretical orientation, Ninio sees this as a boon to developmental researchers because we can now see a path to building children's later complex language from their earliest two-word utterances: 'The message for the field of developmental psycholinguistics is that lexical-specific combinatory rules, item-specific syntactic schemas, should be quite sufficient for the generation of grammatical sentences in children of any developmental stage, as they are the theorized forms of syntactic knowledge in adults as well, underlying the whole of the generative process' (p. 78).

To develop grammar, children need three types of learning: (1) the lexicon of their language along with the logico-semantic and syntactic valency information for each word; (2) the combinatory operation Merge/Dependency; and (3) the ability to apply Merge/Dependency recursively. Given the varied senses and meanings of many words, lexical learning (including logical-semantic and syntactic valency) is not a simple task. Ninio notes that the *Oxford English Dictionary* lists the verb *have* with twenty-seven senses, and *give* with sixty-four, and since each semantic variant has potentially different syntactic behavior, the learning task is large.

Werner & Kaplan (1984/1963) addressed this problem of lexical learning by proposing that learning words is not a process of arbitrarily linking sound and meaning, but that the history of the learning experience for each word (presumably including aspects of neurological activation during learning) continues to influence a speaker's sense of a word when used throughout life. This would imply that even words looking and sounding the same might be experienced differently in use, based on the developmental history of word and meaning. Ninio's book provides its strongest evidence regarding children's learning of Merge/Dependency in their two- and three-word utterances, without addressing in detail how they might later learn the complexities of overlapping lexical meaning or the general process of recursion. She argues forcefully that these three learning processes can usefully replace the search for abstract rule learning, but

leaves us the challenge of further testing the initial Merge/Dependency idea and addressing the later developmental issues.

Merge/Dependency exemplifies the ‘principle of unification’, defined in computational linguistics as combining ‘partially overlapping feature structures belonging to two different words’, and is ‘apparently a pre-condition to multiword speech’ (p. 84). This process, thought by some to be innate, can be explained as a developmental process whereby single words, previously encompassing a total event, can become delimited, and hence combined (Werner & Kaplan, 1984/1963; McCune, 2008). A child at the single-word period, wanting another cookie, says either *more* or *cookie*, unable to combine the words due to their initial overlapping meaning. With development, *more cookie* becomes possible because of the gradual restriction of each word to more specific aspects of the situation – entity and dynamic aspects, respectively – while some overlap remains. This is an interesting correspondence of early organismic psychology with current linguistic notions.

In Chapter 4, Ninio addressed the problem of the potential breadth of similarity. Rejecting generalization through ‘a rule-based process using abstract representations’, she turns to ‘similarity-based analogy’, (p. 91), evocative of Johnson’s (1987) grounding of meaning in bodily experience, but asks: ‘Does generalization by similarity bring abstract rules in by the back door?’ Turning to work by Barsalou (1983, 1991) and Wittgenstein (1978/1953) she grounds the type of similarity driving the transfer of learning linguistic forms in Goal-Driven Learning, a ‘a use-conditional (as opposed to truth-conditional) theory of meaning’ (p. 93). The goal of a task, in this case the learning and production of appropriate syntactic form, drives the selection of the only reliable similarity relationship. Since the syntactic expression of a given meaning employing a given verb cannot be drawn from its semantics (a major point argued in the chapter), transfer from previous experiences of expressing the desired syntactic relation with verbs not necessarily semantically similar to the current verb would drive production of that same syntactic form with a new verb.

Although the ultimate task is ‘learning a language’, the immediate goal of each production is conveying a pragmatically and semantically based message in the manner prescribed by the language. Because of this immediate goal, ‘The dimensions and features of similarity that are then chosen to guide transfer and generalization are those most relevant to the successful completion of the ongoing task’ (p. 93). As in dynamic systems theory (Thelen, 1989; Thelen & Smith, 2006), development must be considered across multiple timescales with each behavioral act contributing to the eventual mature system. Ninio’s approach is compatible with the contextual grounding of dynamic systems: each production is influenced by ongoing contextual and organismic variables as well as the recent and

long-term history of the subject's activity. Learning is an active goal-driven process, where the learner creates ad hoc categories of similarity relevant to the task at hand. If language learning depends upon production, and production depends upon children's ongoing pragmatic communicative goals, there is little reason to believe they would be driven by semantic similarity across syntactic expressions, even if such relationships were reliable. Ninio provides analysis of the varying semantic roles of given syntactic constructs (e.g. the subject can variously be an agent, an instrument, a force or a patient; Payne, 1997). In reviewing others' views of verb syntactic development, Ninio includes a rich variety of opinions and approaches, offering the reader the opportunity to see the 'semantics predicts syntax view'. However, her review provides sufficient analysis to convince the reader that, despite some groupings of verbs where semantics and syntax link, these relationships cannot be depended upon, since 'semantics is mapped in a one-to-many manner in syntax' (p. 97), as in the several semantic roles of 'subject' noted above. Hence, 'our best bet is to conclude that grammatical relations are purely syntactic relations and the dimension of similarity relevant for their definition (and hence their acquisition) is only that of similarity of form' (p. 95). In the remainder of the chapter, several analyses test the effects of including semantic information when tracking children's grammatical development in comparison with a purely syntactic approach. This section provides strong evidence for her thesis, but additional research is clearly needed and those holding the 'semantic bootstrap to syntax' hypothesis will no doubt respond with their own interpretation of this and with additional contradictory evidence.

Chapter 5 brings the book full circle. Ninio proposes Complexity Theory, with statistical characteristics analogous to those previously demonstrated for the Power Law of Learning, as a 'theoretical framework for language acquisition in general, and the acquisition of syntax, in particular' (p. 146). She considers language as a 'bi-partite network' (p. 124) with two types of nodes: speakers and elements of the language they use. Rather than either 'constructing' or 'internalizing' language, she suggests children 'link into it', choosing their initial expressions (i.e. linking to word nodes) from the language they experience from other speakers, but more specifically producing language in relation to their own pragmatic needs. Ninio provides detailed descriptions of the statistical properties of complex systems and tests the reliability of her hypothesis on datasets addressing children's early verb learning in relation to verbs produced by mothers. Precedent for the power law application is found in the work of Zipf (1965/1935), who demonstrated that for very large texts the rank frequency of words forms a skewed distribution. The most frequent words have very high frequency, followed by a rapid decline in frequency for lower ranked words. This same distribution characterizes complex networks, which

are found to be “scale free” in the sense that some hubs have seemingly unlimited links and no node is typical of the others’ (Barabasi & Barabeau, 2003: 60).

Ninio presents the first model of language acquisition and production as a complex system of this sort. In Complexity Theory, a subsystem of the larger whole is likely to exhibit the statistical properties of the entire system (Barabasi & Albert, 1999). To evaluate her proposal, Ninio selected a single form-class of forty-eight Hebrew-speaking mothers’ speech to children, the verb-indirect object (VI) construction. When the rank distribution of mothers using these words was plotted against the frequency of the verb’s use by any mother, the anticipated Power Function typical of complex systems emerged. Using these data as a sample of such language typically experienced by language learners, Ninio then turned to fourteen unrelated young children’s acquisition of the construction. When the children’s sixty-one selections of VI forms were compared to the mothers’ 230, it was clear that the children did not copy the input by relative frequency. While mothers’ most common ten verbs overlapped (thirty-one across forty-eight mothers speaking to their young children), children’s first ten verbs included sixty-one forms. Very frequent mother verbs were attractive to children: the Hebrew equivalents of *give*, *bring* and *have* used by most children were among the most common ten verbs for all mothers, while none of the children produced other popular maternal verbs (e.g. those translating as *say*, *show* or *tell*).

So what are the children doing? In Ninio’s view, the child approaches the language network as a free agent, producing forms learned from the input that suits her pragmatic needs. So input is influential, if the child never hears the word, she will not produce it, but selection by the child for pragmatic goals is the critical feature. In a recent dissertation, Herr-Israel (2006) showed the influence of children’s direct selection from maternal utterances in conversation on building the earliest multiword utterances. In Complexity Theory such selection is termed ‘preferential attachment’, and over time individual preferential attachments by a growing number of speakers learning a language will tend to recreate the complex system they enter, while expanding it with their own creative contributions. Thus Ninio sees the child who begins to speak as becoming an additional node in the language network, linking to those language nodes suiting her goals, and those speaker nodes in her communication environment. This is a powerful model with strong mathematical properties that, while I have not explored them in detail here, offer a new methodological approach to language acquisition, and strong support for the author’s views.

This is an important book for current language development researchers and graduate students, as well as those more closely involved in the controversies of theoretical linguistics. While clearly written, the book

deals with highly complex issues and demands careful study. The empirical solidity of this work in conjunction with its strong theoretical claims poses a challenge to all. Does Ninio offer a middle road for those unconvinced by nativism, but attracted by the comprehensive reach of Chomsky's programs? Ninio's new lexicalism claims that syntactic knowledge is stored in the 'mental lexicon', but her emphasis on the pragmatic basis of language learning and the importance of linkage to speakers as well as linguistic items opens the door to less 'mentalist' interpretations.

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