# Rich languages from poor inputs ed. by Massimo Piattelli-Palmar and Robert C. Berwick (review)

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This collection is a celebration of the late Carol Chomsky's bold, pioneering lifework. It is also an opportunity to reflect on the state of the art in linguistics and its sister disciplines—psycholinguistics and reading research—on three questions that are at the heart of her legacy: the richness of language acquired from impoverished input, its gradual development, and its role in reading and writing. The three parts of this volume address each of these questions in turn.

A rather humbling demonstration of the resilience of language to extreme sensory deprivation is presented by Carol Chomsky's own work on the linguistic abilities of deaf-blind individuals who acquired language haptically, via the Tadoma method (a method that allows language learners to perceive speech by placing their hand on the face and neck of the speaker). Despite radical limitations in input, the linguistic capacities of these individuals are nearly intact; the detailed case studies are reprinted in the final chapter of this volume. Another linguistic triumph in the face of sensory adversity is the ability of blind children to infer the root meaning of verbs such as *see* and *look* from their unique syntactic structure and the putative universal rules linking syntax to semantics—a case documented with great clarity and elegance in the chapter by LILA GLEITMAN and BARBARA LANDAU.

Poverty of stimulus, however, is not restricted to sensory deprivation, nor is it unique to the deaf and blind child. And indeed, big (linguistic) data do not provide discovery procedures for grammatical rules. Just as the impoverished sensory input available to the blind child fails to specify the semantics of *see*, so does the myriad of linguistic evidence available to typical children underdetermine which aspect of the input—word order or syntactic structure—is relevant for sentence structure. This conundrum, outlined by Noam Chomsky over four decades ago (1968), relates to the challenge of forming polar interrogatives with relative clauses (PIRC, see 1a), a task accomplished by children within the first four years of life (Crain & Nakayama 1987).

(1) a. Is the little boy who is crying hurt?
    b. The little boy who is crying is hurt.

But whether children do in fact lack the linguistic evidence necessary to solve the induction problem has been the subject of debate. The three chapters by XUAN-NGA CAO KAM and JANET DEAN FODOR, by ROBERT BERWICK, NOAM CHOMSKY, and MASSIMO PIATTELLI-PALMARINI, and by Noam Chomsky revisit this challenge.

Kam and Fodor's detailed analysis of word-learning bigram models (Reali & Christiansen 2005) demonstrates that, absent an inherent bias to attend to syntactic structure, learners fail at even the simplest task of distinguishing well-formed sentences from ill-formed ones. Similar limitations are documented by Berwick, Chomsky, and Piatelli-Palmarini in two other models—a trigram version based on Reali & Christiansen 2005 and the 'weak substitutability' approach of Clark & Eyraud 2007. According to Berwick and colleagues, the insensitivity to structure (a property they distinguish from the representation of hierarchical structure) also persists in a Bayesian selection model (Perfors et al. 2011).

But, as Berwick and colleagues point out, the poverty-of-the-stimulus challenge goes far beyond the narrow task of sifting well-formed sentences from ill-formed ones, and beyond the PIRC construction or English. An explanation of these facts can only be given within a broader account of the syntactic operations that are allowable in human language. And such an explanation, suggests Noam Chomsky, must begin with a question—the puzzle of why syntactic operations appeal to structural distance, rather than the linear distance among elements. The emergence of this feature in all grammars must reflect the design of the language organ itself (specifically, the computational efficiency of the labeling algorithm), rather than properties of the linguistic input and the functional demands on externalization.

In line with this possibility, language is firmly grounded in human biology. The numerous neurological dissociations between linguistic and nonlinguistic functions, documented in SUSAN CURTISS's chapter, confirm that the language system has a neurologically distinct implementation (albeit not one that is spatially segregated from nonlinguistic functions, contrary to Curtiss's own suggestion; see January et al. 2009, Koelsch 2006, Maess et al. 2001). This implementation is further subject to some interesting individual differences, which TOM BEVER's chapter links to the history of left-handedness in one's family.

But despite the clear biological foundation of the language faculty, its assembly in ontogeny is gradual and prolonged. In a pioneering line of research, Carol Chomsky (1969) showed that, contrary to the received wisdom at the time, certain syntactic constructions are not accurately interpreted by English-speaking children until rather late in development, well toward the end of the first decade. For example, children systematically misinterpret *the doll* in sentence 2a as an agent (i.e. they conclude that the doll can see easily).

(2)  a.  Is the doll easy to see?
     b.  Is the doll eager to see?

Such observations indicate that the grammars of children differ from those of adults. The chapters presented in the second part of this volume consider distinct accounts of such subject/object asymmetries.

The chapters by KEN WEXLER and by ADRIANA BELLETTI and LUIGI RIZZI outline syntactic explanations for these phenomena. Wexler attributes the difficulty of 'tough movement' sentences (e.g. 2a) to the immaturity of the child's argument chain—the hypothesis that children ban the object movement in these sentences because, unlike adults, they do not represent them as defective phases. Considering the child's difficulty with headed object-relative sentences (compared to headed subject relatives; see 3a,b, respectively) in languages such as English and Hebrew, Belletti and Rizzi invoke the notion of intervention. In this view, the child is unable to compute a local relation across an intervener (e.g. *the lion* in 3a) whose morphosyntactic features (+NP) form a proper subset of the target's features (e.g. the +R, +NP features of *the elephant* in 3a). Adults, by contrast, posit weaker restrictions on intervention (they only ban full identity between the features of the intervener and target), so sentences like 3a are ultimately acceptable in mature languages. Both proposals predict that the greater difficulties with object gap sentences (e.g. 2a and 3a, as compared to the subject sentences in 2b and 3b) reflect syntactic principles whose effect is not specific to these constructions or English.

(3)  a.  Show me the elephant that the lion is wetting <the elephant>.
              +R,+NP              **+NP**              +R,+NP
     b.  Show me the elephant that is wetting the lion.

But these expectations are partly countered by results from Basque, an ergative language. In her chapter, ITZIAR LAKA shows that adult speakers of this language exhibit a pattern opposite to the one seen in adult speakers of nominative languages. While adult English speakers, for instance, exhibit greater difficulty in processing object-relative sentences, Basque speakers process them more readily than subject-relative sentences. Although the findings from adults are not directly comparable to the above-mentioned evidence from children, the contrast is nonetheless intriguing. Laka concludes that the difficulties in processing object relatives are neither universal nor invariably syntactic, as morphological markedness and animacy might play an important role.

The two remaining chapters in this section consider additional bootstrapping mechanisms that might facilitate the acquisition of syntactic rules. Using a case study from metrical structure, JULIE ANNE LEGATE and CHARLES YANG propose a tolerance principle, a heuristic that can help identify a rule by comparing the number of lexical items that follow the rule to the number of exceptions. Another chapter, by JEAN-RÊMY HOCHMANN and JACQUES MEHLER, shows how infants might use a statistical heuristic (i.e. the contrast between 'frequent' and 'infrequent' elements) in the extraction of syntactic rules in a manner informed by experience with their native language and universal linguistic biases.

The final section of this volume considers the links between the language system and literacy. This research follows up on the early insights of Carol Chomsky and Charles Read, who noted that children's invented spellings (e.g. 4a; 4b provides a gloss) are governed by phonological and phonetic principles. A chapter by WAYNE O'NEIL demonstrates the intricacy and systematicity of the knowledge shaping invented spellings, and CHARLES READ and REBECCA TREIMAN extend this inquiry to the acquisition of conventional orthographies in various languages.

    (4)  a.  DOT MAK NOYS. MY DADAAY WRX HIR. B CWIYIT.
          b.  Don't make noise. My daddy works here. Be quiet.

Reading, however, is not limited to single-word decoding. Following Carol Chomsky's urging (1976), STEPHANIE GOTTWALD and MARYANNE WOLF examine the role of morphological, syntactic, and semantic knowledge in the acquisition of reading skill, and demonstrate that explicit training on these components (in conjunction with training on phonological decoding) yields measurable gains in reading comprehension. A final chapter by MERRYL GOLDBERG reminds us that that the successful implementation of such research insights can occur only in the context of a nurturing educational environment that promotes risk-taking and creativity, challenges at which Carol Chomsky excelled.

*Rich languages* is an unusual book, assembled as a homage to an unusual woman. Carol Chomsky launched a unique, innovative research program, translational in character, but firmly grounded in the linguistic revolution she had closely witnessed. The various outstanding contributors to this volume—linguists, cognitive scientists, and educators, her colleagues and lifelong friends—are some of the leaders of the generative enterprise. They seamlessly converge on a rich narrative that is cohesive and engaging—a real page-turner. The convergence is itself a testament to the impact of her pioneering path.

In keeping with her legacy, however, one would ultimately hope to see deeper scrutiny, and indeed, puzzlement over the links she had so eloquently documented between literacy and language, most notably, phonology. Those links are surprising because, unlike language, literacy is not a universal human trait, and its acquisition is neither rapid nor spontaneous. But every time a writing system emerges, it is erected upon phonological principles (DeFrancis 1989), and once reading skill is attained, it invariably entails the automatic decoding of phonology from print (Perfetti 2003). Why reading and writing are inextricably linked to phonology—a linguistic component that is typically delegated to the sensorimotor interface, rather than the grammar proper—remains mysterious. Even more remarkable is the growing body of evidence suggesting that, in stark contrast to the sensorimotor interface, phonological patterns are fully productive, subject to putatively universal grammatical constraints (Prince & Smolensky 2004 [1993]) whose precursors are active close to birth (Jusczyk et al. 2002). But these mysteries are all resolved under an account that places phonology at the center of the language faculty, on par with syntax. The possibility that phonology is a core knowledge system (Berent 2013) also accounts for the phonology-literacy links, as cultural inventions are known to form on the heels of core knowledge systems (Carey 2009, Spelke 2000). Such facts suggest that 'poor inputs' might be a broader problem—one that goes beyond the sole purview of syntax.

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**Grammatical variation in British English dialects:** A study in corpus-based dialectometry. By BENEDIKT SZMRECSANYI. Cambridge: Cambridge University Press, 2013. Pp. xvii, 211. ISBN 9781107003453. £62.

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This book analyzes the relationships between a range of dialects of British English using an innovative approach—the dialectometrical analysis of morphosyntactic variation in a corpus of recorded speech. Prior to Szmrecsanyi's research, dialectometry—the simultaneous mathematical analysis of many geographically different linguistic varieties across a wide range of linguistic features—had largely been directed at lexical and phonetic variation (see Maguire & McMahon 2011, though see Spruit 2006 for a notable exception). S's research is the first large-scale dialectometrical investigation into morphosyntactic variation and, to add to its novelty and rigor, it uses as its database an extensive corpus of naturalistic conversational speech. As such, it is a very welcome addition to our understanding of the relationships among British English dialects, to geographical morphosyntactic variation, and to our understanding of (the limits of) dialectometrical and quantitative linguistic methods more generally.

The book is divided into nine chapters. Ch. 1 introduces the rationale for the study and surveys previous analyses of relations among English dialects, both traditional analyses based on isoglosses and dialectrometrical analyses based on lexis and phonetics. Ch. 2 describes the database underlying S's study, the Freiburg English dialect project and corpus (FRED; see Kortmann