

## **Bridging linguistic and neurocognitive approaches to the acquisition of morphosyntax in healthy-developing children and children with Specific Language Impairment**

The intellectual movement in the 1950s, often referred to as “cognitive revolution” began in the modern context of greater interdisciplinary connections, particularly between (cognitive) psychology and linguistics, together with computer science, neuroscience and philosophy, now collectively referred to as “cognitive sciences” (Miller 2003). Together with cognitivism came nativist linguistic approaches to language development, holding that children bring to the world hard-wired machinery containing pre-specified universal sets of principles that interact with the input, yielding adult grammatical competence (Chomsky 1981, 1986). According to nativists, children do not learn language by imitation, analogy or via error-and-trial, as claimed by earlier behaviorists, but by setting the innately-given parameters upon discovering some cues or triggers in the input, which proceeds in a pretty fast fashion (Chomsky 1986; Crain & Pietroski 2005; Lightfoot 1991). This school of learnability has adopted the so-called deterministic (non-probabilistic, “all-or-nothing”) outcome in mathematical sense, rather than accounting for, say, variation in language development (in a more probabilistic sense of “learning”, as reflected in dynamic physical and mathematical systems).

Certain schools of behaviorism, absorbed into experimental and cognitive psychology today, have surfaced in the form of various information processing and other computational theories of language acquisition. Still cognitive in nature, these approaches to language and learnability draw from stochastic models of learning in animals and humans in linguistic and non-linguistic domains, as well as neuroscience and neuropsychological evidence from these domains. Most of these approaches explicitly acknowledge the role of biology but deny Chomsky’s epistemological (representational) type of innateness (Karmiloff-Smith et al. 1998). Moreover, they claim that children’s language learning is initially item-based, but might become more generalized and automatic on the basis of exposure. In other words, cognitive-computational approaches advocate more the role of input frequency and salience – hence, learning in a (more) probabilistic sense (Elman et al. 1996; Goldberg 2005; Tomasello 1992, 2005)

My investigation into early verb forms seeks to combine the two broader approaches to language development, but particularly to unify *various* types of evidence from different cognitive sciences that I crucially see as *supplemental*. Though I address only a little fraction of morphosyntactic learning that the child undergoes in her task, I show that a model that seeks explanation rather than mere description needs to combine linguistic evidence with that of psychology and cognitive neuroscience in order to fully explain the developmental scenario seen in early acquisition of tense (T) (e.g., past, present, future), agreement (Agr) (e.g., subject-verb agreement), modality (e.g., realis/irrealis events/actions), and aspect (durative, non-durative events/actions).

It has been noted that children between the ages of 1;5 and 3;0 cross-linguistically pass through a stage where they produce verbs devoid of T and Agr marking in root clauses where adult grammar requires tensed forms (e.g., *Momma throw ball, Papa wear glasses*) (see Guasti 2003 for review). Though in most languages such verb forms surface as bare verb forms or infinitives, generally marking aspect, they appear as present or past participles in others, generally marking aspect and mood, but—crucially—no T and Agr. In some languages, though, two or more forms can appear along with bare verbs/infinitives or past participles. The percentage of such non-adult *early root nonfinite*

(ERN) forms ranges from 60% up to 90%, generally being higher in languages with less complex morphology (e.g., English, Swedish), and lower in morphologically complex languages (e.g., Slovenian, Spanish).

Interestingly, such early ERNs are even more common in children with developmental disorders and second language learners. Several studies have shown that English-speaking SLI children, for example, are much more prone to T and Agr errors than their healthy-developing counterparts and that the ERN stage gets prolonged to much beyond age 3;5, which is the time when it generally disappears in healthy-developing children (Rice et al. 1995; Wexler & Schütze 1999). Similarly, second language learners generally omit T and Agr morphological marking in high percentages, even though they might have the mental representation of T and Agr in their grammars (Lardiere 2006).

Five major lines of research have tried to explain the existence of ERNs and the acquisition of T and Agr in child language acquisition, namely the omission model (Wexler 1994), the underspecification model (Wexler 1998), the phrase truncation model (Rizzi 1993/4, 2002), the “no initial functional material” maturational account (Radford 1995), and the performance limitations model (Avrutin 1999). I will show that each of these has several shortcomings, either conceptual, empirical, or both. Furthermore, I will show that although children are amazing at early morphosyntax, early grammars show

(a) a developmental pattern exhibited in the psychological models of “learning” (“gradualness”) rather than an “all-or-nothing” outcome with a sudden switch to correct T/Agr marking; (b) intra-subject and inter-subject variation with respect to the marking of T and Agr; (c) crosslinguistic variation in terms of the distribution of errors and the final (non-grammatical) outcomes.

By viewing the acquisition process as a combination of deterministic and probabilistic mechanisms (Yang 2002), my study seeks to explain the acquisition of the earliest verb forms, specifically in early English, Slovenian, and Spanish. I assume a biologically-given linguistic computation and its basic properties and relations, such as hierarchical structure, binary branching, local dependencies, and a concatenation operation à la *Merge*; Chomsky 1995), but—crucially—without the early Chomskyan -type of binary parameter setting. I team up linguistic tools and findings with earlier accounts of morpheme studies (Brown 1977; de Villiers & de Villiers 1978), cognitive neuroscience evidence on the generation and processing of functional categories (Grodzinsky 2000), specifically the claims about the Inflectional Hierarchy Hypothesis (Izvorski & Ullman 1999), computational modelling of T and Agr (Kazman 1991), and developmental psycholinguistic evidence on input sensitivity and the notion of “development” in early grammars (Aguado-Orea & Pine 2006; Rubino & Pine 1998).

I extend the model to the acquisition of T and Agr in children with developmental disorders, particularly SLI. I will show how SLI data can inform my model (and broadly, linguistic models of language development) and show how a psycholinguistic and/or neurolinguistics model can be used for clinical and educational purposes.

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