EVO-DEVO FRAMEWORK: CONTEXTUALIZING LANGUAGE ONTOGENY IN LANGUAGE EVOLUTION

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Language development in human infants has long been of interest to the field of language evolution. Topics of investigation include (but are not limited to) arguments regarding "language fossils" and potential parallels between ontogeny and phylogeny of language development (e.g. Bickerton, 1984; Wray, 1998), co``mparative research with language-trained primates (Savage-Rumbaugh et al., 1993) and arguments regarding language nativism (Berwick, Chomsky & Piatelli-Palmarini, 2013). Perhaps surprisingly, despite such a long-standing interest of the field, to this day there is no systemic approach to the question of language ontogeny in language evolution. This seems crucial since evolution depends on changes in ontogenetic patterns. Given advancements of relevant disciplines (evolutionary, developmental and systems biology) we argue that the time is ripe for developing such an approach. Specifically, we propose that translating the achievements of the Evolutionary Developmental Biology (Evo-Devo) to the field of language evolution is a particularly promising avenue for future research. Evo-Devo approach stresses that *development* is central to evolutionarily processes by becoming the source of phenotypic plasticity on which selection operates and optimizing trait alignment with the adaptive landscape (Jamnickzky et al., 2010; Michel et al., 2018). Moreover, due to similarities in molecular foundations of gene networks expression across distant species (i.e. *deep homology*), analogous or divergent pattern of the same developmental program unfolding in different species and even taxa can be informative for understanding specific selection pressures and convergent and divergent evolution, respectively (Fitch, 2012). Thus, the premise of Evo-Devo approach unites ontogeny and phylogeny on several levels going beyond simplistic claims of recapitulation and in the context

of language emergence beyond simplistic parallels between processes of language acquisition by a child and its emergence in phylogeny. Ultimately, Eco-Evo-Devo theories support the view that organisms evolve as a result of the interactions between their genes, their developmental paths, and the environments in which they live. In the context of human language evolution this Eco-Evo-Devo framework opens the door to views of language evolution that see the origins of modern language as the result of both a biological process that changed our brain and behavior, and a cultural process that enabled the emergence of distinctive aspects of human languages through transmission and use.

In the talk, we will outline how application of this framework provides insights in the field of language evolution. First, in line with Evo-Devo approaches, we will advocate for a systemic approach to language acquisition where language is treated as a multicomponent system (Fitch, 2012). Instead of trying to single out *the component* of language that provides major evolutionary novelty either on the internal (syntax) or external (vocal learning) levels, we will support the view that it is more productive and accurate to investigate development of *systems*, both cognitive and behavioural, along with their interaction with the environment. This is in line with current comparative research, that is no more interested in finding *the trait* that could explain language, but how language results from a unique combination of many shared abilities (Fitch, 2020; Vasileva, 2019). Second, we will argue that since systems develop over the lifespan, constantly being under selection due to changing adaptive resources of an organism (Bateson 2014), the focus should be thus shifted towards the analysis of the emergence and interaction of varied components (e.g. vocabulary and ToM) over the life span, without limiting on early ontogeny. Finally, because development can be conceptualized as continuous bidirectional interactions between different levels from the molecular-DNA to the behavior - psychological ones, leading to trait variability and stability (Lickliter & Honeycutt, 2013; West-Ebenard, 2003), we will defend the view that it is key to investigate systemic patterns of variation in both typical and abnormal cognitive-linguistic development (Barceló-Coblijn, Benitez-Burraco & Irurtzun 2015), with a special emphasis on the *variation in developmental patterns*, rather than capturing trait association at a single time-point become crucial (Michel et al., 2018). Four major processes - heterochrony, heterotypy, heterometry and heterotopy - described in the Evo-Devo that can be applied to the study of language ontogeny to contextualize language ontogeny in language evolution and deserve a close examination.

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