Early language acquisition: an enactive cognition analysis on CDI understanding scores of infants aged 8-18 months.

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The ability that humans exhibit in acquiring language has intrigued multidisciplinary research involving fields that range from psycholinguistics and experimental psychology to more technical computational fields, with the aim of modeling and replicating computationally the underlying mechanisms that drive the language acquisition process.

A number of methodologies have been employed for recording varying aspects of language learning and at various developmental stages. We focus on the very early language acquisition phase and in particular on the **understanding of single words.** State of the art research on such data is primarily concerned with the rate of the vocabulary growth as infants grow, and the effects of demographic variability and social context or gender in language acquisition, as well as frequency effects [1],[2],[3],[4],[6]. For the first time, we focus on the characteristics of the actual terms acquired at different developmental stages. To that end, we make use of the large scale data collected through the Mac Arthur-Bates Communicative Development Inventories (CDIs [5],[6]), a questionnaire instrument for recording parents' knowledge about their children's language skills. In particular, we analyze a sample of understanding scores for 393 single-words in English, which were collected through CDI parental reports of 1089 US-based infants aged 8-18 months [5], [6] coming from diverse socio-demographic backgrounds. In these reports, the parents indicated for each given term a binary answer on whether their infant understands the word or not. By applying clustering techniques on this dataset of vectors of binary understanding scores, we first classified the 1089 participants into categories of learners with similar understanding competency trends, providing a classification of learners that can be regarded as developmental stages according to **mental maturity rather than actual biological age**. We use this classification for further investigation on the characteristics of the sets of terms learnt at different developmental stages, and corresponding word-difficulty estimation . For each developmental stage indicated by our computational analysis, we analysed the grounding of each term acquired per stage, i.e. what the term denotes (reference to abstract/concrete entities, movements, perceptual features) or its function beyond grounding (e.g. use for deixis). Such qualitative analysis forms part of an exploration of the embodied and enactive cognition perspective of language acquired in early developmental phases with the aim to uncover those aspects and functions of language in multimodal and multisensory learning environments that potentially influence or drive language acquisition. Ultimately, the corresponding findings will be captured computationally into a predictive model that will replicate the infant's early learning mechanisms.

In this paper, we argue that the enactive cognition perspective [7] in developmental language acquisition studies opens up new directions of basic research in the field and we show how this perspective is more illuminating and appropriate in comparison to the use of traditional, grammatical characteristics of the words acquired by children, such as part of speech.

References:

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