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REPLICATION AND EMERGENCE PROCESSES IN LANGUAGE EVOLUTION

MÓNICA TAMARIZ

*Language Evolution and Computation Research Unit, School of Philosophy, Psychology
& Language Sciences, The University of Edinburgh monica@ling.ed.ac.uk.*

Replication and emergence characterize many complex adaptive systems such as life or the immune system. In this paper I propose that the evolution of language structure over generations is best explained by a conjunction of replication and emergence processes at the level of linguistic utterances.

REPLICATION happens when a token of a type is produced, and it is (a) similar, (b) caused by and (c) has received information from other tokens of the same type (Sperber, 1996). EMERGENCE is a property of complex adaptive systems (Gell-Mann, 1994), which are sets of elements that interact with their environment following simple rules. As the system unravels, its behaviour is not reducible to its elements and rules: its new properties are emergent or self-organised.

Transmission involves a flow of linguistic information towards new generations of speakers. In their first year of life, infants learn the sound categories of their ambient language, and this involves production and perception reinforcement loops (e.g. Vihman et al., 2009) and statistical category learning (e.g. Maye et al. 2002). With sound categories in place, actual phonetic realizations of sounds behave to all effects as REPLICATORS (Wedel, 2006). Symbolic, referential function is not involved in this process, and the replicated information is purely formal.

Towards the end of their first year, infants begin to produce their first stable sound combinations, which may be words, prosodic patterns etc. learned by imitation. Stable sound combinations also REPLICATE: the production of a token of sound combination is caused by and receives the information from similar tokens previously heard or produced. Imitation learning in humans, but not in other apes, tends to be more dependent on intention than on function: children seem to copy behaviours that they perceive as intentional (Tomasello, 2003) even if they do not have a function (Horner & Whiten, 2005).

In contrast, morphosyntactic, semantic and pragmatic rules and categories cannot be replicated by imitation learning because they are not tokens in speech, but mental abstractions. I argue, *contra* the memetic position, but in agreement

with e.g. Sperber (1996), that mental entities do not replicate: a linguistic rule or category in a speaker's head is not directly caused by tokens of the same rule or category in other speakers' brains and there is certainly no need for information transfer (e.g. by teaching) towards new speakers. Instead, rules and categories EMERGE from interactions between the replicated information (sounds and sound combinations) and their environment, which is rather complex. It includes other sounds and sound combinations; the referents they become symbolically associated with, which have their own set of categories, dependencies and frequency distributions; and the speakers' communicative needs and social interaction patterns.

The perspective of cultural transmission as replication plus emergence has two important consequences. Firstly, the replication of forms independently of their functions suggests that models of language evolution should not be based on units such as Saussurean signs or constructions, where form and function are inseparable. Secondly, this perspective focuses the study of the BIOLOGICAL evolution of language on cognitive mechanisms for the replication of sounds and stable sound combinations (such as vocal learning or form imitation) and for the emergence of complex utterances (such as symbolic association, inference, communication or categorization).

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