CHUNKING AND ASSOCIATIVE LEARNING IN NON-HUMAN PRIMATES

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1. Introduction

A key process in language acquisition is the ability to extract sequences of units (phonemes, words, etc.) that occur together regularly and repeatedly in spoken or written language (Bannard & Matthews, 2008).

McCauley and Christiansen (2019) recently introduced a new model of language comprehension and in which chunking mechanisms are supposed to play a central role in the extraction of recurring multiword units.

Several theories and computational models suggest that chunking mechanisms are more generally central in sequence learning, as the units composing these sequences are in fact associated through elementary associative or Hebbian learning mechanisms and compiled into chunks of information (e.g., the self-organizing consciousness theory, Perruchet & Vinter, 2002; Parser, Perruchet & Vinter, 1998; TRACX, French, Addyman & Mareschal, 2011). Chunking and associative learning mechanisms are not uniquely human, suggesting that the fundamental mechanisms involved in language learning are shared by many other animal species.

Non-human animals have indeed been shown form chunks while learning sequences (e.g., Terrace, 1987), but we know less about how these chunks are formed and evolve during practice. Studying sequence learning behaviors in animals is therefore essential for assessing the similarities and differences between human and non-human animals and reaching a better understanding of chunking mechanisms and their role in language acquisition (Rey, Minier, Malassis, Bogaerts, & Fagot, 2019).

2. Method

Using an operant conditioning device (Fagot & Bonté, 2010), a total of eighteen Guinea baboons (*Papio papio*) were initially trained to produce random visuo-motor sequences by touching a moving target red circle on a touch screen.

They were then presented with a repeated sequence of nine positions and had to perform a serial response time task on the touch screen by touching the moving target. They produced this same motor sequence during 1000 successive trials.

3. Results

We interpreted decrease in response time between two successive positions as these positions being chunked together, whereas increase in response time was interpreted as the chunk boundary. Thus, we identified chunking patterns of the sequence for every baboon. Additionally, the evolution of response times revealed that these patterns evolved during the course of learning, from a concatenation of initially small chunks into larger chunks later on.

4. Discussion

These results provide new evidence on the dynamics of chunking processes in non-human primates and, more generally, on the mechanisms involved in implicit statistical learning, a core learning process in human language acquisition. They suggest that chunking mechanisms start small (chunks of 2 to 3 elements) as it was previously found in humans (e.g. Verwey, 2001; Wymbs, Bassett, Mucha, Porter & Grafton, 2012). We also found that these small chunks were later concatenated into larger chunks leading to increasingly compressed forms of information. These elementary mechanisms are certainly also present and crucial in building the core elements of language comprehension and production as suggested by McCauley and Christiansen (2019).

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