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Humans and baboons, but not pigeons, use letter-sequence information during orthographic processing

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Animal studies investigating orthographic processing have shown that not only humans but also baboons and pigeons can successfully perform word/non-word decisions, despite their lack of phonological or semantic representations. Here we take a comparative modeling approach and investigate the cognitive basis of this lexical decision behavior across the three species to clarify whether phylogenetic relatedness entails similar underlying cognitive operations. We specifically aim to determine which types of information inherent in the letter-string input are utilized to inform lexical decisions by humans, baboons, and pigeons. To this end, we introduce four versions of the Speechless Reader Model, a predictive coding model based on prediction error accumulation. The model was motivated by neuro-cognitive processes involved in human word recognition but is in its current form without phonological or semantic representations. Our central analysis investigates which model variant most fittingly simulates the lexical decision behavior of humans, baboons, and pigeons, respectively. From our simulations, one model emerges as most adequately for humans and baboons: the variant that integrates image-based and letter-based representations sensitive to transitional probabilities. In contrast, pigeons'reading behavior is explained best by the model representing image-based and positional letter frequencies but not transitional probabilities. This difference could be related to the ability of primates to flexibly switch between local and global visual processing strategies, while pigeons show substantial local precedence. Thus, the explanatory value of visual-orthographic codes highlighted here speaks for the ancient origins of some cognitive abilities involved in orthographic processing.

Primary authors: GAGL, Benjamin (University of Cologne); WEYERS, Ivonne (Department of Linguistics, University of Vienna); GÜNTÜRKÜN, Onur (Department of Biopsychology, Ruhr University Bochum); MUELLER, Jutta L. (Department of Linguistics, University of Vienna)

Presenter: GAGL, Benjamin (University of Cologne)

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