

## Substance-Free Logical Phonology in Evolutionary Perspective

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It has been twenty years since the publication of Chomsky's (2005) 'Three factors in language design,' which encouraged research into how human language is shaped by biological, physical, computational, and information structural 'third factor' principles, complementing genetics (first factor) and learned experience (second factor). Early research in this vein (e.g., Samuels 2009a,b) sought to build a phonological theory based entirely on the third factor and arrived at a version of substance-free logical phonology (SFLP). I argue that significant recent advances in neuroscience (e.g. Becker et al. 2025), genomics (e.g. Sebastianelli et al. 2024), and animal cognition (e.g. Lameira et al. 2024, Girard-Buttoz et al. 2025) bolster this case, shedding light on how the first and third factors are inextricably intertwined and yielding insights into how SFLP may have emerged in the human evolutionary lineage, remarkably convergently with birdsong (e.g. Samuels 2015, Gattoni & Tosches 2025, Güntürkün et al. 2024).

Becker, Y., Eichner, C., Paquette, M., et al. (2025) Long arcuate fascicle in wild and captive chimpanzees as a potential structural precursor of the language network. *Nature Communications* 16:4485.

Chomsky, N. (2005) Three factors in language design. *Linguistic Inquiry* 36(1):1-22.

Gattoni, G. and Tosches, M.A. (2025) Constrained roads to complex brains. *Science* 387(6735):716-717.

Girard-Buttoz, C., Neumann, C., Bortolato, T., et al. (2025) Versatile use of chimpanzee call combinations promotes meaning expansion. *Science Advances* 11:eadq2879.

Güntürkün, O., Pusch, R. and Rose, J. (2024) Why birds are smart. *Trends in Cognitive Sciences* 28(3):P197-209.

Lameira, A.R., Hardus, M.E., Ravnani, A., et al. (2024) Recursive self-embedded vocal motifs in wild orangutans. *eLife* 12:RP88348.

Samuels, B.D. (2009a) The third factor in phonology. *Biolinguistics* 3(2-3):355-382.

Samuels, B.D. (2009b) The structure of phonological theory. PhD dissertation, Harvard University.

Samuels, B.D. (2015) Can a bird brain do phonology? *Frontiers in Psychology* 6:1082.

Sebastianelli, M., Lukhele, S.M., Secomandi, S., et al. (2024) A genomic basis of rhythm in birds. *Nature Communications* 15:3095.