

PHONOLOGICAL REPRESENTATION IN BONOBO (*PAN PANISCUS*) AS REVEALED THROUGH VOCABULARY ERRORS

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1. Objective

Human minds contain a complex set of associations with each word, morpheme, and phoneme in our language. When we mis-speak, those associations make some errors more likely than others (Fromkin, 1980). This study seeks to clarify the possible phonological associations within the mind of language-using bonobos.

2. Methods

Participants were two bonobos (*Pan paniscus*) that had been reared in a language-enriched environment and shown to understand English sentences similar to the abilities of a 2.5 year old child (Savage-Rumbaugh et al., 1993). Over the course of 10 years, these apes were given vocabulary tests regularly and all responses made to the lexigram keyboard were recorded and coded for a previous study (Lyn, 2007). These errors were shown to be non-random and associated with visual, conceptual, and auditory representations of the item. For example, lemons-lemonade, orange-apple, and cereal-milk.

To further explore the auditory components of these representations, phonological transcriptions of the errors were coded as a match/no match from the sample to the

error. All examples that included shared morphemes (e.g. Orange-orange juice) were removed, resulting in 1400 example of sample and error pairs.

3. Results

The bonobos made significantly more errors that matched the sample in phoneme than would be expected by chance (see Fig 1). Their responses varied by vowel and consonant, with more consonant matches in the first and third positions, and more vowel matches in the second and fourth positions. For example, BIG and BUG match in the first and third phoneme (bIg and b^g) and JUICE and FOOD match in the second phoneme (jus and fud).

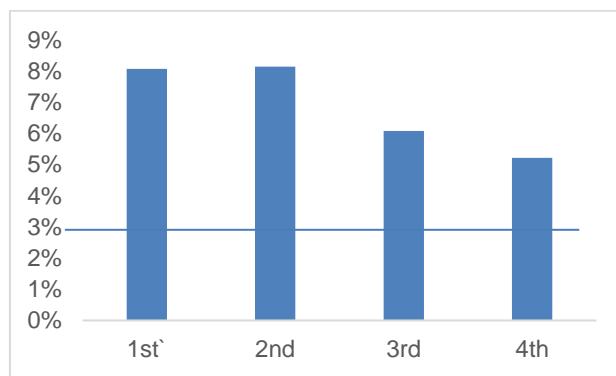


Figure 1. Percentage of phonological matches across the first four positions of sample and error. Line represents conservative estimate of chance, 1/26 (the number of phonemes in each position of the samples and errors ranged from 26-32). All are $p < .001$, binomial test.

4. Discussion

Our results suggest that the web of associations in the mind of language using bonobos is more elaborate than simple auditory similarity and may include phonemic information. These findings further suggest that this building block of human language was present before the evolutionary split of humans and bonobos.

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References

- Fromkin, V. A. (1980) *Errors in linguistic performance. Slips of the tongue, ear, pen and hand*. Academic Press, New York.
- Lyn, H. (2007). Mental representation of symbols as revealed by vocabulary errors in two bonobos (*Pan paniscus*). *Animal Cognition*, 10(4), 461-475.
- Savage-Rumbaugh, E. S., Murphy, J., Sevcik, R. A., Brakke, K. E., Williams, S. L., Rumbaugh, D. M., & Bates, E. (1993). Language comprehension in ape and child. *Monographs of the society for research in child development*, i-252.
- Vitevitch, M. S., & Luce, P. A. (2004). A web-based interface to calculate phonotactic probability for words and nonwords in English. *Behavior Research Methods, Instruments, & Computers*, 36(3), 481–487. <https://doi.org/10.3758/BF03195594>