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Spoken Nursery Rhymes Have a Fractal Rhythmic Structure - Evidence from Patterns of Slow Amplitude Modulation (AM)

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Abstract: Children's knowledge of nursery rhymes predicts later phonological and reading skills (Maclean et al,1999). This developmental relationship may be mediated by rhythmic and prosodic structure: nursery rhymes have been described as perfect metrical poems. Here we investigate the hypothesis that nursery rhymes are rhythmically fractal. 27 nursery rhymes were spoken in a rhythmic or non-rhythmic ('reporting') style by 5 speakers. The speech envelope from each sample was passed through a low frequency (0-50 Hz) 8-channel amplitude modulation (AM) filterbank and channels were analysed for temporal patterning. For rhythmically-spoken rhymes, modulations in adjacent channels were strongly phase-locked so that one modulation cycle in a given channel typically encompassed two full cycles in the next channel. This phase-locked pattern extended across multiple modulation frequencies resulting in a hierarchically-nested, fractal structure. Non-rhythmic samples showed lower phase-locking. The fractal temporal structure of rhymes may serve to optimally entrain neural oscillatory activity for rhythm detection.