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Exploring the Role of Rhythm Processing in Developmental Dyslexia: Unraveling the Relationship with Phonological Abilities

Introduction: Developmental Dyslexia (DD) is a neurodevelopmental disorder characterized by persistent reading and spelling difficulties, frequently accompanied by an extensive array of comorbidities. Despite this variability, a phonological deficit remains the most consistently observed trait across different phenotypic expressions in DD while a rhythm deficit (with or without an associated acoustic impairment) has been hypothesized as the core etiological factor. Current evidence in support of a rhythm deficit in DD is based mainly on English and shows conflicting results. This work extends the study of rhythm issues in DD to include Italian.

Method: 70 age-matched Italian adolescents took part in the study, including individuals with pure DD ($N = 16$), DD comorbid with dyscalculia ($N = 24$), and controls ($N = 30$). They were required to tap in time with the rhythm of Italian sentences and with non-linguistic rhythm prompts or to produce their own rhythmic sequences without external auditory prompts. Additionally, participants performed a phoneme monitoring task where they identified phoneme targets embedded in stressed or unstressed syllables.

Results: The results revealed that the clinical group showed slightly larger asynchronies when synchronizing with rhythmic sequences of isochronous beats at slow tempi. They also demonstrated a tendency for significantly faster spontaneous motor tempo (SMT). There was no group-level difference in synchronization with Italian sentences or in the complexity of unprompted rhythms that participants produced. However, participants with DD were significantly less accurate in phoneme identification, though the performance in the phonological task could not be predicted by their performance across the rhythmic tasks. Instead, phoneme monitoring was best accounted for by participants' use of their attentional resources.

Conclusion: Overall, the current findings challenge the rhythm deficit hypothesis in DD and its explanatory power for DD's phonological abilities, suggesting that the ability to efficiently use attention for phonological processing may be impaired in DD.