Using brain rhythms to improve behavioral predictors of reading

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Introduction

○ **Predicting reading development** is a crucial step towards designing timely interventions to prevent life-long consequences of reading difficulties.

○ Currently, there's three main **behavioral** predictors of reading development: phonological awareness, letter knowledge, and rapid automatized naming. However, the underlying mechanisms for acquiring these skills are not clear.

○ Precision in **oscillatory activity synchronization** to incoming stimuli is a candidate for explaining the differences observed in both acoustic and visual processing of stimuli.

Our **aim** is to to test the role of precision in oscillatory activity as a predictor of reading development, and to improve the predictive validity of behavioral measures by including novel oscillatory-based tasks.

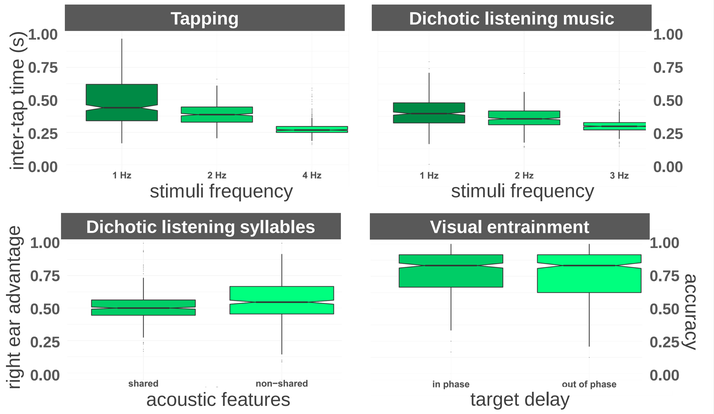
Methods

Sample:

Uruguayan Spanish-speaking preschoolers
mean n: 438 [min: 394, max: 513, 0.5 boys]
mean age: ~5.5 y.o. [min: 5.0, max: 6.0]
decoding skills: ~10 % of the sample

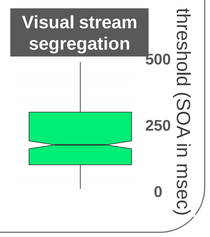
Reading related tasks	• **LK**: Letter knowledge • **RAN**: Rapid automatized naming (letters, numbers, objects & colors) • **PAw**: Phonological awarenes (isolation, blending, segmentation & rhyme) • **vSTM**: Verbal short-term memory
Oscillatory based tasks	• **DLM**:Dichotic listening music • **DLS**: Dichotic listening syllables, tapping to a song • **TAP**: Tapping to the beat • **VEN**: Visual entrainment • **VSS**: Visual stream segregation
General cognitive tasks	• **IQ**: Non-verbal intelligence quotient (WPPSI-III matrices subtest) • **nvSTM**: Non-verbal short-term memory (Corsi cubes) • **VOC**: Vocabulary (BEST)

1. PERFORMANCE



For Letter knowledge, Phonological awareness and Vocabulary tasks, mean accuracy is above chance (one-sample t-tests, Bonferroni adj., all ps <0.01).

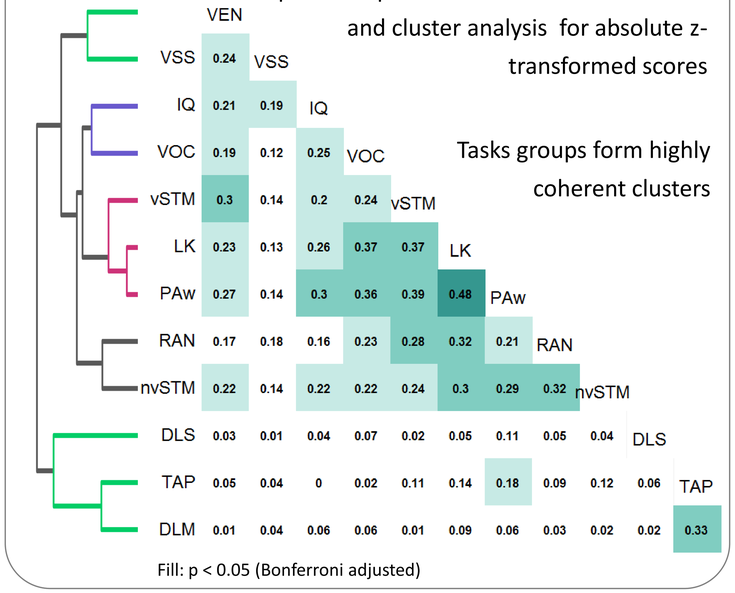
RAN mean RT = 52.52 (sd = 16.2)
vSTM mean raw score = 3.7 (sd = 1.0)
IQ mean raw score = 12.0 (sd = 6.5)
nvSTM mean raw score = 3.7 (sd = 1.1)



2. CLUSTERS and CORELATIONS

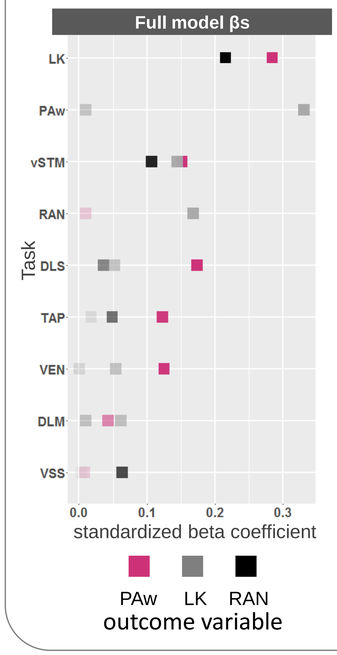
Spearman pairwise correlation coefficients and cluster analysis for absolute z-transformed scores

Tasks groups form highly coherent clusters



Fill: p < 0.05 (Bonferroni adjusted)

3. MODEL FIT and selection



Hierarchical analysis

The model of best fit for Phonological Awareness is::

PAw ~
IQ + nvSTM + gender + school +
VEN + TAP + DLS +
vSTM + LK

Residuals: Min 1Q Median 3Q Max
-1.52 -0.40 -0.03 0.33 2.31
F(9,178)=15.66,, p<0.001
Cooks distance < 0.06

model specification*	R^2 (Adj. R^2)	BIC
null = PAw ~ GC	0.24 (0.22)	495
basic = PAw ~ GC + RR	0.36(0.39)	470
full = PAw ~ GC + RR + OB	0.44 (0.40)	478
best fit**	0.44 (0.41)	459

GC: general cognitive, RR: reading related , OB: oscillatory based
*all models include gender and school as fixed facotrs
**includes significant predictors from full model

CONCLUSIONS

○ Oscillatory-based tasks, behaviorally measured, account for a significant amount of variance in Phonological awareness tasks, but not in other reading related tasks. This supports their role in specifying phonological representations.

PERSPECTIVES

○ To asses the relationship between these predictors and reading skills proper, a **second phase** of this tudy will take place on the sample sample after reading instruction.