UNIVERSITEIT VAN AMSTERDAM

Child Development and Education

Are phonological processing, frequency discrimination, and categorical perception core impairments in children at family risk of dyslexia?

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Dyslexia: multiple risk factors

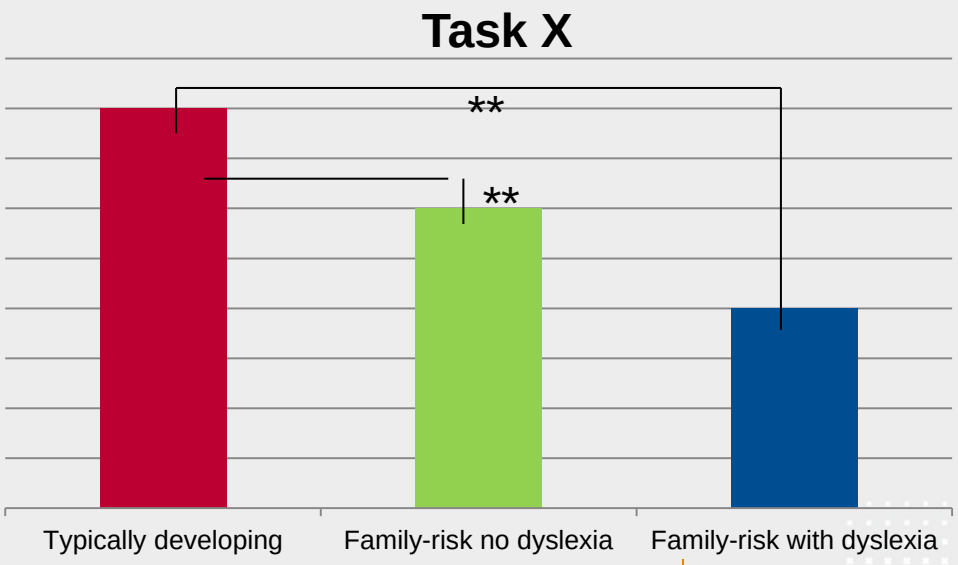
- Proximal causes of dyslexia
  - Phonological deficit
- Disputed underlying causes of dyslexia
  - Auditory processing deficit (frequency discrimination)
  - Speech perception deficit (categorical perception)
- Are disorders causally related or comorbidities?

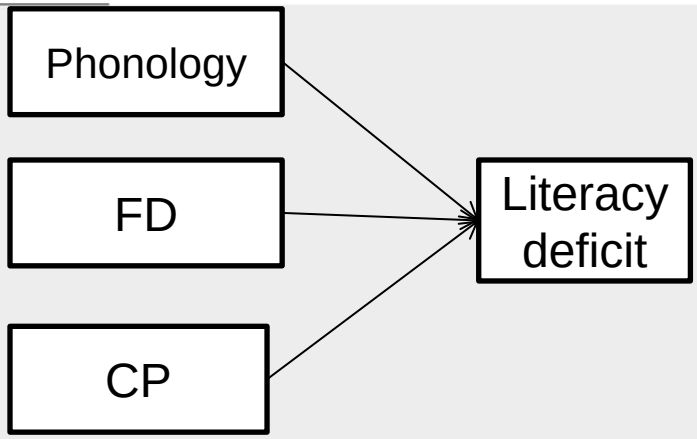
Endophenotypes of dyslexia

- Heritability of dyslexia
- Within families, affected and unaffected relatives may share some but not all of the features of dyslexia
- Recent interest in ‘cognitive endophenotypes’ – heritable ‘risk factors’ rather than absolute deficits
  - Proximal to the genetic etiology
  - Associated with the deficit in the population
  - State-independent: present in unaffected relatives

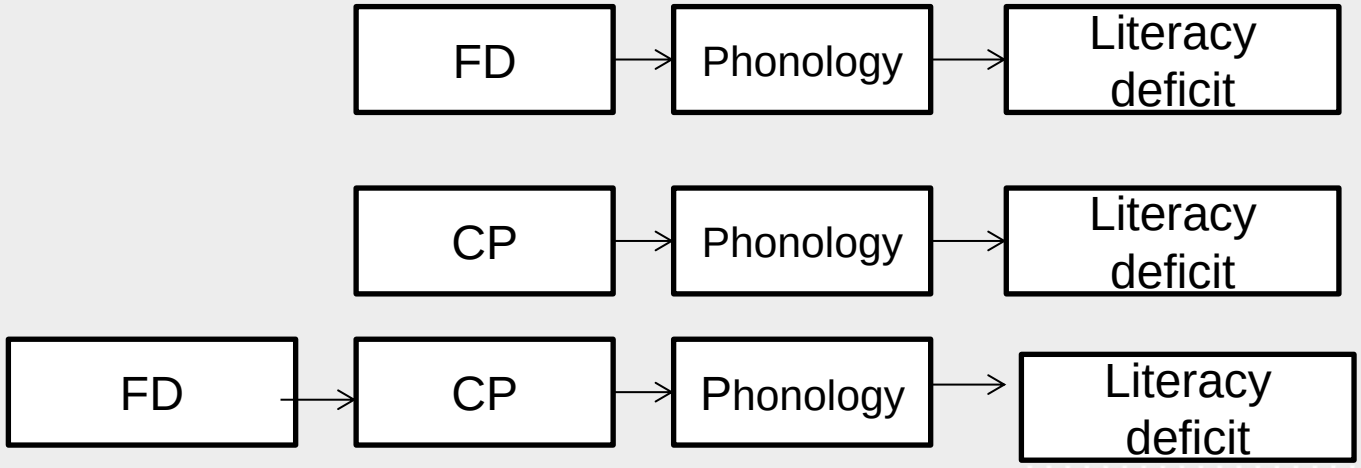
Task X: Endophenotype?

- Children with dyslexia < normal readers/spellers
- FR children < no FR children
- FRdys < FRnodys < no FR children





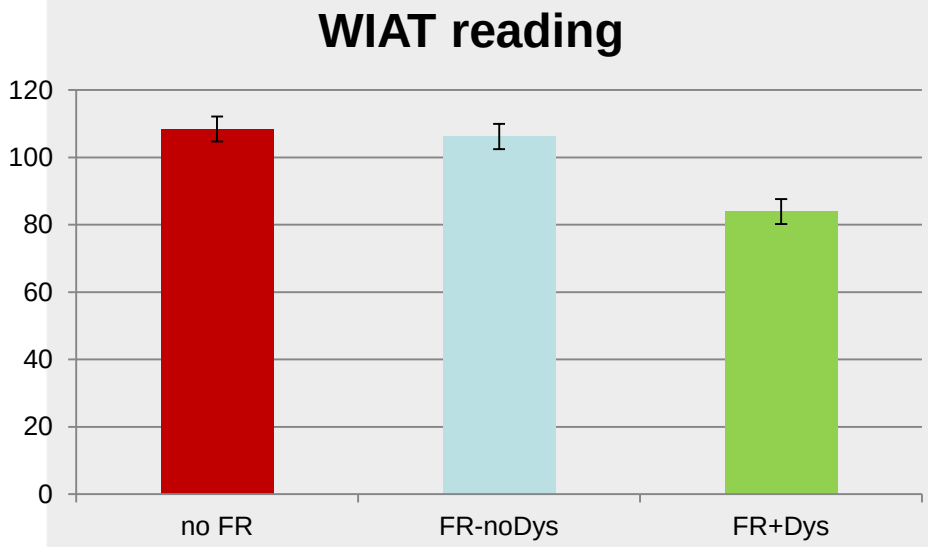
Putative endophenotypes of dyslexia

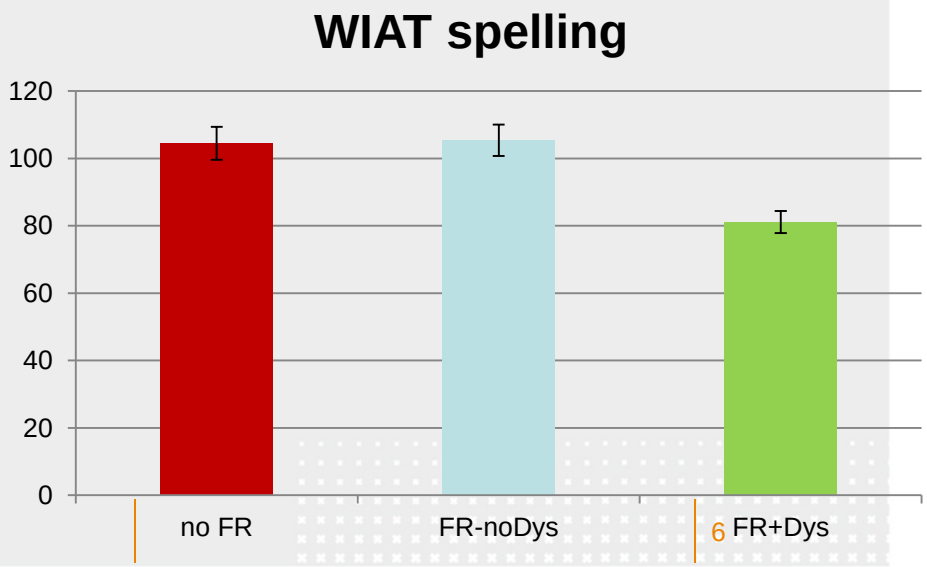


Three possible causal models of dyslexia

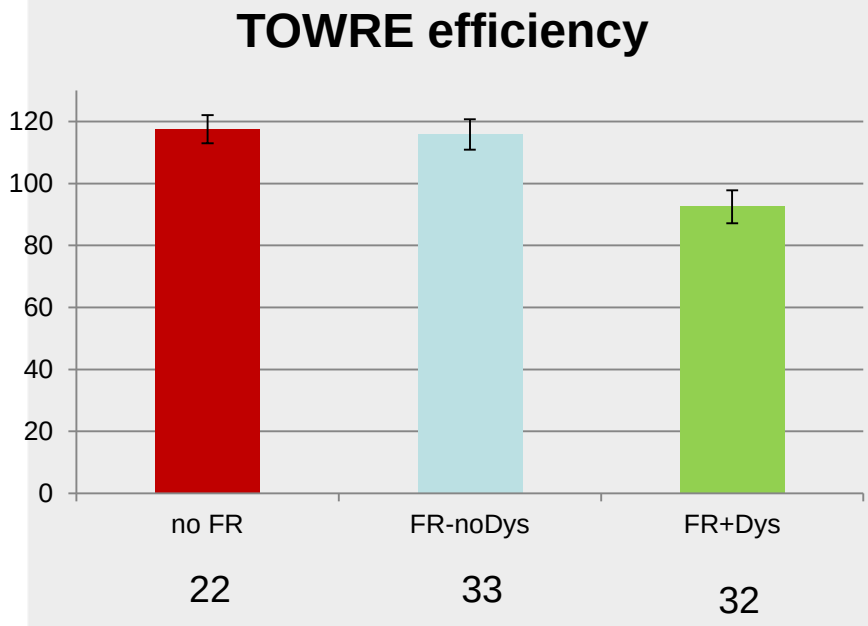
Method: Participants

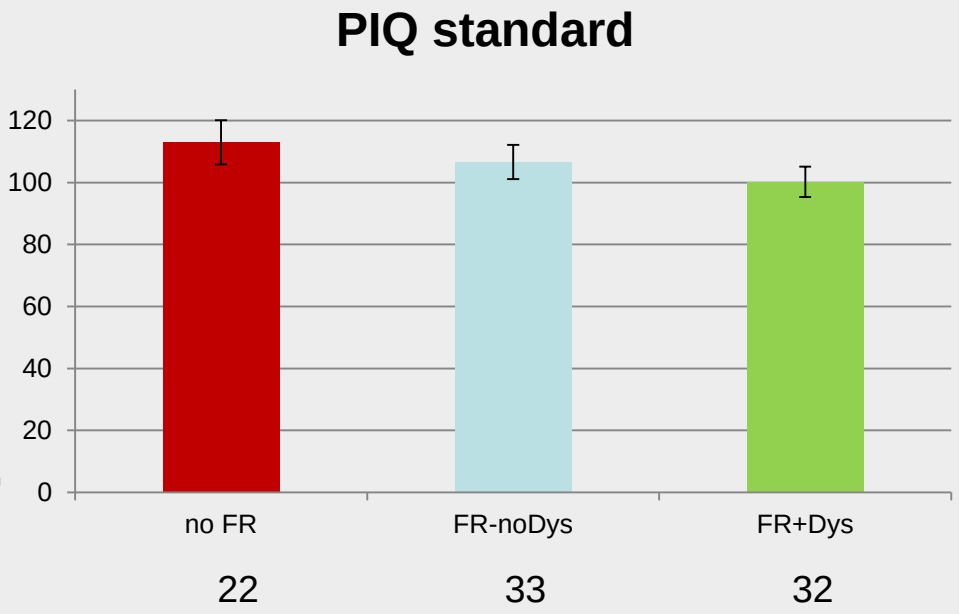
- 65 FR:
  - 32 FR+dyslexic: mean age 114 months
  - 33 FR-not dyslexic: mean age 103 months
- 22 no FR: mean age 97 months





Method: Participants



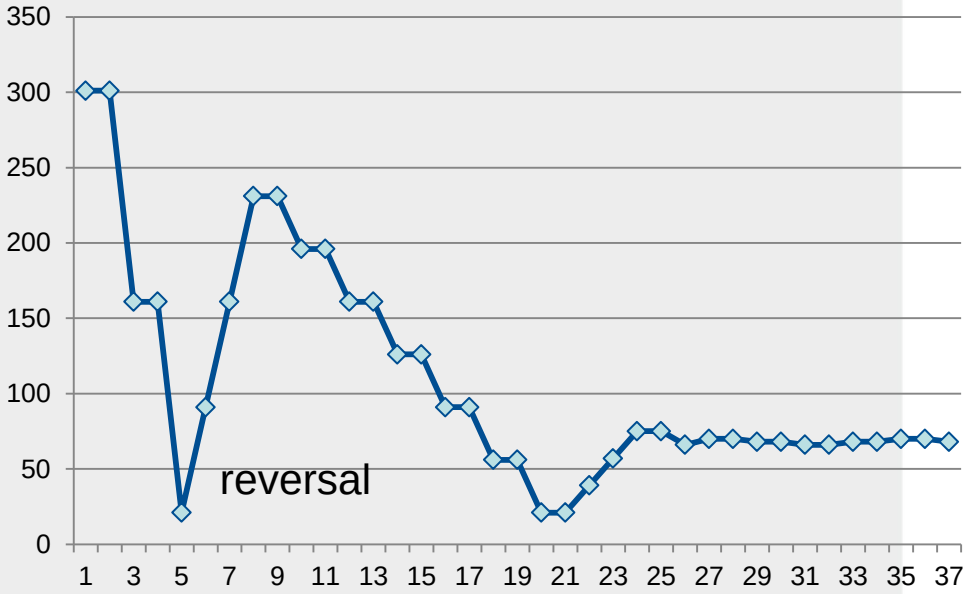


FR-noDys group does not differ from no FR group on literacy measures

Method: Tasks

- Phonology:
  - Non-word repetition (based on Dollaghan & Campbell)
  - Phoneme awareness: phoneme deletion
  - Verbal memory: Word Recall (WMTB-C)
- Frequency discrimination
- Categorical perception (Messaoud-Galussi et al., 2011)
- Attention (SWAN)

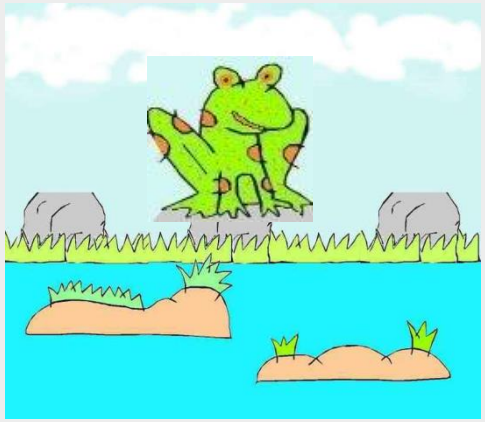
Frequency Discrimination

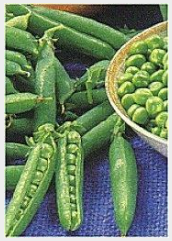


From large step sizes (8Hz) to small ones (0.1 Hz); to stable threshold
8 reversals (or 60 trials max)

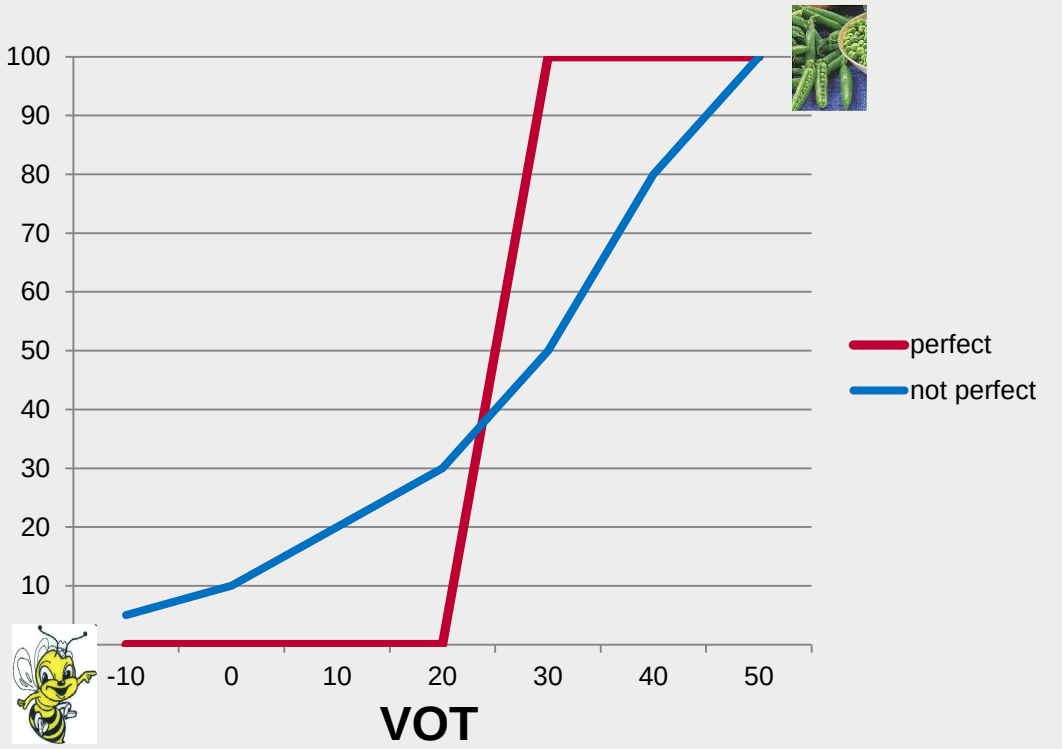
Outcome: parameter at which child can discriminate two sounds

Categorical Perception p/b





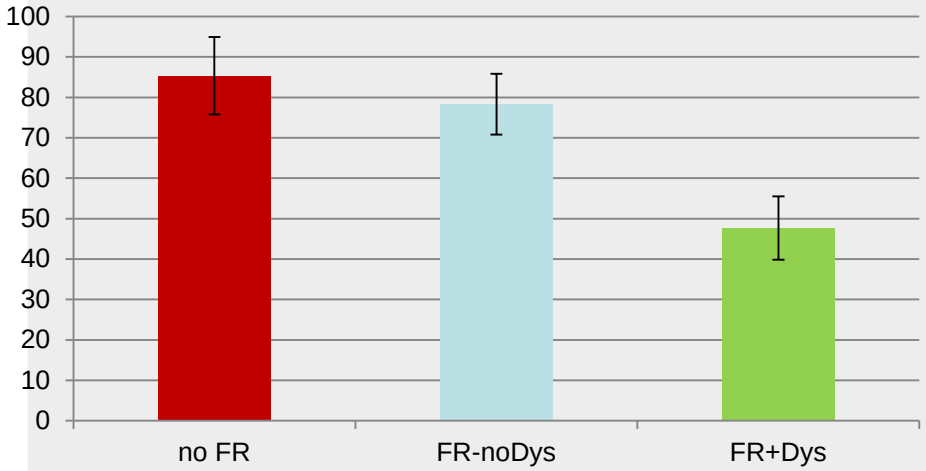
pea bee



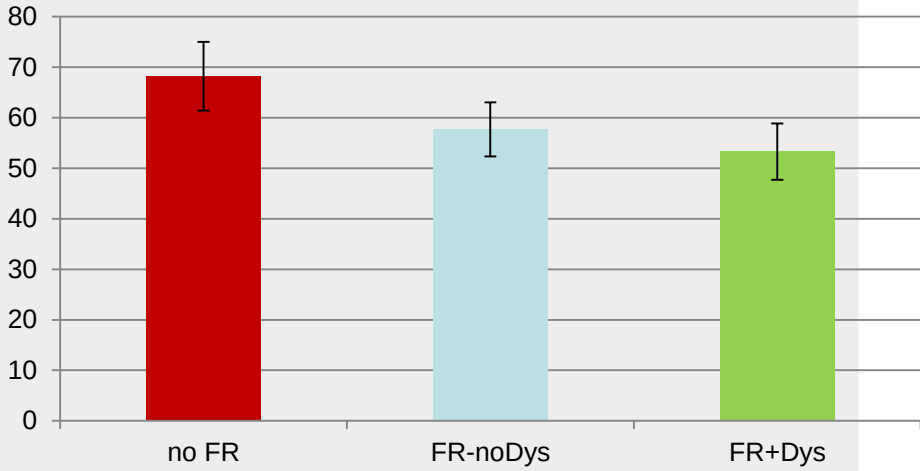
Steepness of slope
Phoneme boundary
Proportion endpoints correct

Results: Phonological Measures

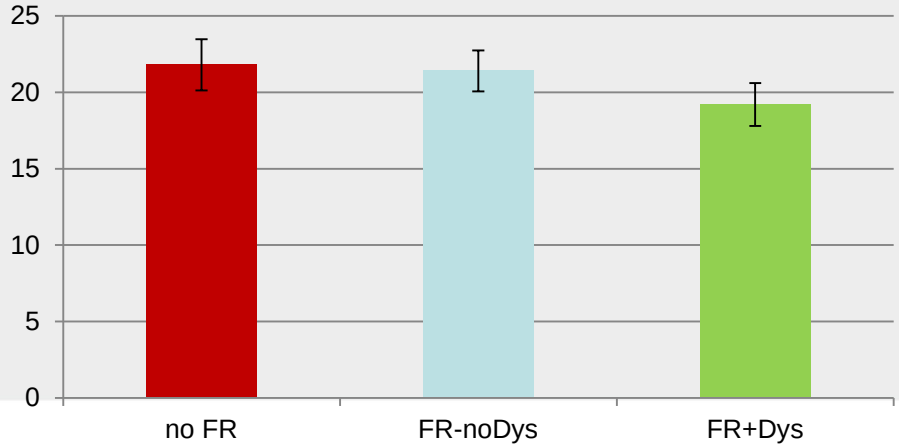
PD percentage correct



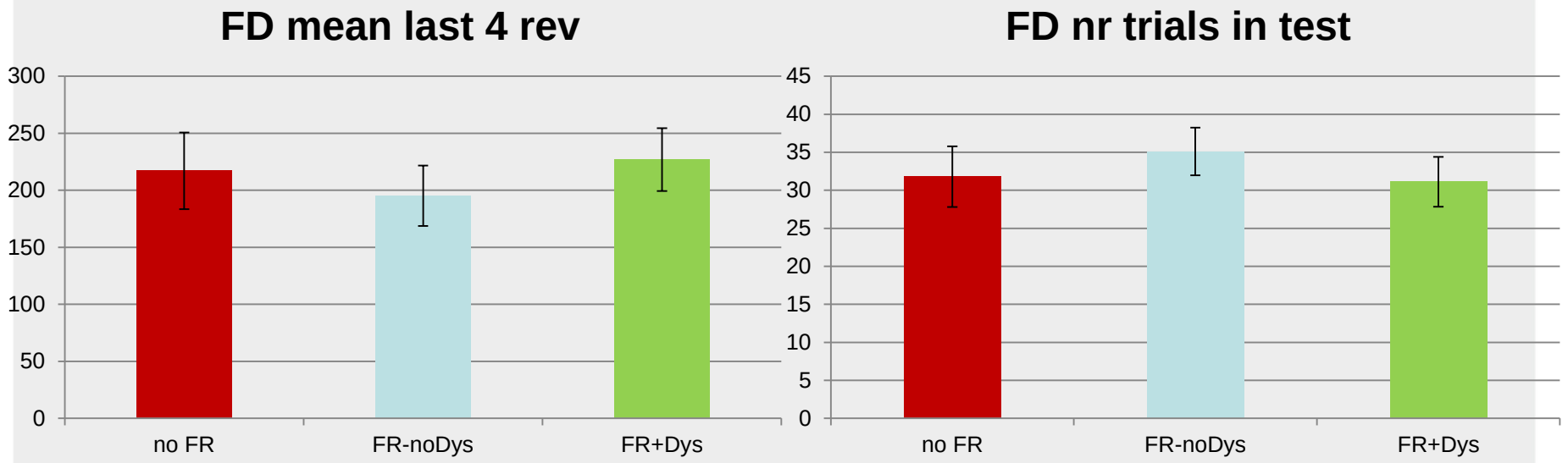
NWR percentage correct



Word-recall raw



Results: Frequency discrimination



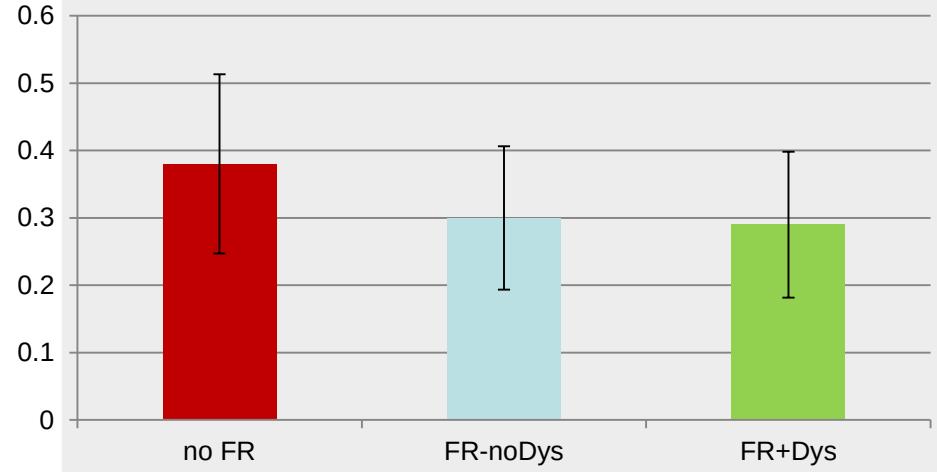
Correlations between measures of FD (rs > .9) → reliable measure

Improved performance for >8 (cf <8) → sensitive measure

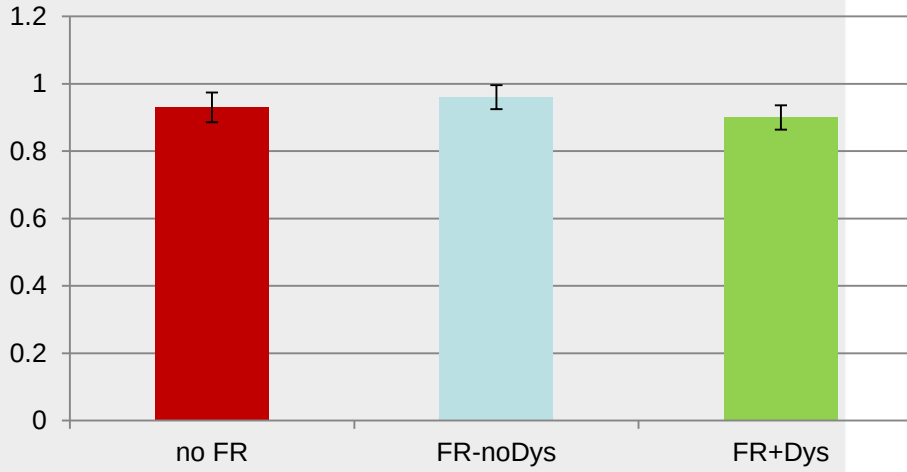
Findings do not differ when measures of attention are taken into account as covariate

Results: Categorical perception

CP slope excluding catch trials



CP endpoints correct



Correlations between measures of CP (rs > .9) → reliable measure

Improved performance for >8 (cf <8) → sensitive measure

Findings do not differ when measures of attention are taken into account as covariate + endpoint scores do not differ between groups

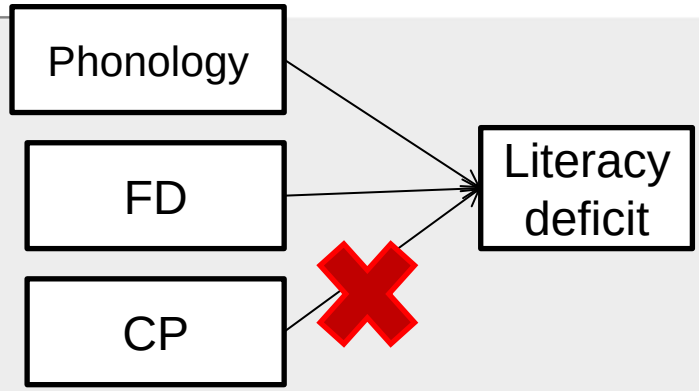
Do measures of phonology, FD and CP associate with individual differences in literacy?

		word recall	NWR	FD mean 4 reversals	CP t-slope	WIAT reading	WIAT spelling	TOWRE reading
all	PD	.363***	.400**	-.197	.069	.745***	.666***	.731***
	word recall		.550***	-.054	.042	.465***	.452***	.409***
	NWR			-.155	.015	.536***	.419***	.523***
	FD				-.175	-.202*	-.130	-.198
	CP					.086	-.053	.030

Summary

- Two main criteria for endophenotypes
  - FR status related to measure
  - Literacy outcome related to measure

	Task related to FR?	Task related to literacy?
Phonology	√	√
Categorical perception	-	-
Frequency discrimination	-	√?



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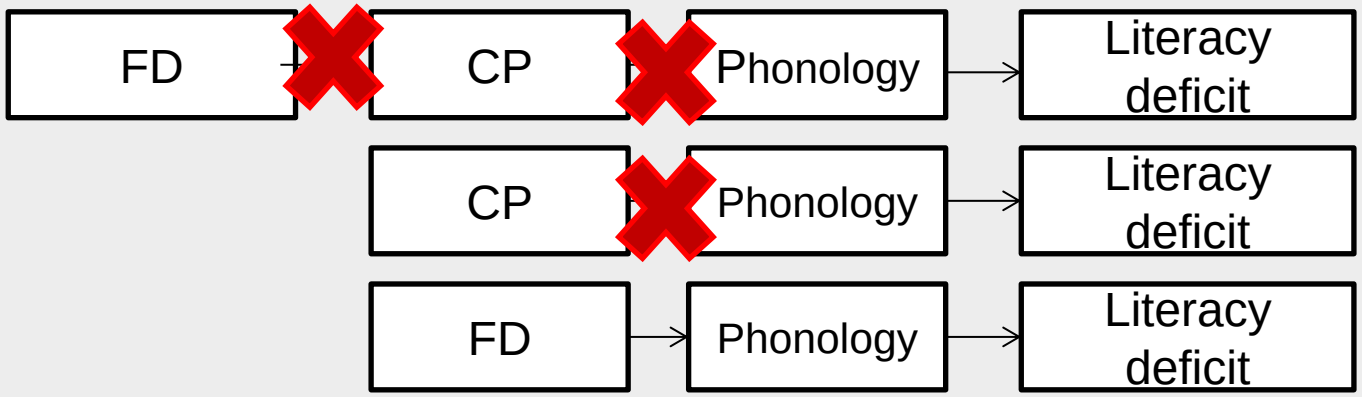

Causal models of dyslexia

Conclusions

- Phonology is a core impairment in children at-risk of dyslexia.
- As frequency discrimination and categorical perception are not, the focus in diagnosis and intervention should not be on these measures of auditory and speech processing.