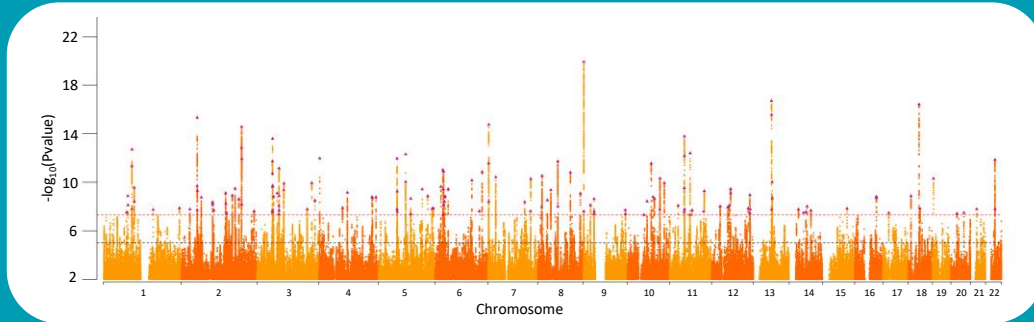# A GWAS-by-subtraction of non-cognitive skills using Genomic SEM reveals association with increased risk for psychological disorders.

Perline Demange

- **Educational attainment (EA) is more than just cognition: non-cognitive skills, e.g. motivation, curiosity, self-control, also matter.**
- **To understand the link between EA and health traits, both cognitive and non-cognitive components should be investigated: we need a better understanding of the genetics of non-cognitive skills.**
- **However, few big cohorts have reliable and consistent measures of non-cognitive skills, as necessary for a GWAS.**

GWAS of non-cognitive aspects of educational attainment
- We leveraged existing well-powered GWAS and Genomic Structural Equation Modelling to construct a GWAS of NonCog (Figure 1).
- We found **157 independent SNPs** associated with NonCog (SNP h2= .064, SE=.002).
- We partially filter cognition out of NonCog, resulting in possible underestimation of differences between Cog and NonCog (Figure 3 IQ).

How does NonCog differ from Cog?
- **No difference in tissue and cell-type specific gene enrichment**: both are expressed in neurons.
- NonCog might be more associated with white matter volume, and Cog with grey matter (Figure 2).
- NonCog is **positively associated** with advantageous personality traits and some psychiatric disorders.
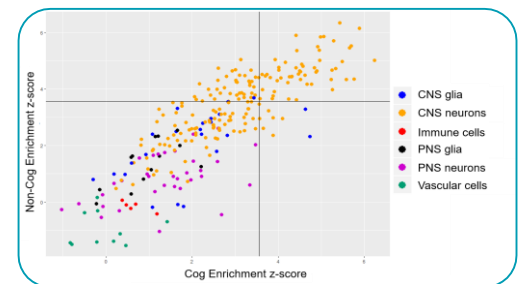
What does it mean?
- We successfully run the **first GWAS of non-cognitive aspects of EA**, using genomic SEM.
- More research into NonCog might benefit our understanding of mental health.
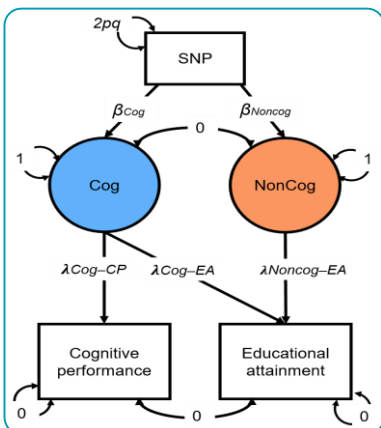

Fig. 4. MAGMA Enrichment z-scores for cell-type gene-sets from Zeisel et al., 2018.

Fig. 1. Structural equation model using summary statistics from Lee et al., 2018.

Volume	Cog	NonCog
Total brain	0.220 (0.039)	0.066 (0.035)
Grey matter	0.064 (0.037)	0.065 (0.039)
White matter	- 0.014 (0.039)	- 0.118 (0.033)

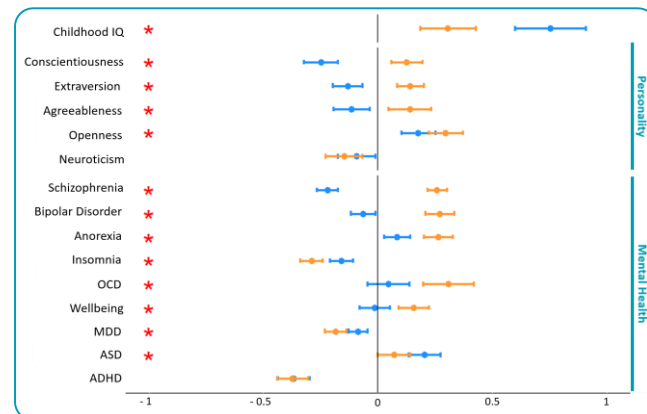Fig. 2. Genetic correlations (SE) with brain volume measures (Zhao et al., 2019).

Fig. 3. Genetic correlations with NonCog and Cog (95%CI). Red star indicates a significant difference.

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