"The Heidelberg Five"
personality dimensions and polygenic risk for neuroticism

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Introduction

The HeiDE study is a longitudinal investigation that started in the 1990s and, at baseline, assessed an array of personality tests in 5,133 individuals (e.g. Amelang et al., 2004). Principal components factor analysis was used to identify five latent personality dimensions (The Heidelberg Five), interpreted as Emotional Lability (ELAB), Lack of Behavioral Control (LBCN), Type-A-Behavior (TYAB), Locus of Control over Disease (LOCC), and Psychoticism (PSYC). Biomaterial was collected at follow-up, on average 8.5 years later. Here, we were interested in the relationship between The Heidelberg Five and polygenic risk scores (PRS) for neuroticism, a clinically relevant personality trait of "The Big Five" personality model that is closely related to ELAB on the phenotype level.

Methods

Briefly, two HeiDE subsamples were genotyped on Illumina SNP arrays (n_1=2,387 and n_2=881; post-QC). We imputed common variants (MAF≥0.01) using the 1000 Genomes Phase 3 reference panel. Neuroticism PRS for HeiDE participants were constructed with PLINK 1.9 (https://www.cog-genomics.org/plink2), using a large GWAS from the Social Science Genetic Association Consortium (SSGAC; n=170,911; Okbay et al., 2016) as training sample. PRS were calculated at twelve different p-value thresholds (1e-06, 1e-05, 1e-04, 0.001, 0.01, 0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 1).

Results

We compared baseline regression models, in which factor scores of each of The Heidelberg Five personality dimensions are explained by age, sex, age^2, the first four principal components of an ancestry principal components analysis and genotyping chip, to regression models that additionally included a term for the neuroticism PRS. The neuroticism PRS significantly improved the R^2s of models for ELAB (Figure 1, top; max. improvement: 0.8%), LBCN (Figure 1, middle; max. improvement: 0.26%) and PSYC (Figure 1, bottom; max. improvement: 0.18%) across most p-value thresholds, but not for TYAB or LOCC (data not shown).

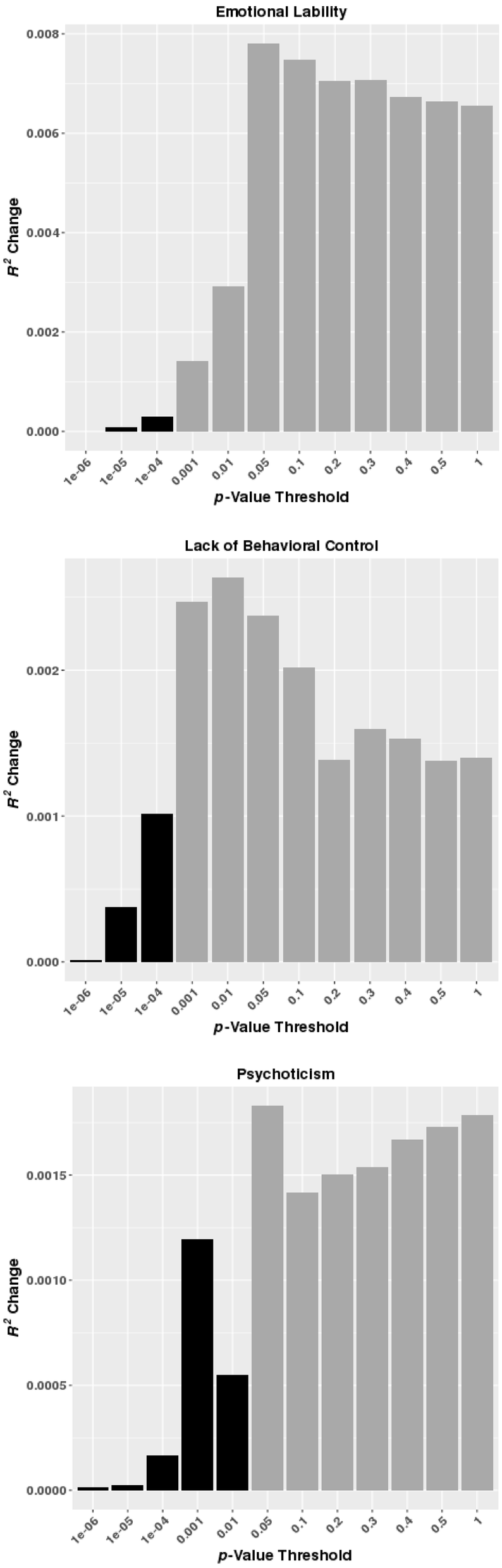

Figure 1. PRS for The Big Five personality trait neuroticism, calculated at twelve different p-value thresholds (x-axis), improve the R^2s (y-axis) of most baseline regression models of ELAB, LBCN, and PSYC. Gray bars indicate FDR-significant p-value thresholds.

Discussion

These data confirm an overlap of ELAB and neuroticism on the genetic level. Also, they suggest that neuroticism overlaps genetically with LBCN, a personality trait related to executive function. Finally, a surprising finding is that PSYC and neuroticism, which have been postulated to be personality traits phenotypically independent of each other (Eysenck, 1991), share a genetic basis.

References

Amelang, Hasselbach, Stürmer (2004) Zeitschrift für Gesundheitspsychologie 12:102-15.
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Okbay et al. (2016) Nature Genetics 48:624-33.

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