CORTICAL PATTERNING GENES ARE ASSOCIATED WITH INDIVIDUAL DIFFERENCES IN VISUAL ORIENTATION PERCEPTION

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PURPOSE
Orientation is a fundamental property of visual scene elements. Perception of orientation is supported by orientation-tuned neurons, which are organized into functional columns in visual cortex. Cortical orientation maps develop under genetic control, and genetic factors contribute to individual differences in their configuration. However, it is unknown whether genetic polymorphisms actually contribute to individual differences in the ability to detect orientation.

METHODS
In a cohort of 1000 healthy young adults, we measured psychophysical thresholds for visual discrimination of orientation. Orientation was introduced into random dot textures by modulating density along an oblique axis (stripes), or by incorporating coherently oriented dot pairs (Glass patterns; streaks). We assessed univariate and multivariate associations of the two behavioral phenotypes with 642,758 single-nucleotide polymorphism (SNP) markers distributed throughout the genome.

RESULTS & CONCLUSIONS
The strongest univariate and multivariate associations were observed between orientation discrimination performance and a marker in HEBP1. Secondary associations were observed with regulatory elements modulating expression of genes with roles in the development of cortical architecture. Our results thus point to a pathway from genetic mechanisms to behavior via structure and function. The associated genes may influence the ability to detect orientation in visual textures by affecting the functional organization of visual cortex.