Title: Perceptual Diversity and Cognitive Style in Synaesthesia and the General Population: Insights from the Perception Census

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Background: The Perception Census, run jointly by the University of Sussex and the University of Glasgow, represents a paradigm shift in the study of human perception and is the largest project of its kind. The Census comprises 56 tasks divided into 11 sections, with over 100,000 sections completed by more than 40,000 participants from diverse backgrounds and age groups. All participants were asked whether they had different types of synaesthesia, with consistency tests offered to those reporting synaesthetic experiences. This provides an unprecedented opportunity to explore how individual differences in perception and cognition relate to synaesthesia in a large, randomly sampled population.

Methods: After exclusions and demographic matching, our final sample comprised synaesthetes with up to six different types of synaesthesia (N = 1,697) and non-synaesthete controls (N = 17,448). We focussed on three hypothesis-driven task groups that connect with prior synaesthesia literature: (1) Visual Perception and Memory (visual illusions, colour perception and preferences, aftereffects, change blindness, motion coherence); (2) Auditory Perception (McGurk effect, beat and tonality alignment, pitch discrimination, music experience); and (3) Cognitive Style (visual and auditory imagery, sensory sensitivity questionnaires, anomalous perception, autism traits,

pattern glare, mental rotation). Our aims were three-fold: to explore how perceptual differences relate to synaesthesia presence; to examine whether differences depend on specific synaesthesia types (e.g., colour versus spatial synaesthesia); and to investigate how differences relate to the number of synaesthesia types reported.

Results: Compared to non-synaesthetes, in Visual Perception tasks, synaesthetes were less prone to the Ebbinghaus and Müller-Lyer illusions. They were also more accurate at perceiving perfect circles (compared to polygons), detecting changes in the change-blindness task, and had longer, more vivid colour after-effects. In Auditory Perception tasks, synaesthetes demonstrated significantly superior performance in beat alignment, pitch discrimination, and tonality detection, with music experience also significantly higher in synaesthetes. In Cognitive Style tasks, synaesthetes scored significantly higher on imagery questionnaires (visual and auditory), sensory sensitivity measures (PSQ, GSQ, CAPS), autism-spectrum traits (AQ), pattern glare sensitivity, and amodal completion vividness. Although there were some exceptions in which specific concurrents were associated with task-specific advantages (e.g., spatial synaesthetes outperformed controls on the change-blindness task, whereas colour synaesthetes did not), individuals with colour synaesthesia (grapheme–colour, days–colour, sound–colour) generally performed comparably to those with spatial synaesthesia (sequence–space). The number of synaesthesia types an individual possessed was not associated with a "dose-dependent" effect in Visual or Auditory Perception tasks; however, such effects were observed in certain Cognitive Style measures, with a greater number of synaesthesia types correlating with higher self-reported imagery abilities and sensory sensitivities.

Conclusions: The results suggest the presence of a common synaesthetic disposition across all synaesthesia types, characterised by vivid mental imagery, heightened sensory sensitivity, a detail-oriented attention style, and a tendency toward enhanced veridical perception. This suggests that synaesthetic advantages may arise from a general cognitive-perceptual disposition rather than isolated cross-sensory pairings. Understanding this broader profile highlights the

substantial variation in human perceptual experience and underscores how large-scale studies of perceptual diversity can reveal the hidden complexity of cognition and consciousness.