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Fine-grained steps in the neural processing of visual and auditory input cannot be studied at the group level but only in individual brains. Representations from convolutional neural networks have been used as explanatory models for these stimulus-induced hierarchical brain activations. However, none of the functional magnetic resonance imaging data sets that are currently available has adequate amounts of data for sufficiently sampling their representations. We have recorded a large functional magnetic resonance imaging data set in a single participant exposed to spatiotemporal and auditory naturalistic stimuli, acquiring approximately 120,000 whole-brain volumes (23 hours) of single-presentation data and 26 repetitions of a smaller resampled set (11 minutes). The data have been recorded with fixation over a period of 6 months.

Testing the Navigation Skills of 3.7 Million Participants With a Video Game

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When scientists need to record signals from human participants such as their eye movements or their brain activity, they need to ask them to physically come to a research facility. This process is costly and time-consuming. As a consequence, the human sample size in a typical neuroscience paper is below 100, and the cohort often consists in students from the local university. Here, we argue that video games can be a useful and cost-effective solution to drastically increase the sample size and diversity of human-based experiments. We developed Sea Hero Quest, a mobile gaming app that records users' spatial

exploration strategies. The game has been downloaded 3.7 million times in every country in the world. We are using these data to create the world's largest benchmark of how humans navigate, which will then go on to become a critical diagnostic tool for dementia in the future.

Effects of Face Familiarity in Humans and Deep Neural Networks

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The recognition of familiar faces is a crucial aspect of human social life. Recent evidence suggests that familiar faces are processed more robustly and efficiently than unfamiliar faces, but the neural mechanisms underlying this effect remain unknown. In a recent magnetoencephalography study, we found that identity and gender, but not age, representations are enhanced for familiar faces very early during processing, suggesting that familiarity affects face perception by altering feedforward face processing. Here, we tested this hypothesis by asking whether familiarity enhancements emerge in purely feedforward deep neural networks trained on face identity. We trained two deep neural networks on two distinct large-scale sets of face images and extracted activations to left-out images of trained ("familiar") or untrained ("unfamiliar") identities, respectively. Using representational similarity analysis, we found that gender and identity, but not age, information is significantly enhanced for familiar versus unfamiliar faces in the penultimate layer of these networks ($p < .05$; bootstrap test). Together, these findings suggest that the strong behavioral familiarity effect may be implemented via a feedforward mechanism in the brain and further show that many specific properties of human face perception emerge spontaneously from a model optimized for face identification.

Idiosyncratic Brain and Behavioral Representations

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