Congruent and opposite Neurons: Neural Substrate of a Complete Picture of Multisensory Processing

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Presentation Abstract Summary The brain performs optimal multisensory integration to accumulate the stimulus information from cues of different modalities. However, multisensory integration will lose cue disparity information, with the amount of information loss increases with the extent of integration. It is essential to maintain the lost cue disparity information during integration; otherwise the brain cannot discriminate cue differences. However, the neural substrate for maintaining the lost cue disparity information remains unknown, thus we address this issue theoretically. In an example of visual-vestibular integration for heading direction on neurons at dorsal medial superior temporal (MSTd) and ventral intraparietal (VIP), there are two types of neurons, congruent and opposite neurons, with roughly the same number in these areas. The preferred heading directions of congruent (opposite) neurons are similar (opposite by 180 degree) under visual or vestibular cues. Congruent neurons are responsible for integration, but the functions of opposite neurons remain largely unknown. We propose a Bayesian model and its decentralized network implementation. The network reproduces congruent and opposite neurons, and we found the congruent neurons perform optimal integration, while the opposite neurons represent the lost cue disparity information in congruent neurons. Our study sheds light on a whole picture of multisensory information processing.

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