CROSSMODAL INTERACTION OF LINEAR VESTIBULAR AND VISUAL STIMULATION IN MACAQUE AREA VIP

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Navigation in space requires the brain to compute a unique representation of the environment by matching information from different sensory sources. Areas in the brain containing multimodal neurons could play an important role in solving this integration problem. Many neurons in macaque ventral intraparietal area (VIP) are multimodal and respond to visual stimuli simulating forward/backward motion. Here we investigated whether neurons respond also to real translatory movements and if so how visual and vestibular signals are combined.

We recorded single unit activity in area VIP of two monkeys during vestibular and visual stimulation. The vestibular stimulation consisted of forward and backward motion on a parallel swing. This stimulation was performed either in darkness (pure vestibular condition) or in a lit room to allow bimodal stimulation. Forward and backward motion was simulated visually by contracting and expanding optic flow stimuli (pure visual condition).

86% of the neurons showed a significant response to linear vestibular stimulation in darkness. 36% were directionally selective for both, pure visual and pure vestibular stimulations. 58% of these cells had the same preferred direction (i.e. they combined visual and vestibular signals synergistically), 42% an opposite preferred direction (i.e. nonsynergistic). Comparison of neuronal responses to bimodal and pure visual/vestibular stimulation revealed that either the visual (48%) or the vestibular component (43%) could dominate the cell's response. For 9% of the neurons bimodal stimulation resulted in a loss of directional selectivity.

We conclude that area VIP plays an important role for navigation in space.

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