Lecture 5 – Neural Bases of Multisensory Integration

The primate/human brain devotes a lot of its hardware to processing vision. But our experience of the world is inherently multisensory. Typically, it will be one unified multisensory experience. We accept that different parts of the brain will extract the early parts of those inputs like visual, auditory, tactile etc. inputs, but how is that all put together? How does our brain give rise to this unified experience? To what extent can something that happens in one sensory modality influence our experience in a different sensory modality?

Overview

1. Brain regions involved in multisensory integration
2. Multisensory integration in speech perception
    a. The McGurk effect and timing of A/V speech perception
    b. The ventriloquist effect
    c. Role of attention in audiovisual integration (behavioural & EEG evidence)
3. Multisensory integration between vision and touch
    a. Single neuron recording
    b. Behaviour in normal humans and brain lesioned patients
    c. 'Rubber hand' illusion and effects of tool use
4. Neural basis for attention shifts between modalities

Interesting philosophical issue about how we perceive the world. Müller's (1835) Laws of Specific Nerve Energies – the nature of perception if defined by the pathway over which the sensory information is carried. Hence, the origin of the sensation is not important.

Between neurons, the point of communication is via axons and dendrites and action potentials – and this method of communication is the same across brain areas and across different species of animals. Why is it then that the excitation of one pathway that leads to the back of the head gives you a visual experience, and an excitation of another pathway that leads to the temporal lobe gives us an auditory experience? Why is it that one pattern of excitation in the brain gives us the feeling of seeing things as opposed to the feeling of hearing something? There is actually nothing in the neural hardware than can give us the answer to this question. You can't look at a chain of neurons and "oh! That looks like it will give an experience of seeing something when stimulated". You can measure action potentials, and the resulting effects on muscles, but you will never know what the experience is.

To this day, we still have no answer to this question. Maybe in synaesthesia these pathways get mixed up? Who knows.