

## **Cerebral correlates of multimodal deixis: prosodic focus, syntactic extraction, digital- and ocular- pointing**

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Deixis, or pointing, is the ability to draw the viewer/listener's attention to an object, person, direction or event. Pointing has multiple modalities: it can be manual or digital (with the index finger), ocular, labial and vocal. It is ubiquitous and probably universal in human interactions. It has long been said to be specific to human primates, although some great apes might share this capacity, which may be related to the thumb-index finger opposition. Pointing is gradually acquired by children, first by pointing with the eyes, then the finger, then with intonation and finally with syntax. Finger pointing is crucial in speech acquisition and seems to be strongly correlated with lexical construction, and morphosyntax emergence. The role of digital pointing in language acquisition suggests that vocal pointing and pointing in other modalities may share a common cerebral network.

Several neuroimaging studies on pointing will be discussed. It will be argued from a study on digital and ocular pointing that these two modalities seem to recruit a network including the left posterior parietal and frontal cortex. A second study on vocal pointing, including prosodic pointing (i.e. focus) and syntactic pointing (i.e. syntactic extraction) will be presented. It will be shown that prosodic pointing seems to recruit a left temporo-parieto-frontal network, including Wernicke's area, the supramarginal gyrus and Broca's region, whereas syntactic pointing mainly involves Broca's region. Finally the results of a very recent study of multimodal pointing (digital, ocular, prosodic and syntactic) will be presented. The common pattern of parietal activation in ocular, digital and prosodic pointing will be discussed. A grammaticalization process will be suggested to explain the lack of parietal activation in syntactic pointing.