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3. Kinaesthetic motor imagery: brain and muscle coordination

Singing is made up of any number of muscle activations depending on the task. This may vary from singing legato, coloratura, executing complex intervals, managing the technical demands of supporting high or low notes, belting or singing falsetto as well as maintaining resonance, articulating well, managing register shifts and mixing voice qualities.

Motor imagery is an excellent way of bringing these separate tasks together so that the whole system is able to sing effectively through the inter co-ordination not just of different muscle groups but different muscle systems. Everything in the vocal instrument is integrated and separate elements cannot be activated individually or consciously.

Muscles may be described as voluntary (skeletal) or involuntary (smooth) but this can be misleading because complex voluntary movements are not brought about by the conscious activation of each separate muscle. Skilled movements must always be learned so that the pattern of use becomes automatic. Only the initiation of the pattern is under conscious control.

When it comes to singing, this is crucial because if the wrong pattern is initiated at the outset, muscles may not be coordinated correctly and the ability to sing openly and freely may be compromised

Even the simplest singing task requires the coordination of many muscles that are often simultaneously involved in other activities. For example, many muscles involved in

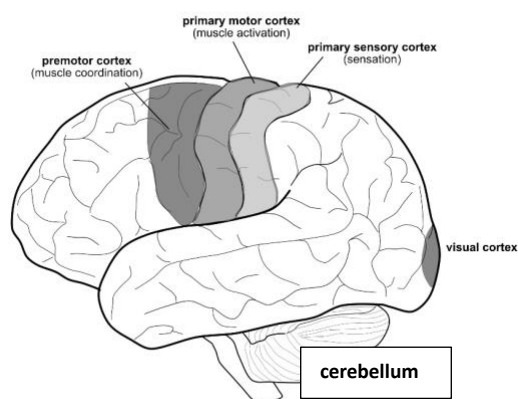
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breathing are also important in maintaining posture and vocal support. All voluntary muscles are controlled by an area in the brain known as the *primary motor cortex*. Behind the primary motor cortex lies the *primary sensory cortex* which receives sensations from the body that are important for controlling muscle activity and which play a very important part in kinaesthetic motor imagery.

The area in front of the primary motor cortex known as the *premotor cortex* is responsible for coordinating complex patterns of muscle activity such as those involved in singing. the premotor cortex is one of the regions of the brain that contains mirror neurones, a type of nerve cell that may be involved in the imitation and the interpretation of gesture. Mirror neurones are so called because they are active when a movement is seen and when it is performed.

Gesture could therefore play a vital role in the application of KMI in vocal pedagogy.



Very simplified diagram of the brain showing the areas discussed above. Notice how close together the sensory and motor areas (feeling and moving) are. Note that the **cerebellum** is also involved in motor function and this will be discussed in the next article.



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