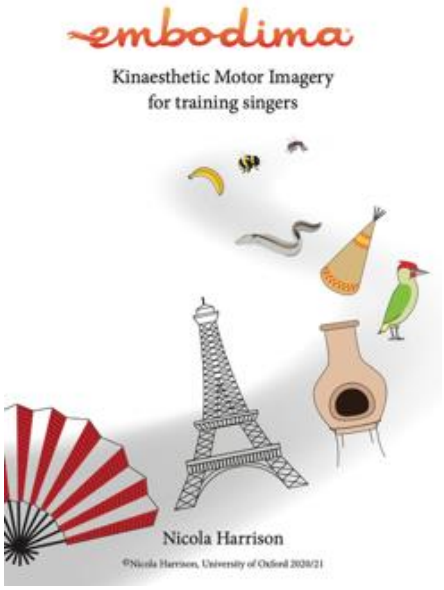
MOTOR TRAINING FOR SINGERS WITH EMBODIMA™

Here Nicola Harrison originator of Embodima ™ talks about motor training and how Embodima™ is helping singers globally through applied neuroscience to coordinate the muscles of singing swiftly and effectively.



WHAT IS EMBODIMA™?

Embodima™ is a swift and effective motor training approach that uses neuroscience to activate and coordinate the muscles of singing. 38 visual and gestured cues are mapped into the anatomy of the singing body and stored in the brain. Each cue is a short cut to complex muscle coordinations initiated by the brain for singing. The outcome is an embodied, authentic sound.

SINGING IS AN INTERNAL DANCE

We use between 90 -100 muscles for every vocalisation - an astonishing number of muscle systems that we have to coordinate in order to produce a sung sound. Which goes to show the sheer scale of what we, as singers, have to do.

Add to this the mindblowing fact that the muscle systems we use in order to sing were evolved for a multitude of other physical functions such as breathing, eating, swallowing, coughing, defecating, giving birth, standing, walking. As singers we have to recruit these same muscles for an entirely different practice -and not only do we have to

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coordinate them differently, they are also often already in use simply to keep us upright, to dance, move across a stage, speak, perform, swallow.

SINGERS ARE SUPERHEROES!

Now we begin to see how complex singing is! And the most complex part is that the majority of our singing muscles are multifunctional and CAN NOT be coordinated together by our conscious mind. Singing is a whole body activity, so how do we get it to work effectively for us?

SINGING IS TASK-RELATED

Yes! We can't coordinate the numerous and hidden muscles of singing by ourselves but they can be activated by a singing task. This could be a simple vocalise or a full blown aria, but it is the demands of the task itself that will activate and coordinate muscle groups. And the ability to do this effectively depends entirely on how well that task is responded to by the brain and whether muscle coordinations have been laid down correctly in the first place.

SO HOW DOES EMBODIMA ™ HELP US TRAIN THE MUSCLES OF SINGING?

Embodima™ delivers a simple, clear message to the brain to coordinate the muscles of singing. Whatever the vocal task, there is an Embodima™ 'cue' for the muscle coordinations it requires. We call these cues Embodima ™ 'neuro-prompts' because they prompt the brain to activate complex muscle coordinations.

WHAT IS MOTOR TRAINING?

Motor means movement and movement comes from muscles. When we train in any physical discipline, we lay down task-specific memories in the motor areas of the brain. These are sometimes referred to as muscle memories, but this is imprecise because muscles do not have memories – all movement patterns are laid down in the motor areas of the brain. So they are called motor memories.

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Motor training is used extensively in sport, instrumental training, dance and medical rehabilitation. In singing it has been less effective and requires an adjusted approach. This is because the muscles of singing are hidden, complex and cannot be inter coordinated in a conscious way.

WHAT IS MOTOR MEMORY?

In most physical activities, it is through repeated practice that we can lay down motor memories in the brain. Once that pattern of activity is stored, it can be reproduced without conscious thought. This is because the muscles have now been trained to behave in a certain way. This behaviour will now be reproduced in exactly the same way each time that task or movement is required.

In everyday life we are all familiar with creating motor memories, such as reaching for a cup and bringing it to the mouth without spilling the contents. We learned this coordination as a toddler and such an action takes a lot of repetition before the bib is no longer required!

If the ability to control the muscles from the brain is disrupted, as in a stroke, then a new pattern will have to be re-established through repetition and embedded afresh in the brain of the patient.

ELITE MOTOR TRAINING

If we want to create a motor memory to an elite level we have to repeat an action thousands of times. In sport we are told it takes between 10,000 and 40,000 repetitions depending on the complexity of the action, to lay down a motor memory in the brain. It's a tough way of learning, to repeat and repeat exercises until we have embedded the process and made that action natural and intuitive.

When motor memories are laid down incorreclty – due to misunderstanding ot lack of instruction, for example – it can take thousands more repetitions to override them.

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SINGING AND MOTOR MEMORY

Establishing motor memories in singers is extremely complex as it is necessary to coordinate postural, respiratory, vocal tract articulatory, laryngeal muscles and many more simultaneously. When we bring the voice to performance, we then have to add physical movement – gesture, unusual body postures, and particularly in CCM, the complex demands of singing and dancing simultaneously.

EMBODIMA™ AND MUSCLES

Embodima™ distills the complex muscle coordinations of singing into a series of 38 images. These are visual cues that relate to shape and movement of muscles within the body. Each image has an accompanying gesture. Together they form a 'neuro-prompt 'which activates the relevant parts of the brain to initiate movement. (see Fig 1). Instead of thousands of repetitions to embed the muscle patterns, we only have to repeat the action on a few times to establish the new motor memory.

Some Embodima™ Visual Cues

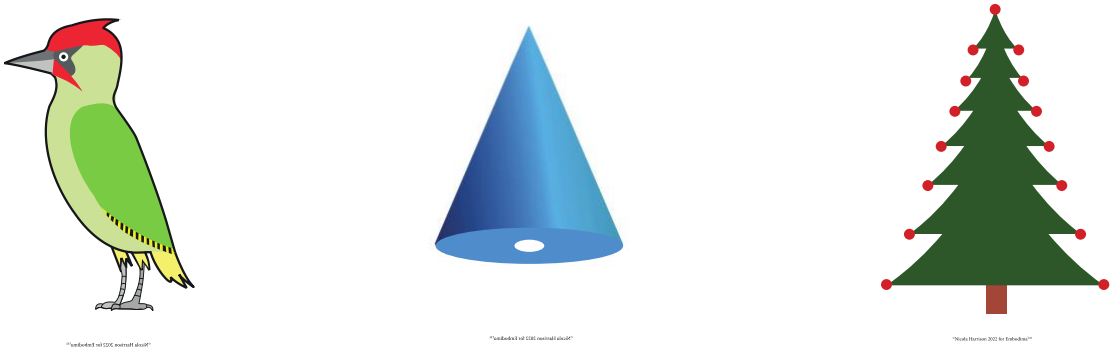

Fig 1. An intriguing set of 38 images that cover every aspect of vocal technique from establishing and matching resonance, tone-placing, integrating passaggi, achieving whistle register, building range, strong belt, staccato, vocal leaps, connecting intervals, octave leaps, riffs, colorature, onsets and much more. Embodima neuro-prompts are swift, immediate and cut out overthinking. Each image is task-specific and mapped into the body through deep study of anatomy and work in the dissection labs where we explored the length, direction of pull and coordination of whole muscle systems on human specimens. This research was then used as the basis for the mapping of the 38 visual cues, and their gestured prompts.

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A BIT ABOUT THE BRAIN

During repeated practice, the part of the brain known as the cerebellum is responsible for the refinement of movement and muscle coordination. Structures deep within the forebrain (the basal ganglia or striatum) are also involved. The memory of this movement pattern is formed and stored in the supplementary and pre-motor cortical areas of the brain. [1]

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 managing muscle activity. [2]

This plays a very important part in feeling the movement of Embodima ™ gestures which have been mapped within the body.

The area in front of the primary motor cortex is known as the premotor cortex. It 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. [3] Mirror neurones are so called because they are active when a movement is seen and then 'mirrored,' in this case the Embodima™ gestures which are demonstrated by the singing teacher and imitated by the student.

Embodima™ works by supplying motor images (visual cues) and gestures that exactly replicate the muscle movements required for singing tasks. Embodima™ is a form of 'Embodied Cognition' in which specialised neuro-prompts communicate directly with the brain, which responds immediately by sending messages to all the muscles required for a specific singing task.

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[1] Doyon, J., Bellec, P., Amsel, R., Penhune, V., Monchi, O., Carrier, J., Lehéricy, S., Benali, H., 2009. Contributions of the basal ganglia and functionally related brain structures to motor learning. Behavioural Brain Research, Special issue on the role of the basal ganglia in learning and memory 199, 61–75

[2] Rajmohan, V., Mohandas, E., 2007. Mirror neurone system. Indian Journal of Psychiatry 49, 66.

[3] Yágüez, L., Nagel, D, Hoffman, H., Canavan, A.G.M., Wist, E., Hömberg, V., 1998. A mental route to motor learning: Improving trajectorial kinematics through imagery training. Behavioural Brain Research 90, 95–106.

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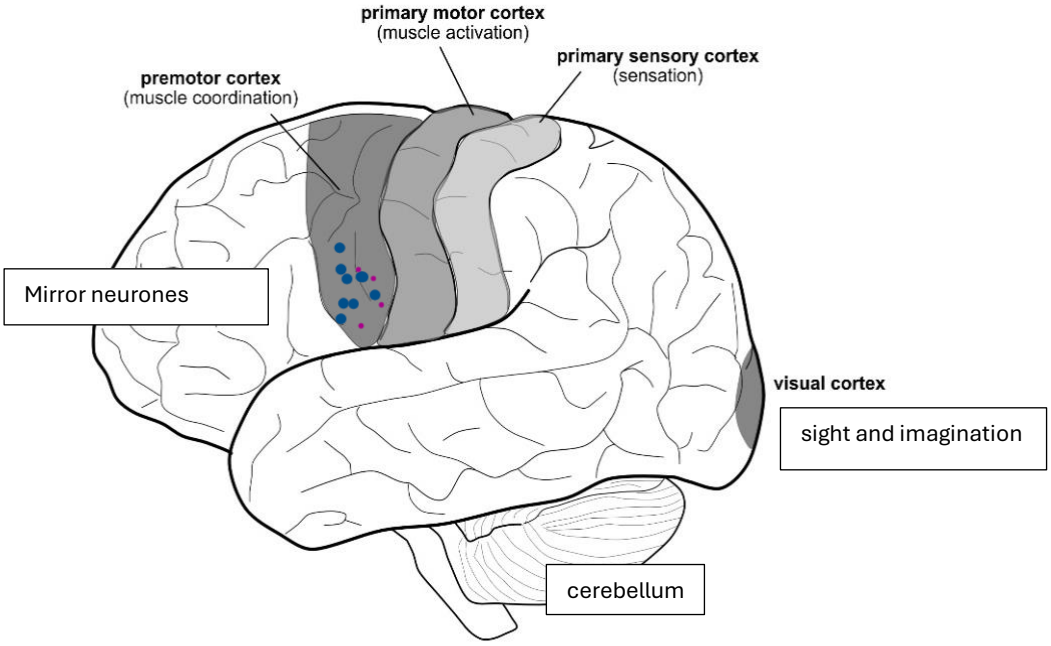

Fig 2. Simple diagram of the brain showing areas discussed ©Dr Alan Watson 2024

EMBODIMA™ IN TEACHING SINGING

The student is shown the motor image (visual cue) and its accompanying gesture.

Together they form the neuro-prompt which sends a message to the visual, sensory and motor areas of the brain.

The correct muscle systems are activated.

An immediate motor memory is created and stored in the brain.

This motor memory can be activated by sight or mention of the Embodima™ neuro-prompt.

Here is an article published in Classical Music magazine. It explains how Embodima™ works and also gives you an Embodima neuro-prompt you can try out in your own teaching.
https://embodima.co.uk/wp-content/uploads/2024/07/brain_magic_classical_music_magazine.pdf

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THE TESTING BEHIND EMBODIMA™

This approach has been evolved over years of research using anatomical mapping, extensive testing and validation by neuroscientists, anatomists and singing teachers. Testing of Embodima ™ began in 2011 with preliminary work carried out with neuroscientists at University College Hospital (Prof J. Rothwell and Dr D. Hoad) and Oxford University (Prof J. Stein).

Fuller investigation continued with Dr Alan Watson, neuro-anatomist at Cardiff University. After evolving a testing method and a process of validation and independent assessment, results were very promising. For more information about the science behind Embodima™ please visit: https://embodima.co.uk/the-science-of-embodima/ Eight articles and an abstract written in collaboration with Alan Watson can also be found here.

SUMMARY

Athletes can see the track, the hurdle, the ball. They can see and feel their limbs as they move towards the goal. Musicians can play their instrument externally or hold it in their hands so the motor cues they might use to train their muscles to perform complex tasks can be far more overt.

In singers however, additional help is required to ensure the correct coordination of numerous muscles. Embodima ™ provides that help. It is safe, effective and switches off overthinking, bringing to the singer an immediate integration of body and voice to create an *embodied* sound. It has been used effectively on adult learners, children and young adults, conservatoire students, choirs, singing teachers and young professionals and has proved a valuable resource in vocal rehabilitation. Because Embodima™ instruction is physical, practical and unambiguous, it provides a supportive learning approach for students with dyslexia, dyspraxia, ADHD and ASD.

ENTER THE WORLD OF EMBODIMA!

If you're interested in learning more and using Embodima™ cues in your own teaching, you can dip your toe in the water with this innovative and practical one day course. Working in small groups, you receive individual supervision with three Embodima™ trainers. Enquiries: embodimaevolution@gmail.com

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