Mirror Neurons in Vocal Pedagogy

Background
Working with adults who have spent most of their lives convinced they can’t sing, I am passionate about providing a positive singing experience in the fastest way possible.

Likewise, with patients experiencing strain, tension and exhaustion, I want to unlock their larynxes as quickly as I can.

I’ve often found imitation can be the fastest way to get a desired vocal quality, however, I have also noted its limitations.

Learning about mirror neurons has helped me to understand the role, and limitations, of imitation in my therapy and teaching.

Mirror Neurons
are nerve cells within the brain that are active during both the performance of an action and the perception (via sound, sight, or through spoken/written language) of the same action (1-3).

There is a flow on effect down to the level of the muscles involved in that action (4, 5). This flow on effect may be responsible for the sensations we feel in our own body when we listen to other singers who sing in a vocal tone similar to our own.

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<tr>
<th>Current theories of mirror neurons and imitation</th>
<th>Implications for teaching vocal skills.</th>
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<td>• Will only be activated if the person can do the precise action already. Otherwise the recognised components of the action that exist within the person’s repertoire will be activated (6, 7)</td>
<td>• People can only accurately imitate what they have already done in the past, otherwise they will do the closest they can</td>
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<td>• Whether we have an existing motor plan for an action influences the perception of that action (8)</td>
<td>• Perhaps explains the high success of using basic emotional/vegetative vocalisations as stepping stones to more complex tasks</td>
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<td>• Activation is beyond conscious control – automatic priming (9)</td>
<td>• Helpful for teachers to be able to produce common, if not all, “errors” so that they can more quickly identify what is happening differently &amp; provide a bridge to the goal</td>
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<td>• Circuitry is developed through motor exploration with attention to the sensory results – associative learning (10, 11)</td>
<td>• The teacher must be sure all aspects of the model they demonstrate are what they want imitated, as students may unconsciously imitate aspects the teacher didn’t intend</td>
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<td>• These neurons can be activated by verbal labels (2)</td>
<td>• Need to work towards the student gaining voluntary control if they require it.</td>
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<td>• Supports ensuring students pay attention to the sound and kinaesthetic sensations of their singing</td>
<td>• Supports the use of labelling particular behaviours (e.g. “vibrato”) to enable voluntary retrieval and reproduction later</td>
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Case Study One
65 y.o. female 10 years of dysphonia.
• **Primary Complaint:** strain & increased effort
• **Perceptual Ax:** mild strain & roughness
• **Was immediately able to imitate a forward resonance “oo” with nil roughness/strain**
• Able to also copy other vowels & siren across different pitches
• Reported with astonishment that she felt so much looser & freer after just 2-3 minutes of copying SOVT syllables
• Husband reminded us both she had been a professional singer in her younger years.
• Worked to ensure patient could reproduce voluntarily without SP model
Case Study Two
35 y.o. recently graduated emergency services officer, very reserved.
- **Primary complaint:** frequent voice loss, excessive strain & effort
- **Perceptual Ax:** mild – moderate breathiness, mild strain & roughness, little forward resonance
- **Unable to gain any forward resonance through imitation alone despite multiple different semi-occluded vocal tract CV combinations used**
  - Improved resonance was only gained through going back to basic vegetative vocalisations and the patient slowly manipulating his jaw and tongue (sensory-motor exploration)

Some Areas for Future Research
- **Mechanisms of interference vs. enhancement of mirror neuron activation and vocal imitation?**
- **Nervousness versus a feeling of safety in the lesson/therapy session.**
- **When is it more useful to have a patient name or describe a modelled vocal quality in their own words rather than the teacher giving it a specific label?**
- **How is visual & auditory information integrated in the activation of mirror neurons controlling the vocal tract?**

References
10. Catmur C: Sensorimotor learning and the ontogeny of the mirror neuron system. Neuroscience letters 2013; 540:21-27