

## Tilting - a Quixotic pursuit?

For centuries, vocal pedagogues, singers and listeners have described the qualities they hear in the singing voice, and attempted to explain them in terms of activity, movement or just the intrinsic attributes of the human larynx. Some of this terminology is beautiful and poetic, some of it is enlightening, and some of it is just downright misleading. Voices: their sounds and ability to move our emotions are just the same as ever; but we do now have some more specific knowledge about what is actually happening in and around the larynx itself. Many of our confusions have arisen as we attempt to explain activity in terms of sensation, for example: 'I feel it vibrating in my chest, therefore my chest is making the sound'. Even more confusions arise as we inevitably simplify very complex interactive systems. Vocal sounds cannot be categorised into neat classifications: there are too many variables, too many grey areas between the main distinguishable voice qualities. I am encouraged and heartened by the changes in terminology that are infusing our pedagogical world. Most teachers now know that one cannot possibly sing by, with or from the diaphragm. Or, for that matter, the stomach. We aspire to communicating truthfully and unambiguously, but with elegance, simplicity and imagination.

Sound qualities can be breathy or clear, tight or gentle, hard or soft, shouty or whoopy, dark or bright, nasal, vibrant, ringing, twangy, hooty and many more. Some of these descriptors are clearly functional (eg. nasal) and some are just descriptive of what we hear (eg. bright). In terms of relating function to sound quality, we do have clearly defined register terminology. This has been identified and agreed by voice scientists (Roubeau, Henrich et al. 2009) but is still disputed or re-defined by singing teachers. The scientists agree that we have four registers. Firstly M0 (vocal fry, pulse or creak), which is a low-pitched series of clicks that sound like a creaky door. Secondly we have M1 (chest, thick-fold, speech quality), this is the vocal register we all use for most of our speaking and that which men use for most of their singing. Then we have M2 (adult male falsetto, female head voice), which women and children use in their upper range for singing. Finally there is M3 or whistle register that isn't used much except for special effects. The difference between vocal registers is defined by the vibratory behaviour of the vocal folds and the acoustic properties of the sound (Titze 1988).

We can also have different adductory behaviours of the vocal folds (Herbst, Qiu et al. 2011), in addition to the register categories. If we use more vocalis or thyroarytenoid activity, it results in stiffer vocal folds and a greater percentage of vocal fold closure per cycle, giving a stronger sound. If we use more interarytenoid and lateral cricoarytenoid, the vocal folds will close along their entire length for

each cycle, giving a clearer, less breathy sound. These two are not mutually exclusive and can occur in either register (Kochis-Jennings, 2012). A bit of judicious mix-and-match can lead one register to sound fairly similar to another one (Echternach, Sundberg et al. 2010). We could even call it overlap or another grey area. Then we have resonance phenomena: these are purely to do with the way in which the sound energy is manipulated in the vocal tract (Sundberg 1987). Again, we can select certain frequency bands and boost or dampen them, this can be used to make the sound brighter, darker, stronger, lighter, fuller, ringing etc. And once more, this can be mixed with changes at the vocal fold level in order to create some ambiguity in the nature of the voice quality.

In order to change pitch we need to change the mass per unit length of the vocal folds (normally by lengthening and thinning them); the stiffness of the vocal fold (increasing the isometric contraction between antagonistic muscles) or the pressure of the air underneath them. Air pressure changes alone won't change pitch much, so we can probably leave that one out (Gramming, Sundberg et al. 1988). The thickness or mass of the vocal folds is related to registers, it is difficult to change rapidly to and fro between registers, unless you are intentionally yodelling. Register changes tend to be related to pitch in that M1 will be easier and more efficient in lower pitches, M2 will be easier and more efficient in higher pitches. Whatever we are doing in terms of register, vocal fold thickness, vibratory behaviour, or resonance enhancement – if these factors remain constant, when the pitch rises, the vocal folds lengthen (Roubeau, Chevrie-Muller et al. 1997). This is as a result of the cricothyroid muscle contracting, pulling the front of the thyroid cartilage closer to the cricoid cartilage and increasing the distance between the front of the thyroid cartilage and the back of the cricoid. If we want to keep the pitch the same and still lengthen the vocal folds, it only is possible to do this to a very small degree by decreasing the isometric contraction of the vocalis muscle, so that as the mass per unit length decreases, the stiffness decreases also. The other adductory muscles also need to be increased slightly to ensure phonation (Chhetri, 2014). The amount of movement will be small - it's a limited action. So any actually observable tilting of the thyroid is to do with pitch change; all other vocal quality changes are to do with other actions.

So what is meant when singers are asked to 'tilt' more, they may even be asked to sing the same pitch but with 'more tilt'. We know that nothing is actually tilting if the pitch remains the same, so what is happening here? We know that tilting is a term generally used to describe the movement of the thyroid cartilage in relation to the cricoid cartilage. It's what happens in our larynx as we change pitch. Let's clear one thing up to start with: in the past some people have referred to two actions, cricoid tilt and thyroid tilt. The former was thought to be the movement of the

cricoid cartilage whilst the thyroid remained still. This is impossible to achieve. The cricoid cartilage is the top of the trachea, it's fixed in place relative to the cartilaginous rings beneath it. There's a bit of movement but no tilting movement whilst the thyroid remains still. The only direct muscle attachment to the cricoid cartilage is the cricothyroid; this can only move the back of the cricoid back and up – this is part of the movement that would lower pitch. The movement that happens as a result of the contraction of the cricothyroid muscle is a movement of both cartilages in relation to each other; the singer can't select or choose either one to move any more or less.

What might a teacher want when he or she asks for 'more tilting'? Presumably the pitch needs to stay the same, therefore the difference required is a voice quality change. This may be a larynx action (vocal fold closure of the cartilaginous portion in order to reduce breathiness, or medial compression to make the vocal fold stiffer) or it could be a resonance one (increase of higher frequencies leading to brighter sound). It could be a register action (reduced vocal fold mass moving phonation to M2) or something related to a reduced air flow (I haven't mentioned breathing but it is important). It's not possible that these actions will result in a significant enough contraction of the cricothyroid muscle in order to move the thyroid cartilage in relation to the cricoid. So the singer isn't actually tilting anything.

Sometimes the teacher may ask for more 'crying', 'whining', 'whingeing' or 'complaining' in the sound. These will access a combination of actions resulting in a brighter sound (resonance), easy access to higher pitches (cricothyroid flexibility), reduced vocal fold adduction (register) and lack of breathiness (Lateral Cricothyroid + Interarytenoid activation). It is a complex recipe, with a simple emotive, primal trigger. This is where simplification is very powerful as a pedagogical tool. Feeling something and letting it just flow into your singing can result in the most complex of interactions just falling into place. The teacher just needs to know the right feeling to suggest.

If we are directing a student to produce a certain timbre in the voice by making an internal movement, this needs to be accurate and easy to feel. If the internal movement is actually not happening but is a metaphor, the student may struggle to achieve this unless the metaphor is made explicit. So why use a metaphor that could be confused with an actual movement? There are many of these in traditional singing teaching and we need to question everything that we do and say. We know that the human brain will respond more easily to motor learning acquisition if the instruction is for an external sensation rather than an internal one (focus on the end of the tightrope, not on your feet). If we ask the student to 'tilt' the result may

be cumbersome and effortful. If we ask the student to 'cry' the result may be easier. If the singer is asked to 'tilt and remain in tilt', the result could be unnecessary muscle tension; singing direction is dynamic interaction, not a held position.

The use of imagery and metaphor is essential as a teaching tool in order to stimulate the creative imagination of the singer. We need more than just nuts and bolts: we need feelings, ideas and reference points. Imagination is what defines us as human, we can rehearse an event in our imagination that hasn't happened or may never happen. We use this in order to be creative: for engineering, architecture, fine art, theatre, music, interior design etc. Creativity and imagination are immeasurably important to humans and the way that we interact with the world. If we are to teach: to impart information, to facilitate change, to enable and empower; we need both imagery and information. Sometimes the information is too complex and has to be presented as a picture or a story in order to be understood. We hope that our students know, deep-down, the difference between the two.

Where simplification can be problematic is if we start to believe our simplistic explanations. It's like the structure of the atom - what we are told at GCSE isn't what we are told at A level which isn't what we are told for undergraduate study, and even the particle physicists don't really understand it and yet GCSE students think that they do.

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