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Resonance strategies and glottal behaviour in the two main laryngeal mechanisms for professional operatic singers

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In lyrical singing, two principal laryngeal mechanisms are used to produce all the notes across the singer's tessitura. Laryngeal mechanisms M1 and M2 are characterised by a greater and lesser vibrating mass respectively. Different timbres between the two are at least partly explained by their different glottal behaviours. However, different adjustments of the vocal-tract resonances, which can also contribute to different timbres, may also be involved, but have been neglected. We studied seven professional operatic singers, who produced sustained vowels at the same pitch using both laryngeal mechanisms. Vocal-tract resonances were directly measured during phonation, by broadband acoustic excitation at the mouth. Glottal behaviour and laryngeal movement were measured indirectly with an electroglottograph. As expected, we measured lower values of open quotient and higher sound pressure levels in M1 than in M2. In most cases, the first two vocal-tract resonances were characterised by lower frequencies in M2 than in M1. In the singer's formant region, similar resonance-frequency values were found for both laryngeal mechanisms. The effect on the sound spectrum of an open-quotient increase together with a first-formant decrease may be modelled by source-filter theory. The theoretical and measured amplitudes of the first two harmonics will be compared.