

1 **Appendix S2**

2 **Cross-examination of spectrum prominence and VRP contour rippling.**

3 To test the idea that resonance may boost the SPL, all individual VRPs in
4 Charts_S6 were cross-examined for ripples (local maxima) in the maximum VRP
5 contour that do co-occur in association with a distinctly prominent harmonic. The
6 overall results of the analysis done here, are summarized in the main text.

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8 The search is for “yellow to red” spots at high SPL (for the $L_{Hmax/Rest}$ metric) along
9 each upper VRP contour, where it is not H1 but a higher harmonic that dominates and
10 also peaks. Next, a coinciding local extreme in the maximum VRP contour may
11 provide the evidence that the observed harmonic-formant tuning actually adds to the
12 SPL. Note that a formant may boost a single harmonic very selectively, but as long as
13 this harmonic does not hold a significant fraction of the overall power, the $L_{Hmax/Rest}$
14 metric will still stay “green” despite any apparent tuning.

15 **Tuning effects in M1**

16 Clear examples of tuning in combination with a local extreme SPL are seen with
17 untrained female voices singing in M1 for subjects, UF1, UF2, UF3 and UF6 and, less
18 convincing, also with UF7, UF13 and UF15. Subjects UF4, UF12 and UF16, show
19 apparent tuning without any rippling in the upper contour. For the trained female
20 voices singing in M1 it is much harder to discern convincing examples, although
21 perhaps to some degree the phenomenon appears with participants TF5 and TF9.
22 Selection without a clear maximum contour rippling is seen with TF3, TF4, TF7, TF8,
23 TF10 and TF11. With singer TF1 singing above C5, the maximum SPL even drops

24 while H2 becomes more sharply peaked (the $N_{H_{\max}}$ metric confirms that it is still H2,
25 check Charts_S5). Singer TF3 shows around tone A4-B4 two orange spots, one at 80
26 dB and one at 90 dB SPL where distinct harmonic selection or tuning occurs.
27 However, this mechanism is not effective or not exploited at extreme SPL around C5
28 at 102 dB SPL. With the trained male singers: TM1, TM2, TM3 and TM6, a distinct
29 cresting harmonic (yellow to red spot) is reported without any convincing rippling in
30 the maximum SPL. For all three voice groups, the VRPs do also show ripples in the
31 maximum SPL contour without any associated markings of a single harmonic tuning
32 in to a formant. The explanation for this could be that the energy is not contained
33 within a single harmonic, but carried by two harmonics, each centered in a different
34 formant. We therefore tested a special metric that senses a double-peak setting. The
35 results for that metric are not presented here, as it did not provide any evidence for
36 such a scenario.

37 **Tuning effects in M2**

38 With the higher average f_0 in M2, the harmonics are sparser, so-harmonic-formant
39 interactions should, in theory, become more visible. An interaction of H2 with either
40 F1 or F2 is the most likely scenario. The earlier $N_{H_{\max}}$ patterns (see Charts_S5)
41 already reported that above tone E5, H2 stops being the strongest component. From
42 that point onwards, H2 will generally have passed F2 (at around 1300 Hz), and H1
43 alone holds all power. With 13 of all the 33 voices, we observe no clear peaking of
44 H2 at high SPL in the range up to E5. With the remaining 20 voices, there is spectral
45 cresting associated with H2 in some form (UF2, UF3, UF6, UF7, UF9, UF10, UF11,
46 UF13, UF16), (TF1, TF3, TF4, TF7, TF8, TF10, TF11), (TM1, TM4, TM6, TM7).
47 With again only 10 of these, some coinciding peaking of the maximum VRP contour

48 is seen (UF2, UF6, UF10, UF11, UF16), (TF3, TF8, TF10), (TM6, TM7). Generally,
49 we observe a wide bulging upper contour in M2, where F1 and F2 never resolve as
50 separate interactions. Moreover, the associated increase in the maximum SPL does
51 not necessarily correspond to an increasing prominence for H2. With some VRPs, H2
52 evidently traverses the formant frequency, while the maximum SPL curve just follows
53 a nearly linear trend. With subject UF4 there is bulging of the maximum VRP contour
54 precisely within the designated F1/F2 interaction zone, but H2 remains weaker than
55 H1. Note the many cases in which at high SPL in M2 the fundamental is not the
56 strongest component, where theoretically the formant(s) should affect the SPL.