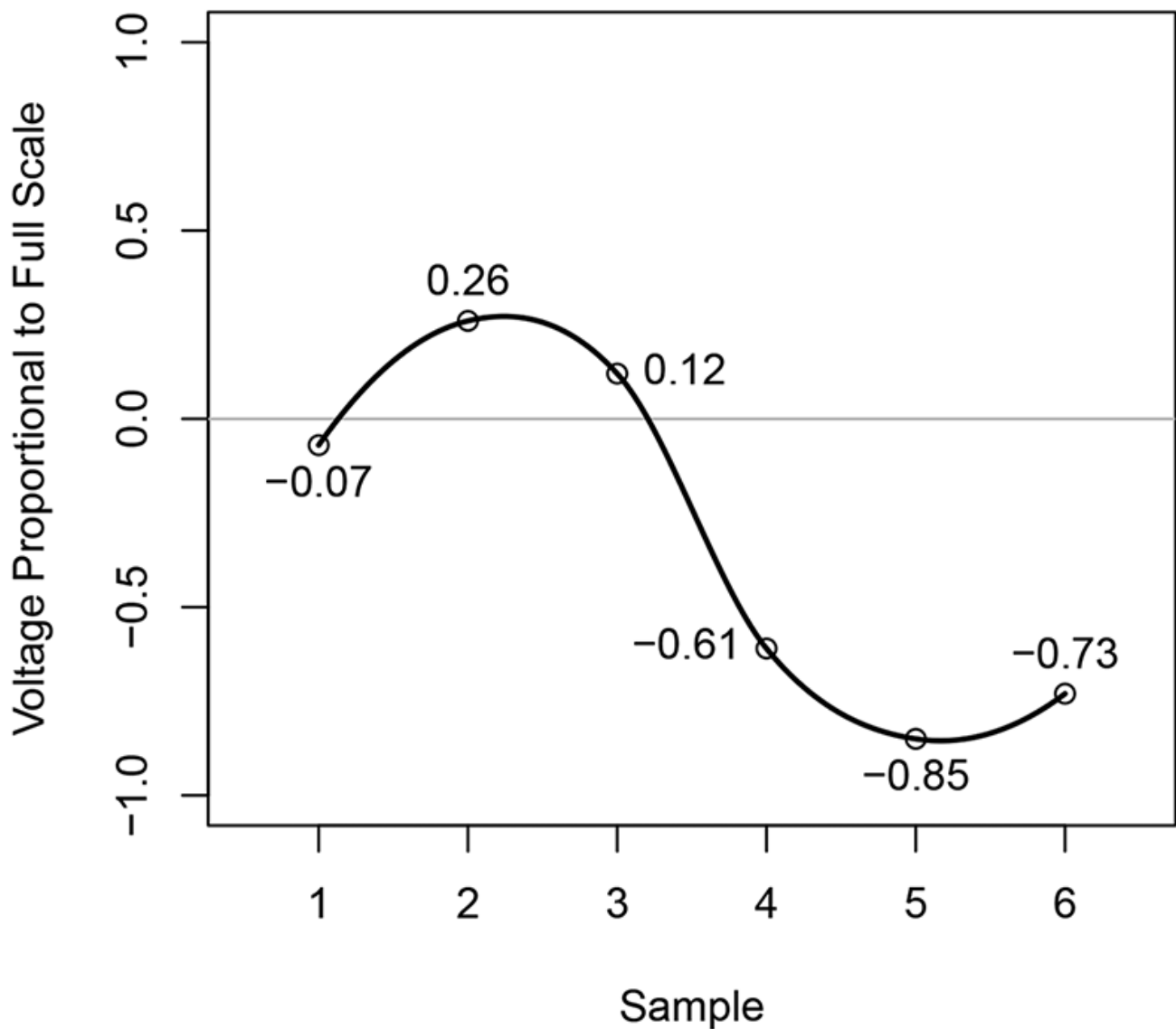


### MTO 30.1 Examples: de Clercq, Some Proposed Enhancements to the Operationalization of Prominence

(Note: audio, video, and other interactive examples are only available online)

<https://mtosmt.org/issues/mto.24.30.1/mto.24.30.1.declercq.html>

Example 1. Hypothetical audio signal fragment with instantaneous voltage values (relative to digital full scale) for six samples



**Example 2.** Table of true RMS, average RMS, and prominence values for different sections in four collaborations by Eminem (“Em”) and Rihanna (“Ri”)

Song	Singer:	Time	True RMS			Average RMS			2022
	Section		Vocal	Mix	Prom.	Vocal	Mix	Prom.	Prom.
Love the Way You Lie	Ri: Ch1	0:00–0:25	.0875	.0965	91%	.0796	.0900	88%	85%
	Em: Vr1	0:26–1:10	.1461	.2114	69%	.1291	.1973	65%	67%
Love the Way You Lie, Pt. 2	Ri: Vr1	0:00–0:44	.1262	.1667	76%	.1185	.1596	74%	92%
	Ri: Ch1	0:45–1:20	.1903	.3593	53%	.1763	.3528	50%	47%
	Em: Vr3	3:06–4:03	.1642	.2761	59%	.1416	.2536	56%	53%
Numb	Ri: Ch1	0:40–1:20	.1087	.2510	43%	.1001	.2282	44%	38%
	Em: Vr3	2:21–2:49	.1997	.3073	65%	.1708	.2827	60%	62%
The Monster	Ri: Ch1	0:00–0:18	.1122	.1191	94%	.0976	.1074	91%	89%
	Em: Vr1	0:19–0:52	.1612	.2527	64%	.1401	.2371	59%	62%

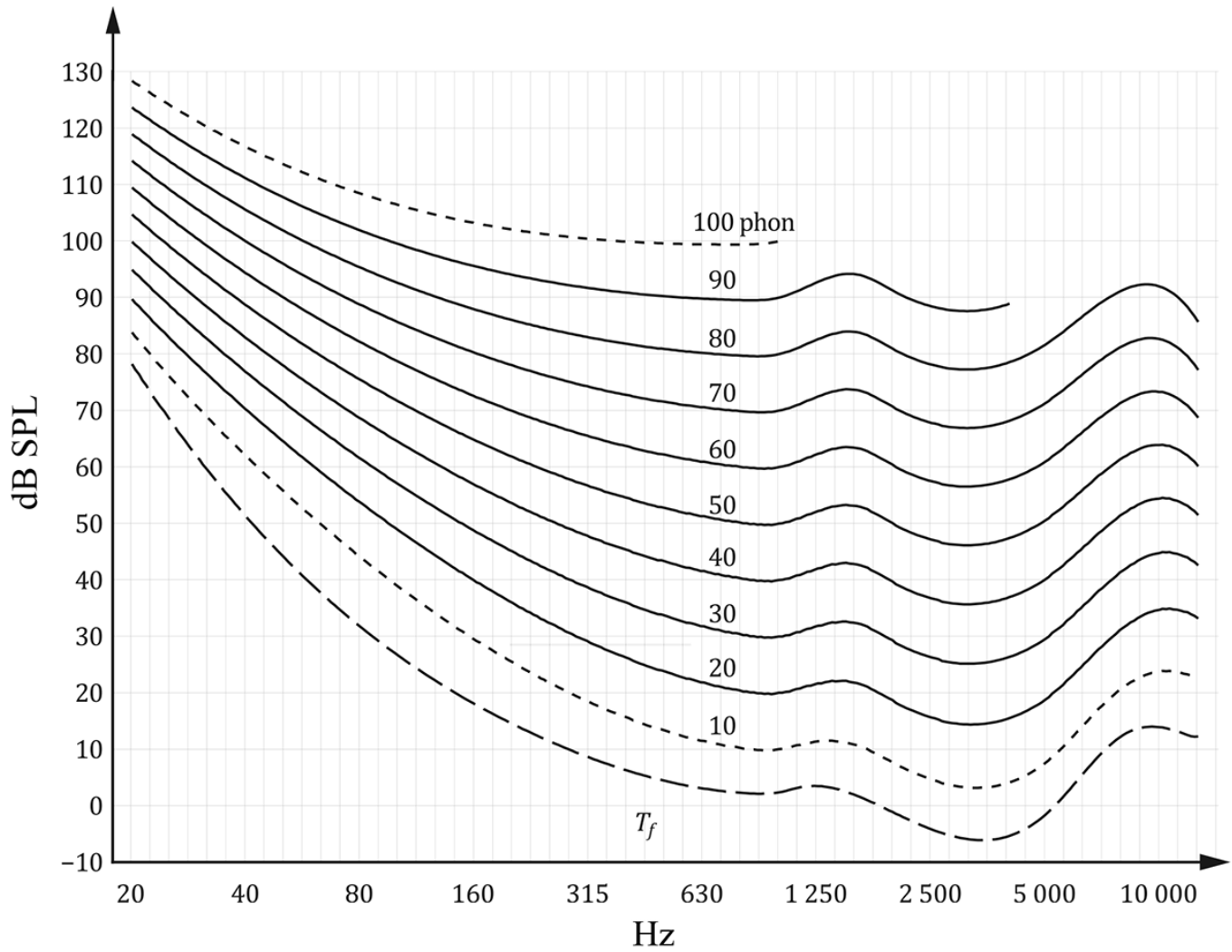
**Example 3.** Table of different hypothetical levels for vocal, instrumental, and mix, with corresponding prominence calculations using Duguay’s method and the improved method

						Prominence		
Vocal		Instrumental		Mix		Vocal/Mix		Vocal/Inst.
dBFS	RMS	dBFS	RMS	dBFS	RMS	%	dB	dB
−0.1	.6990	−20.0	.0707	−0.1	.7026	99.5	0.0	+19.9
−11.0	.1993	−20.0	.0707	−10.5	.2115	94.2	−0.5	+9.0
−14.0	.1411	−20.0	.0707	−13.0	.1578	89.4	−1.0	+6.0
−17.0	.0999	−20.0	.0707	−15.2	.1224	81.6	−1.8	+3.0
−20.0	.0707	−20.0	.0707	−17.0	.1000	70.7	−3.0	0.0
−23.0	.0501	−20.0	.0707	−18.2	.0866	57.8	−4.8	−3.0
−26.0	.0354	−20.0	.0707	−19.0	.0791	44.8	−7.0	−6.0
−29.0	.0251	−20.0	.0707	−19.5	.0750	33.4	−9.5	−9.0
−40.0	.0071	−20.0	.0707	−20.0	.0711	10.0	−20.0	−20.0
−∞	0	−20.0	.0707	−20.0	.0707	0.0	−∞	−∞

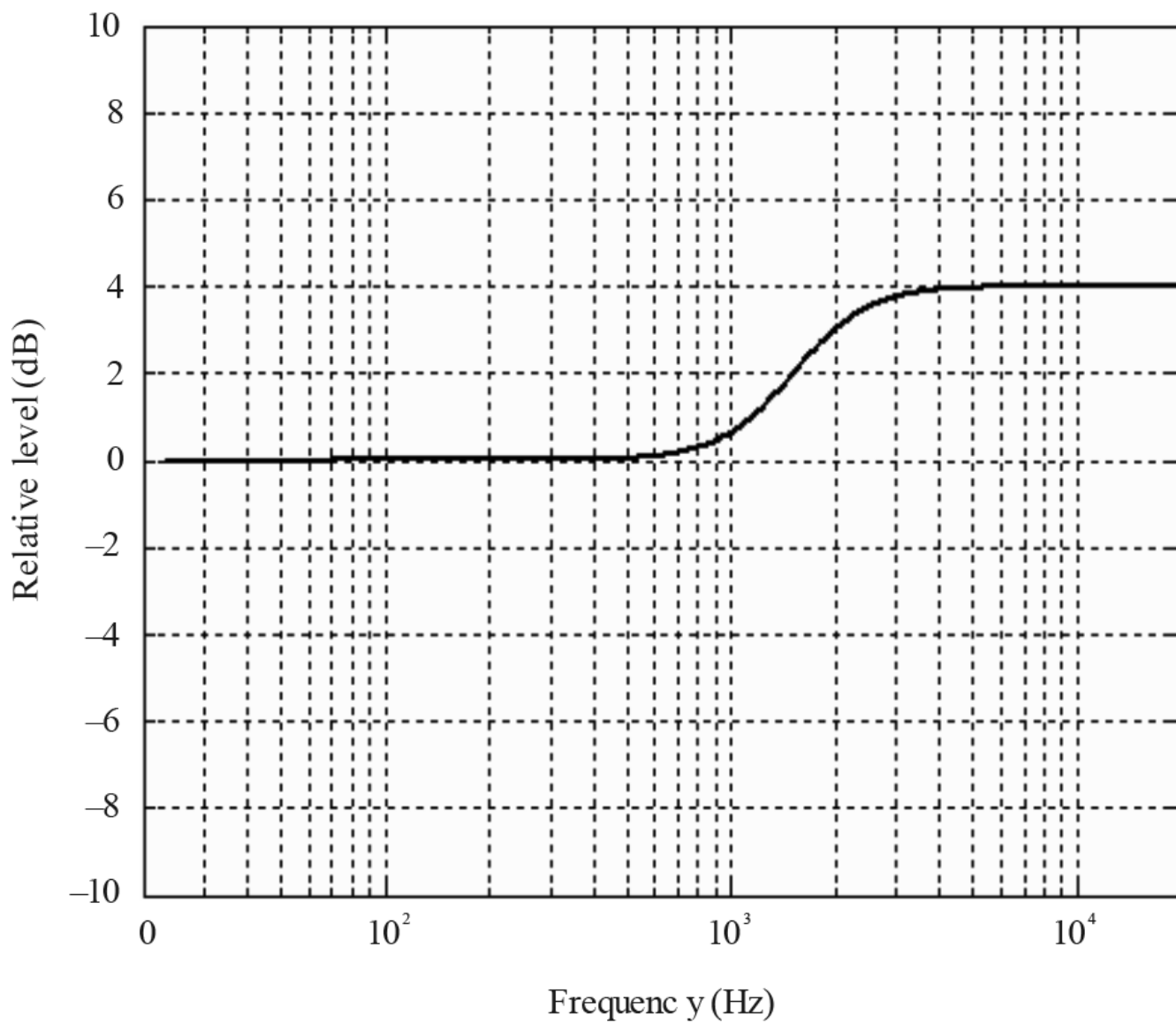
**Example 4.** Recalculation of vocal prominence in terms of decibels (dB) for four collaborations by Eminem (“Em”) and Rihanna (“Ri”), as analyzed by Duguay (in Example 18)

Song	Singer:	Time	RMS			Prominence in dB
	Section		Vocal	Inst.	Mix	
Love the Way You Lie	Ri: Ch1	0:00–0:25	.0875	.0408	.0965	+6.6
	Em: Vr1	0:26–1:10	.1461	.1528	.2114	–0.4
Love the Way You Lie, Pt. 2	Ri: Vr1	0:00–0:44	.1262	.1090	.1667	+1.3
	Ri: Ch1	0:45–1:20	.1903	.3048	.3593	–4.1
	Em: Vr3	3:06–4:03	.1642	.2220	.2761	–2.6
Numb	Ri: Ch1	0:40–1:20	.1087	.2262	.2510	–6.4
	Em: Vr3	2:21–2:49	.1997	.2337	.3073	–1.4
The Monster	Ri: Ch1	0:00–0:18	.1122	.0398	.1191	+9.0
	Em: Vr1	0:19–0:52	.1612	.1946	.2527	–1.6

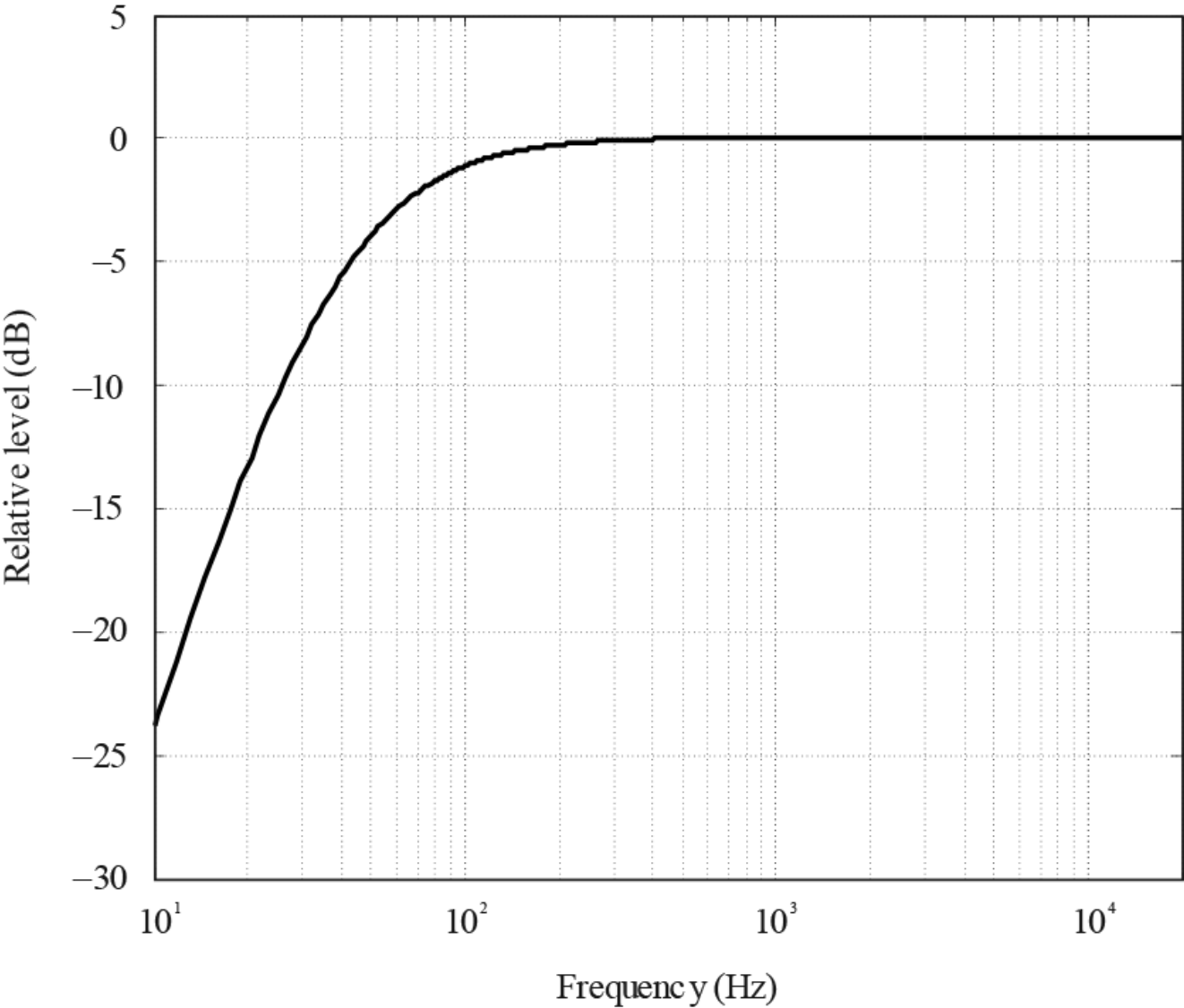
**Example 5.** Equal-loudness-level contours for pure tones under free-field listening conditions (ISO 226:2023). The long-dashed line indicates the threshold of hearing ( $T_f$ ). Contour lines at 10 and 100 phons are drawn with short-dashed lines due to a lack of sufficient experimental data



**Example 6.** Frequency response of high-shelf filter used in the first stage of K-weighting (ITU-R BS.1770-4)



Example 7. Frequency response of high-pass filter used in the second stage of K-weighting (ITU-R BS.1770-4)



**Example 8.** Recalculation of vocal prominence in terms of loudness units (LU) for four collaborations by Eminem (“Em”) and Rihanna (“Ri”), as analyzed by Duguay (in Example 18)

Song	Singer:	Time	LUFS		Prominence in LU
	Section		Vocal	Inst.	
Love the Way You Lie	Ri: Ch1	0:00–0:25	–18.1	–25.0	+6.9
	Em: Vr1	0:26–1:10	–13.0	–14.0	+1.0
Love the Way You Lie, Pt. 2	Ri: Vr1	0:00–0:44	–14.8	–16.2	+1.4
	Ri: Ch1	0:45–1:20	–10.4	–8.8	–1.6
	Em: Vr3	3:06–4:03	–12.2	–11.0	–1.2
Numb	Ri: Ch1	0:40–1:20	–13.2	–12.0	–1.2
	Em: Vr3	2:21–2:49	–10.2	–12.5	+2.3
The Monster	Ri: Ch1	0:00–0:18	–15.4	–24.5	+9.1
	Em: Vr1	0:19–0:52	–12.9	–13.3	+0.4

**Example 9.** Vocal prominence in terms of loudness units (LU) for four collaborations by Eminem (“Em”) and Rihanna (“Ri”), ordered by decreasing prominence

Song	Singer:	Time	LUFS		Prominence in LU	2022 Prominence
	Section		Vocal	Inst.		
The Monster	Ri: Ch1	0:00–0:18	–15.4	–24.5	+9.1	89%
Love the Way You Lie	Ri: Ch1	0:00–0:25	–18.1	–25.0	+6.9	85%
Numb	Em: Vr3	2:21–2:49	–10.2	–12.5	+2.3	62%
Love the Way You Lie, P2	Ri: Vr1	0:00–0:44	–14.8	–16.2	+1.4	92%
Love the Way You Lie	Em: Vr1	0:26–1:10	–13.0	–14.0	+1.0	67%
The Monster	Em: Vr1	0:19–0:52	–12.9	–13.3	+0.4	62%
Love the Way You Lie, P2	Em: Vr3	3:06–4:03	–12.2	–11.0	–1.2	53%
Numb	Ri: Ch1	0:40–1:20	–13.2	–12.0	–1.2	38%
Love the Way You Lie, P2	Ri: Ch1	0:45–1:20	–10.4	–8.8	–1.6	47%