Online Resource 1

Article: Workout intensity and structure affect breathing pattern dynamics during cycling

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Supplemental Table S1. Linear mixed models for the comparison of all six workouts

Model: variable ~ workout × time + sex + fitness + (1 | participant), fitted on 10-s averages with time centered within each workout, so the workout terms are differences in the workout mean from LIT and the time × workout terms are differences in drift slope from LIT. Reference categories: LIT, male, trained. Reserve models use each participant's values scaled 0–100% between the resting minimum and the ramp-test maximum. β, estimate; SE, standard error; CI, confidence interval; p_{BH}, Benjamini–Hochberg-adjusted p within each model. Mean workout duration (min): LIT 57.0, THR 31.0, 5x4 29.8, 15x1 28.9, 30x30 29.4, SEP 34.5. Per-workout levels and slopes (Table 1) are linear combinations of these coefficients.

f_R (breaths·min^{-1}) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	29.31	0.92	[27.51, 31.11]	31.95	<0.001	<0.001
Sex [female]	−0.31	1.13	[−2.53, 1.90]	−0.28	0.782	0.790
Fitness [recreationally trained]	−1.89	1.12	[−4.08, 0.30]	−1.69	0.091	0.098
Workout [THR]	9.66	0.05	[9.57, 9.76]	209.90	<0.001	<0.001
Workout [5x4]	9.30	0.05	[9.21, 9.39]	201.60	<0.001	<0.001
Workout [15x1]	10.06	0.05	[9.97, 10.16]	206.00	<0.001	<0.001
Workout [30x30]	8.97	0.05	[8.88, 9.07]	189.01	<0.001	<0.001
Workout [SEP]	4.83	0.05	[4.74, 4.92]	106.84	<0.001	<0.001
Time (per min, centered)	0.088	0.002	[0.085, 0.091]	56.65	<0.001	<0.001
Workout [THR] × time	0.279	0.004	[0.271, 0.287]	66.05	<0.001	<0.001
Workout [5x4] × time	0.315	0.005	[0.306, 0.324]	68.36	<0.001	<0.001
Workout [15x1] × time	0.387	0.005	[0.377, 0.397]	76.32	<0.001	<0.001
Workout [30x30] × time	0.326	0.005	[0.317, 0.336]	67.43	<0.001	<0.001
Workout [SEP] × time	0.055	0.004	[0.048, 0.062]	14.63	<0.001	<0.001

f_R (% reserve) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	39.01	1.69	[35.70, 42.33]	23.09	<0.001	<0.001
Sex [female]	2.90	2.08	[−1.18, 6.98]	1.39	0.164	0.173
Fitness [recreationally trained]	−1.28	2.06	[−5.32, 2.75]	−0.62	0.533	0.542
Workout [THR]	20.10	0.10	[19.91, 20.29]	205.92	<0.001	<0.001
Workout [5x4]	19.27	0.10	[19.08, 19.46]	196.98	<0.001	<0.001
Workout [15x1]	20.89	0.10	[20.69, 21.10]	201.82	<0.001	<0.001
Workout [30x30]	18.82	0.10	[18.62, 19.02]	187.02	<0.001	<0.001
Workout [SEP]	10.04	0.10	[9.85, 10.22]	104.74	<0.001	<0.001
Time (per min, centered)	0.198	0.003	[0.192, 0.205]	60.41	<0.001	<0.001

Workout [THR] × time	0.569	0.009	[0.551, 0.587]	63.53	<0.001	<0.001
Workout [5x4] × time	0.654	0.010	[0.634, 0.673]	66.82	<0.001	<0.001
Workout [15x1] × time	0.808	0.011	[0.787, 0.829]	75.16	<0.001	<0.001
Workout [30x30] × time	0.693	0.010	[0.673, 0.714]	67.59	<0.001	<0.001
Workout [SEP] × time	0.109	0.008	[0.094, 0.125]	13.74	<0.001	<0.001

V_T (L) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	2.361	0.061	[2.242, 2.480]	38.92	<0.001	<0.001
Sex [female]	−0.786	0.075	[−0.933, −0.640]	−10.51	<0.001	<0.001
Fitness [recreationally trained]	−0.254	0.074	[−0.399, −0.109]	−3.43	<0.001	<0.001
Workout [THR]	0.502	0.003	[0.497, 0.508]	191.48	<0.001	<0.001
Workout [5x4]	0.560	0.003	[0.555, 0.566]	213.07	<0.001	<0.001
Workout [15x1]	0.577	0.003	[0.572, 0.583]	207.42	<0.001	<0.001
Workout [30x30]	0.550	0.003	[0.545, 0.555]	203.31	<0.001	<0.001
Workout [SEP]	0.276	0.003	[0.271, 0.281]	107.00	<0.001	<0.001
Time (per min, centered)	−0.0033	0.0001	[−0.0034, −0.0031]	−36.96	<0.001	<0.001
Workout [THR] × time	−0.0042	0.0002	[−0.0047, −0.0038]	−17.60	<0.001	<0.001
Workout [5x4] × time	−0.0030	0.0003	[−0.0035, −0.0024]	−11.26	<0.001	<0.001
Workout [15x1] × time	−0.0018	0.0003	[−0.0023, −0.0012]	−6.10	<0.001	<0.001
Workout [30x30] × time	−0.0011	0.0003	[−0.0016, −0.0005]	−3.93	<0.001	<0.001
Workout [SEP] × time	−0.0042	0.0002	[−0.0046, −0.0038]	−19.76	<0.001	<0.001

V_T (% reserve) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	58.52	1.36	[55.85, 61.18]	43.02	<0.001	<0.001
Sex [female]	−2.49	1.68	[−5.77, 0.79]	−1.49	0.137	0.145
Fitness [recreationally trained]	−2.13	1.66	[−5.38, 1.11]	−1.29	0.198	0.207
Workout [THR]	19.55	0.10	[19.35, 19.75]	192.07	<0.001	<0.001
Workout [5x4]	22.02	0.10	[21.82, 22.22]	215.90	<0.001	<0.001
Workout [15x1]	22.62	0.11	[22.41, 22.83]	209.57	<0.001	<0.001
Workout [30x30]	21.73	0.10	[21.53, 21.94]	207.15	<0.001	<0.001
Workout [SEP]	10.47	0.10	[10.27, 10.66]	104.79	<0.001	<0.001
Time (per min, centered)	−0.136	0.003	[−0.143, −0.129]	−39.67	<0.001	<0.001
Workout [THR] × time	−0.165	0.009	[−0.183, −0.147]	−17.65	<0.001	<0.001
Workout [5x4] × time	−0.109	0.010	[−0.129, −0.089]	−10.71	<0.001	<0.001
Workout [15x1] × time	−0.067	0.011	[−0.089, −0.045]	−5.99	<0.001	<0.001
Workout [30x30] × time	−0.048	0.011	[−0.069, −0.027]	−4.46	<0.001	<0.001
Workout [SEP] × time	−0.177	0.008	[−0.193, −0.161]	−21.33	<0.001	<0.001

$\dot{V}_E$ (L·min^{-1}) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	70.54	1.95	[66.72, 74.35]	36.20	<0.001	<0.001
Sex [female]	−27.08	2.40	[−31.78, −22.37]	−11.28	<0.001	<0.001
Fitness [recreationally trained]	−14.40	2.37	[−19.05, −9.75]	−6.07	<0.001	<0.001
Workout [THR]	37.27	0.13	[37.02, 37.53]	289.41	<0.001	<0.001
Workout [5x4]	38.84	0.13	[38.59, 39.09]	300.86	<0.001	<0.001
Workout [15x1]	41.05	0.14	[40.78, 41.32]	300.45	<0.001	<0.001
Workout [30x30]	37.36	0.13	[37.10, 37.62]	281.36	<0.001	<0.001
Workout [SEP]	18.56	0.13	[18.32, 18.81]	146.82	<0.001	<0.001
Time (per min, centered)	0.077	0.004	[0.068, 0.085]	17.70	<0.001	<0.001
Workout [THR] × time	0.518	0.012	[0.495, 0.541]	43.83	<0.001	<0.001
Workout [5x4] × time	0.675	0.013	[0.650, 0.700]	52.31	<0.001	<0.001

Workout [15x1] × time	0.909	0.014	[0.881, 0.936]	64.03	<0.001	<0.001
Workout [30x30] × time	0.778	0.014	[0.751, 0.805]	57.46	<0.001	<0.001
Workout [SEP] × time	−0.013	0.010	[−0.033, 0.008]	−1.22	0.222	0.230

$\dot{V}_E$ (% reserve) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	32.75	1.16	[30.48, 35.03]	28.21	<0.001	<0.001
Sex [female]	1.13	1.43	[−1.68, 3.93]	0.79	0.431	0.443
Fitness [recreationally trained]	−3.33	1.41	[−6.10, −0.56]	−2.36	0.019	0.021
Workout [THR]	26.33	0.08	[26.17, 26.50]	313.51	<0.001	<0.001
Workout [5x4]	27.73	0.08	[27.57, 27.90]	329.43	<0.001	<0.001
Workout [15x1]	29.25	0.09	[29.08, 29.43]	328.32	<0.001	<0.001
Workout [30x30]	26.63	0.09	[26.46, 26.80]	307.54	<0.001	<0.001
Workout [SEP]	12.99	0.08	[12.83, 13.15]	157.56	<0.001	<0.001
Time (per min, centered)	0.048	0.003	[0.042, 0.053]	16.83	<0.001	<0.001
Workout [THR] × time	0.365	0.008	[0.350, 0.381]	47.42	<0.001	<0.001
Workout [5x4] × time	0.491	0.008	[0.475, 0.508]	58.33	<0.001	<0.001
Workout [15x1] × time	0.633	0.009	[0.615, 0.651]	68.42	<0.001	<0.001
Workout [30x30] × time	0.548	0.009	[0.531, 0.565]	62.08	<0.001	<0.001
Workout [SEP] × time	−0.010	0.007	[−0.024, 0.003]	−1.50	0.133	0.142

$\dot{V}O_2$ (mL·min^{-1}) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	2699.1	57.6	[2586.3, 2811.9]	46.90	<0.001	<0.001
Sex [female]	−1030.0	70.9	[−1169.0, −891.0]	−14.52	<0.001	<0.001
Fitness [recreationally trained]	−565.3	70.1	[−702.7, −427.9]	−8.06	<0.001	<0.001
Workout [THR]	905.7	3.0	[899.7, 911.6]	297.77	<0.001	<0.001
Workout [5x4]	836.8	3.0	[830.9, 842.8]	274.51	<0.001	<0.001
Workout [15x1]	845.2	3.2	[838.9, 851.5]	261.97	<0.001	<0.001
Workout [30x30]	877.3	3.1	[871.2, 883.5]	279.79	<0.001	<0.001
Workout [SEP]	352.5	3.0	[346.7, 358.4]	118.07	<0.001	<0.001
Time (per min, centered)	0.99	0.10	[0.79, 1.19]	9.63	<0.001	<0.001
Workout [THR] × time	5.05	0.28	[4.50, 5.59]	18.08	<0.001	<0.001
Workout [5x4] × time	5.01	0.30	[4.42, 5.61]	16.45	<0.001	<0.001
Workout [15x1] × time	6.58	0.34	[5.92, 7.23]	19.62	<0.001	<0.001
Workout [30x30] × time	7.40	0.32	[6.77, 8.02]	23.14	<0.001	<0.001
Workout [SEP] × time	−3.10	0.25	[−3.59, −2.62]	−12.53	<0.001	<0.001

$\dot{V}O_2$ (% reserve) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	51.23	0.94	[49.39, 53.08]	54.52	<0.001	<0.001
Sex [female]	−2.15	1.16	[−4.42, 0.12]	−1.86	0.063	0.069
Fitness [recreationally trained]	−4.52	1.14	[−6.76, −2.28]	−3.95	<0.001	<0.001
Workout [THR]	25.71	0.08	[25.54, 25.87]	306.48	<0.001	<0.001
Workout [5x4]	23.70	0.08	[23.53, 23.86]	281.89	<0.001	<0.001
Workout [15x1]	24.05	0.09	[23.88, 24.23]	270.35	<0.001	<0.001
Workout [30x30]	24.88	0.09	[24.71, 25.05]	287.70	<0.001	<0.001
Workout [SEP]	9.73	0.08	[9.57, 9.90]	118.22	<0.001	<0.001
Time (per min, centered)	0.018	0.003	[0.012, 0.023]	6.36	<0.001	<0.001
Workout [THR] × time	0.149	0.008	[0.134, 0.164]	19.36	<0.001	<0.001
Workout [5x4] × time	0.164	0.008	[0.147, 0.180]	19.50	<0.001	<0.001
Workout [15x1] × time	0.194	0.009	[0.176, 0.212]	20.99	<0.001	<0.001
Workout [30x30] × time	0.215	0.009	[0.197, 0.232]	24.35	<0.001	<0.001

Workout [SEP] × time	−0.085	0.007	[−0.099, −0.072]	−12.50	<0.001	<0.001

$\dot{V}CO_2$ (mL·min^{-1}) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	2474.0	54.4	[2367.3, 2580.6]	45.48	<0.001	<0.001
Sex [female]	−1014.8	67.0	[−1146.1, −883.4]	−15.14	<0.001	<0.001
Fitness [recreationally trained]	−537.2	66.3	[−667.0, −407.3]	−8.11	<0.001	<0.001
Workout [THR]	1008.6	3.4	[1001.9, 1015.4]	292.99	<0.001	<0.001
Workout [5x4]	999.4	3.5	[992.7, 1006.2]	289.66	<0.001	<0.001
Workout [15x1]	1016.4	3.7	[1009.2, 1023.6]	278.34	<0.001	<0.001
Workout [30x30]	1020.8	3.5	[1013.9, 1027.8]	287.62	<0.001	<0.001
Workout [SEP]	484.3	3.4	[477.7, 491.0]	143.32	<0.001	<0.001
Time (per min, centered)	0.12	0.12	[−0.11, 0.34]	1.01	0.314	0.324
Workout [THR] × time	−0.05	0.32	[−0.67, 0.57]	−0.15	0.879	0.883
Workout [5x4] × time	−2.45	0.34	[−3.13, −1.78]	−7.11	<0.001	<0.001
Workout [15x1] × time	−1.07	0.38	[−1.81, −0.33]	−2.82	0.005	0.006
Workout [30x30] × time	1.84	0.36	[1.13, 2.55]	5.08	<0.001	<0.001
Workout [SEP] × time	−8.43	0.28	[−8.98, −7.88]	−30.05	<0.001	<0.001

$\dot{V}CO_2$ (% reserve) (df = 103384)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	41.69	1.06	[39.61, 43.76]	39.40	<0.001	<0.001
Sex [female]	−2.69	1.30	[−5.24, −0.13]	−2.06	0.039	0.043
Fitness [recreationally trained]	−2.05	1.29	[−4.58, 0.47]	−1.59	0.111	0.119
Workout [THR]	26.14	0.09	[25.98, 26.31]	307.35	<0.001	<0.001
Workout [5x4]	25.85	0.09	[25.68, 26.01]	303.15	<0.001	<0.001
Workout [15x1]	26.34	0.09	[26.16, 26.52]	291.91	<0.001	<0.001
Workout [30x30]	26.39	0.09	[26.22, 26.57]	300.95	<0.001	<0.001
Workout [SEP]	12.24	0.08	[12.07, 12.40]	146.53	<0.001	<0.001
Time (per min, centered)	−0.007	0.003	[−0.012, −0.001]	−2.34	0.019	0.021
Workout [THR] × time	0.005	0.008	[−0.010, 0.020]	0.67	0.506	0.517
Workout [5x4] × time	−0.049	0.009	[−0.066, −0.032]	−5.73	<0.001	<0.001
Workout [15x1] × time	−0.024	0.009	[−0.042, −0.006]	−2.55	0.011	0.012
Workout [30x30] × time	0.047	0.009	[0.030, 0.065]	5.30	<0.001	<0.001
Workout [SEP] × time	−0.217	0.007	[−0.230, −0.203]	−31.24	<0.001	<0.001

HR (beats·min^{-1}) (df = 75962)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	129.94	1.90	[126.22, 133.65]	68.53	<0.001	<0.001
Sex [female]	4.22	2.32	[−0.32, 8.76]	1.82	0.069	0.074
Fitness [recreationally trained]	−5.74	2.30	[−10.25, −1.24]	−2.50	0.012	0.014
Workout [THR]	34.42	0.14	[34.15, 34.69]	249.42	<0.001	<0.001
Workout [5x4]	31.69	0.14	[31.42, 31.96]	231.25	<0.001	<0.001
Workout [15x1]	34.54	0.15	[34.25, 34.83]	234.60	<0.001	<0.001
Workout [30x30]	33.70	0.15	[33.41, 33.99]	227.77	<0.001	<0.001
Workout [SEP]	14.06	0.14	[13.79, 14.33]	101.42	<0.001	<0.001
Time (per min, centered)	0.165	0.005	[0.156, 0.175]	33.55	<0.001	<0.001
Workout [THR] × time	0.564	0.012	[0.540, 0.588]	46.07	<0.001	<0.001
Workout [5x4] × time	0.398	0.013	[0.372, 0.423]	30.85	<0.001	<0.001
Workout [15x1] × time	0.607	0.015	[0.578, 0.635]	41.71	<0.001	<0.001
Workout [30x30] × time	0.548	0.014	[0.520, 0.576]	38.27	<0.001	<0.001
Workout [SEP] × time	0.047	0.011	[0.026, 0.069]	4.26	<0.001	<0.001

HR (% reserve) (df = 75962)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	54.48	1.01	[52.51, 56.46]	54.16	<0.001	<0.001
Sex [female]	4.12	1.23	[1.71, 6.53]	3.36	<0.001	<0.001
Fitness [recreationally trained]	−4.20	1.22	[−6.59, −1.82]	−3.45	<0.001	<0.001
Workout [THR]	26.22	0.11	[26.01, 26.43]	246.56	<0.001	<0.001
Workout [5x4]	24.21	0.11	[24.00, 24.41]	229.21	<0.001	<0.001
Workout [15x1]	26.41	0.11	[26.19, 26.64]	232.82	<0.001	<0.001
Workout [30x30]	25.57	0.11	[25.34, 25.79]	224.24	<0.001	<0.001
Workout [SEP]	10.51	0.11	[10.30, 10.72]	98.38	<0.001	<0.001
Time (per min, centered)	0.116	0.004	[0.109, 0.124]	30.68	<0.001	<0.001
Workout [THR] × time	0.441	0.009	[0.422, 0.459]	46.74	<0.001	<0.001
Workout [5x4] × time	0.310	0.010	[0.291, 0.330]	31.26	<0.001	<0.001
Workout [15x1] × time	0.478	0.011	[0.456, 0.500]	42.68	<0.001	<0.001
Workout [30x30] × time	0.418	0.011	[0.397, 0.440]	37.90	<0.001	<0.001
Workout [SEP] × time	0.043	0.009	[0.026, 0.060]	5.06	<0.001	<0.001

Cadence (rpm) (df = 100319)

Term	β	SE	95% CI	t	p	p_{BH}
Intercept (LIT, male, trained; mean time)	85.23	1.26	[82.75, 87.70]	67.59	<0.001	<0.001
Sex [female]	−6.48	1.55	[−9.52, −3.43]	−4.17	<0.001	<0.001
Fitness [recreationally trained]	−5.26	1.54	[−8.27, −2.25]	−3.43	<0.001	<0.001
Workout [THR]	−0.01	0.07	[−0.14, 0.13]	−0.09	0.926	0.926
Workout [5x4]	0.41	0.07	[0.27, 0.54]	5.95	<0.001	<0.001
Workout [15x1]	1.63	0.07	[1.49, 1.77]	22.42	<0.001	<0.001
Workout [30x30]	3.05	0.07	[2.91, 3.19]	42.97	<0.001	<0.001
Workout [SEP]	2.60	0.07	[2.47, 2.73]	38.98	<0.001	<0.001
Time (per min, centered)	0.034	0.002	[0.029, 0.039]	14.74	<0.001	<0.001
Workout [THR] × time	−0.065	0.006	[−0.077, −0.053]	−10.53	<0.001	<0.001
Workout [5x4] × time	−0.033	0.007	[−0.046, −0.020]	−4.92	<0.001	<0.001
Workout [15x1] × time	0.018	0.007	[0.003, 0.033]	2.40	0.016	0.018
Workout [30x30] × time	0.047	0.007	[0.033, 0.061]	6.51	<0.001	<0.001
Workout [SEP] × time	0.014	0.005	[0.003, 0.025]	2.59	0.010	0.011

Supplemental Table S2. Perceived exertion (Borg 6–20) and its relation to breathing and metabolic variables

All models are linear mixed models with a random intercept per participant (REML), matching the other models in the paper; Benjamini–Hochberg correction across the headline tests of this table and within each pairwise family. Physiological variables are expressed in % reserve and averaged over the 30 s before each rating (for SEP post-bout ratings, over the bout itself).

a) Session-peak RPE

Workout	n	Median [IQR]	Mean ± SD	Model mean [95% CI]
LIT	83	11 [9, 12]	10.8 ± 2.2	10.85 [10.41, 11.29]
THR	79	16 [15, 18]	16.4 ± 2.2	16.41 [15.96, 16.86]
5x4	84	18 [16.5, 19]	17.7 ± 1.9	17.69 [17.25, 18.13]
15x1	77	18 [17, 19]	17.9 ± 1.7	17.77 [17.32, 18.23]
30x30	81	17 [16, 18]	17.0 ± 1.9	16.90 [16.45, 17.34]
SEP	81	16 [15, 17]	15.8 ± 2.5	15.81 [15.37, 16.26]

Workout effect $F(5, 479) = 234.4$, $p < 0.001$. Pairwise differences (a − b), Borg units:

Contrast	Difference [95% CI]	p	p_{BH}
5x4 − 15x1	−0.08 [−0.55, 0.40]	0.752	0.752
5x4 − 30x30	0.80 [0.33, 1.27]	<0.001	0.001
15x1 − 30x30	0.88 [0.39, 1.36]	<0.001	<0.001
THR − 5x4	−1.28 [−1.75, −0.81]	<0.001	<0.001
THR − 30x30	−0.48 [−0.96, 0.00]	0.048	0.055
SEP − THR	−0.60 [−1.08, −0.12]	0.014	0.017
SEP − 30x30	−1.08 [−1.56, −0.61]	<0.001	<0.001
SEP − LIT	4.96 [4.49, 5.43]	<0.001	<0.001
THR − LIT	5.57 [5.09, 6.04]	<0.001	<0.001

b) RPE drift within each workout and comparison with f_R drift

Model: RPE ~ workout × time + (1 | participant), time centered within workout; in-session ratings only (SEP: post-bout ratings). Accumulated = slope × mean workout duration. The RPE-versus-f_R contrast expresses both on a common scale (% of the Borg range, % reserve) at the same ratings and tests the measure × time interaction with an added random intercept per participant × measure.

Workout	Ratings	RPE slope, Borg·min^{-1} [95% CI]	p	Accumulated	RPE vs f_R, %·min^{-1}	p_{BH} (difference)
LIT	255	0.009 [−0.004, 0.023]	0.173	0.5	0.07 vs 0.12	0.517
THR	210	0.091 [0.065, 0.116]	<0.001	2.8	0.65 vs 0.52	0.517
5x4	391	0.099 [0.083, 0.116]	<0.001	3.0	0.70 vs 0.87	0.225
15x1	200	0.136 [0.111, 0.162]	<0.001	3.9	0.97 vs 0.93	0.725
30x30	218	0.107 [0.082, 0.132]	<0.001	3.1	0.76 vs 0.68	0.535
SEP	540	0.064 [0.053, 0.075]	<0.001	2.2	0.46 vs 0.36	0.228

c) Coupling of RPE to each variable

Each predictor was split into a within-participant deviation and a participant mean (Enders and Tofighi 2007); slopes are Borg units per 10% reserve of the within component. Within-session: RPE and predictor centered within each participant × workout session, in-session ratings only (1437 ratings, 365 sessions, 85 participants), random intercepts for participant and session. All ratings: centered within participant, including warm-up ratings (1963 ratings). R^2: within-session (repeated-measures) R^2 (Bakdash and Marusich 2017). ΔAIC relative to the best model on identical rows.

Predictor	Within-session slope	R^2	ΔAIC	p_{BH}	All-ratings slope	R^2	ΔAIC
f_R	0.87 [0.79, 0.95]	0.30	0.0	<0.001	1.42 [1.35, 1.48]	0.49	397.9
$\dot{V}_E$	1.19 [1.06, 1.31]	0.24	62.6	<0.001	1.42 [1.37, 1.47]	0.58	0.0
HR	0.63 [0.51, 0.74]	0.10	272.6	<0.001	1.03 [0.97, 1.08]	0.41	658.3
V_T	−0.63 [−0.76, −0.49]	0.07	309.2	<0.001	1.24 [1.16, 1.33]	0.32	951.0
$\dot{V}O_2$	0.63 [0.41, 0.85]	0.03	339.0	<0.001	1.54 [1.48, 1.60]	0.57	48.0
$\dot{V}CO_2$	−0.44 [−0.68, −0.20]	0.01	359.6	<0.001	1.40 [1.34, 1.47]	0.50	359.2

All-ratings model with the within components entered together: f_R 0.60 [0.52, 0.68]; HR 0.19 [0.12, 0.26]; $\dot{V}O_2$ 1.60 [1.39, 1.81]; $\dot{V}CO_2$ −0.67 [−0.86, −0.47] Borg per 10% reserve.

d) SEP: rise in RPE across each bout versus the rise in each variable

ΔRPE across bout k = post-bout rating minus the rating 1 min before bout k (warm-up rating for bout 1), paired with the span-matched physiological change (bout mean minus the mean of the 30 s before the pre-bout rating). Model: ΔRPE ~ Δvariable (within) + Δvariable (between) + time + (1 | participant), bouts inside each participant's isotime window (355 bouts, 71 participants; HR 283 bouts).

Variable	Borg per 10% reserve [95% CI]	p	p_{BH}
f_R	0.04 [−0.20, 0.27]	0.758	0.848
HR	−0.06 [−0.67, 0.55]	0.848	0.848
$\dot{V}O_2$	0.20 [−0.30, 0.71]	0.427	0.848
$\dot{V}CO_2$	0.15 [−0.42, 0.72]	0.612	0.848
$\dot{V}_E$	0.15 [−0.32, 0.61]	0.543	0.848
V_T	−0.04 [−0.29, 0.22]	0.781	0.848

Change in the per-bout rise across the session:

Per-bout rise	Mean	Change per min [95% CI]	p
ΔRPE (Borg)	3.59	0.008 [−0.008, 0.023]	0.334
f_R (% reserve)	7.80	−0.041 [−0.117, 0.035]	0.291
HR (% reserve)	10.70	−0.123 [−0.162, −0.084]	<0.001
$\dot{V}CO_2$ (% reserve)	11.03	0.035 [0.003, 0.066]	0.030

Dissociation test (ΔRPE and Δf_R z-scored and stacked, measure × time): −0.009 SD·min^{-1} [−0.022, 0.003], p = 0.137. Sensitivity: f_R change defined as in Table 2 (10–25 s after bout onset versus the 20 s before; bouts 2 onward): 0.11 [−0.08, 0.30], p = 0.238; all bouts, without the isotime restriction: −0.08 [−0.27, 0.10], p = 0.383.

e) Excess f_R

Excess f_R = observed f_R (% reserve) minus the f_R predicted by the participant's own ramp test at the same $\dot{V}CO_2$ (% reserve); the ramp relation was built from 10-s means, loess-smoothed and constrained to be non-decreasing, and excess f_R is undefined outside the ramp $\dot{V}CO_2$ range. Model: RPE ~ $\dot{V}CO_2$ (within + between) + excess f_R (within + between) + (1 | participant); 2436 ratings, 88 participants. Likelihood-ratio test against the $\dot{V}CO_2$-only model (ML): $\chi^2(2) = 574.1$, $p < 0.001$. In-session ratings only: excess f_R 0.82 [0.75, 0.89] (1788 ratings).

Term	Borg per 10% reserve [95% CI]	p
Intercept	10.70 [8.50, 12.89]	<0.001
$\dot{V}CO_2$, within	1.40 [1.35, 1.45]	<0.001
$\dot{V}CO_2$, between	0.54 [0.19, 0.90]	0.003
Excess f_R, within	0.80 [0.74, 0.87]	<0.001
Excess f_R, between	0.03 [−0.32, 0.38]	0.874

Median (mean) excess f_R by workout, % reserve: LIT 5.4 (6.9), THR 14.4 (16.5), 5x4 8.8 (9.4), 15x1 15.6 (18.6), 30x30 14.7 (16.4), SEP 14.1 (14.8).

Supplemental Table S3. Responses to the recovery-to-work and work-to-recovery transitions in the four intermittent protocols

Model: outcome ~ workout × time + sex × time + fitness × time + (1 | participant), fitted on individual intervals inside each participant's isotime window, with time centered within each workout; 5x4, male and trained are the reference categories. Values are per-workout estimates [95% CI]; p tests the 5x4 value against zero and every other protocol against 5x4. Prevalence is the percentage of analyzed intervals in which the variable crossed the inflection threshold; latencies are conditional on detection. Magnitudes are in % reserve (cadence and power in % of the pre-transition value). Full coefficient tables are in the accompanying workbook (hiit_lme_centred.xlsx in Supplemental_Table_S3_interval_transition_models.xlsx).

a) Inflection latency after the recovery-to-work transition (s) and detection prevalence (%)

Variable	5x4	15x1	30x30	SEP	% 5x4	% 15x1	% 30x30	% SEP
f_R	44.7 [42.2, 47.1]	12.7 [10.9, 14.4]	4.7 [3.2, 6.1]	6.0 [3.7, 8.3]	92	73	58	73
V_T	34.7 [32.7, 36.7]	26.4 [24.6, 28.1]	10.5 [8.8, 12.3]	14.2 [12.3, 16.1]	93	44	22	80
$\dot{V}_E$	21.6 [19.6, 23.6]	20.3† [18.6, 22.0]	6.7 [5.1, 8.4]	6.6 [4.7, 8.5]	99	81	53	95
$\dot{V}O_2$	17.6 [16.2, 19.1]	21.4 [20.5, 22.4]	7.3 [6.2, 8.4]	7.7 [6.5, 9.0]	99	94	34	96
$\dot{V}CO_2$	20.8 [19.3, 22.4]	30.6 [29.3, 31.8]	4.6 [3.5, 5.7]	7.3 [5.9, 8.7]	100	66	36	98
HR	10.6 [8.6, 12.6]	25.6 [23.8, 27.4]	11.0† [8.7, 13.3]	4.3 [2.4, 6.2]	81	71	12	78
Cadence	9.5 [8.2, 10.8]	1.9 [1.1, 2.7]	1.6 [0.9, 2.3]	1.3 [0.3, 2.4]	76	76	64	85

b) Response magnitude, 10–25 s after the recovery-to-work transition (% reserve)

Variable	5x4	15x1	30x30	SEP
f_R	2.9 [1.3, 4.5]	4.4* [3.0, 5.9]	5.1 [3.7, 6.6]	6.7 [5.1, 8.2]
V_T	3.3 [1.9, 4.8]	−2.5 [−3.8, −1.2]	−1.9 [−3.2, −0.7]	7.3 [5.9, 8.7]
$\dot{V}_E$	4.5 [3.6, 5.5]	2.0 [1.2, 2.9]	3.0 [2.1, 3.8]	9.0 [8.1, 9.9]
$\dot{V}O_2$	6.8 [6.0, 7.6]	2.1 [1.5, 2.8]	0.0 [−0.6, 0.6]	11.0 [10.3, 11.8]
$\dot{V}CO_2$	4.5 [3.8, 5.2]	−1.3 [−1.9, −0.7]	0.4 [−0.2, 1.0]	9.2 [8.5, 9.9]
HR	3.9 [3.2, 4.6]	−0.3 [−0.9, 0.3]	−1.6 [−2.1, −1.1]	6.8 [6.2, 7.5]
Cadence	3.7* [0.3, 7.1]	4.5† [1.2, 7.8]	3.0† [−0.3, 6.2]	10.7 [7.3, 14.0]

c) Response magnitude, 10–25 s after the work-to-recovery transition (% reserve)

Variable	5x4	15x1	30x30	SEP
f_R	−1.1† [−2.8, 0.5]	−2.0† [−3.5, −0.5]	−3.3 [−4.8, −1.9]	2.9 [1.3, 4.5]
V_T	−4.6 [−6.2, −3.1]	2.2 [0.8, 3.7]	2.2 [0.8, 3.6]	9.7 [8.2, 11.2]
$\dot{V}_E$	−4.7 [−5.6, −3.7]	−0.3 [−1.1, 0.5]	−1.5 [−2.3, −0.6]	8.2 [7.3, 9.1]
$\dot{V}O_2$	−5.4 [−6.2, −4.6]	−2.0 [−2.7, −1.3]	0.6 [0.0, 1.3]	5.9 [5.2, 6.7]
$\dot{V}CO_2$	−5.0 [−5.7, −4.2]	2.3 [1.7, 3.0]	0.2 [−0.4, 0.8]	15.0 [14.3, 15.7]
HR	−1.4 [−2.2, −0.6]	0.8 [0.0, 1.5]	1.9 [1.2, 2.5]	4.5 [3.7, 5.3]
Cadence	−3.9* [−6.6, −1.2]	−3.4† [−6.1, −0.8]	−2.1 [−4.7, 0.6]	−7.4 [−10.0, −4.7]

Unmarked $p < 0.001$; * $0.001 \le p < 0.05$; † $p \ge 0.05$.

d) Paired differences between f_R and each other variable (other − f_R)

Negative latency differences mean the other variable responded earlier than f_R; negative magnitude differences mean it changed less. Simultaneity is the percentage of paired inflections within ±2 s (pooled across protocols).

Variable, outcome	5x4	15x1	30x30	SEP	±2 s, %
V_T, latency, s	−9.9 [−13.2, −6.6]	13.7 [11.1, 16.4]	5.8 [3.4, 8.3]	8.3 [5.2, 11.4]	3.5
V_T, magnitude, % reserve	0.9 [−0.4, 2.2]	−6.2 [−7.0, −5.4]	−6.7 [−7.3, −6.0]	1.0 [−0.1, 2.2]	
$\dot{V}_E$, latency, s	−23.0 [−25.9, −20.1]	7.2 [5.1, 9.2]	1.0 [−0.8, 2.8]	0.3 [−2.3, 3.0]	41.2
$\dot{V}_E$, magnitude, % reserve	1.7 [0.7, 2.8]	−2.1 [−2.7, −1.5]	−2.0 [−2.5, −1.5]	2.5 [1.7, 3.4]	
$\dot{V}O_2$, latency, s	−27.0 [−29.8, −24.1]	8.8 [6.8, 10.8]	2.7 [0.8, 4.6]	1.8 [−0.8, 4.4]	23.5

$\dot{V}O_2$, magnitude, % reserve	4.2 [3.2, 5.3]	−1.8 [−2.5, −1.2]	−4.8 [−5.4, −4.3]	4.6 [3.7, 5.5]	
$\dot{V}CO_2$, latency, s	−23.8 [−26.8, −20.8]	17.8 [15.6, 20.0]	0.0 [−2.0, 2.0]	1.3 [−1.4, 4.0]	28.8
$\dot{V}CO_2$, magnitude, % reserve	1.9 [0.9, 2.9]	−5.2 [−5.8, −4.6]	−4.5 [−5.0, −3.9]	2.8 [1.9, 3.6]	
HR, latency, s	−33.7 [−36.9, −30.5]	13.0 [10.8, 15.3]	8.3 [5.5, 11.0]	−1.3 [−4.2, 1.7]	17.5
HR, magnitude, % reserve	1.5 [0.5, 2.5]	−4.1 [−4.8, −3.5]	−6.3 [−6.9, −5.8]	0.5 [−0.4, 1.4]	
Cadence, latency, s	−35.2 [−38.0, −32.3]	−10.7 [−12.6, −8.8]	−2.9 [−4.6, −1.3]	−4.6 [−7.1, −2.1]	44.5
Cadence, magnitude, % reserve	0.5 [−0.9, 1.9]	0.1 [−0.8, 1.0]	−2.8 [−3.6, −2.1]	4.0 [2.8, 5.2]	

Supplemental Table S4. Sensitivity analyses

a) Initial fast phase and the linearity of drift (knot analysis)

A common knot was grid-searched across workouts and variables (best fit at 10 min); the whole-workout model was refitted with a hinge term giving each workout a pre- and post-knot slope, and separately on post-knot data only. Slopes in % reserve·min^{-1} [95% CI]; accumulated = post-knot slope × mean post-knot duration.

Workout	Pre-knot slope	Post-knot slope (hinge)	Slope, post-knot data only	Accumulated
f_R				
LIT	0.97 [0.91, 1.03]	0.14 [0.13, 0.15]	0.14 [0.13, 0.15]	6.4
THR	1.98 [1.91, 2.05]	0.43 [0.40, 0.45]	0.42 [0.39, 0.45]	8.8
5x4	1.44 [1.38, 1.51]	0.65 [0.62, 0.68]	0.72 [0.68, 0.75]	14.2
15x1	1.51 [1.44, 1.58]	0.82 [0.79, 0.85]	0.84 [0.80, 0.88]	15.8
30x30	1.55 [1.48, 1.62]	0.66 [0.63, 0.69]	0.68 [0.64, 0.71]	13.1
SEP	0.68 [0.62, 0.75]	0.22 [0.20, 0.24]	0.17 [0.15, 0.19]	4.2
V_T				
LIT	0.34 [0.28, 0.40]	−0.17 [−0.18, −0.16]	−0.15 [−0.16, −0.15]	−7.2
THR	0.11 [0.04, 0.17]	−0.41 [−0.44, −0.39]	−0.37 [−0.40, −0.34]	−7.8
5x4	−0.68 [−0.75, −0.61]	−0.10 [−0.13, −0.07]	−0.03 [−0.06, 0.00]	−0.6
15x1	−0.04 [−0.11, 0.04]	−0.26 [−0.30, −0.23]	−0.22 [−0.26, −0.18]	−4.2
30x30	−0.02 [−0.09, 0.06]	−0.24 [−0.27, −0.21]	−0.19 [−0.23, −0.16]	−3.8
SEP	−0.72 [−0.79, −0.65]	−0.22 [−0.24, −0.20]	−0.34 [−0.36, −0.32]	−8.4
$\dot{V}_E$				
LIT	0.78 [0.73, 0.83]	−0.01 [−0.02, 0.00]	0.00 [−0.01, 0.00]	−0.2
THR	1.67 [1.61, 1.73]	0.06 [0.04, 0.08]	0.07 [0.05, 0.10]	1.5
5x4	0.80 [0.74, 0.85]	0.45 [0.43, 0.47]	0.56 [0.53, 0.58]	11.0
15x1	1.27 [1.21, 1.34]	0.46 [0.44, 0.49]	0.50 [0.46, 0.53]	9.3
30x30	1.25 [1.19, 1.31]	0.37 [0.34, 0.39]	0.41 [0.38, 0.44]	7.9
SEP	0.12 [0.07, 0.18]	0.02 [0.00, 0.03]	−0.09 [−0.11, −0.07]	−2.2
$\dot{V}O_2$				
LIT	0.52 [0.47, 0.57]	−0.02 [−0.03, −0.02]	−0.02 [−0.02, −0.01]	−0.7
THR	1.12 [1.06, 1.18]	−0.10 [−0.12, −0.08]	−0.07 [−0.09, −0.05]	−1.4
5x4	0.11 [0.06, 0.17]	0.20 [0.18, 0.23]	0.33 [0.30, 0.35]	6.5
15x1	0.71 [0.65, 0.77]	0.03 [0.00, 0.06]	0.07 [0.04, 0.10]	1.3
30x30	0.82 [0.76, 0.88]	0.03 [0.00, 0.05]	0.07 [0.04, 0.10]	1.4
SEP	−0.10 [−0.15, −0.04]	−0.06 [−0.08, −0.04]	−0.19 [−0.20, −0.17]	−4.6
$\dot{V}CO_2$				
LIT	0.90 [0.85, 0.95]	−0.08 [−0.08, −0.07]	−0.06 [−0.07, −0.06]	−3.0
THR	0.79 [0.74, 0.85]	−0.22 [−0.25, −0.20]	−0.18 [−0.20, −0.15]	−3.7
5x4	−0.38 [−0.44, −0.32]	0.05 [0.03, 0.08]	0.16 [0.13, 0.18]	3.1
15x1	0.25 [0.19, 0.31]	−0.13 [−0.16, −0.10]	−0.08 [−0.11, −0.05]	−1.6
30x30	0.45 [0.39, 0.51]	−0.10 [−0.13, −0.08]	−0.05 [−0.08, −0.02]	−1.0
SEP	−0.64 [−0.70, −0.59]	−0.13 [−0.15, −0.11]	−0.28 [−0.30, −0.26]	−7.0
HR				
LIT	0.70 [0.64, 0.77]	0.07 [0.06, 0.08]	0.07 [0.06, 0.08]	3.3
THR	1.55 [1.48, 1.62]	0.27 [0.24, 0.29]	0.30 [0.27, 0.33]	6.3
5x4	0.73 [0.66, 0.79]	0.32 [0.30, 0.35]	0.39 [0.36, 0.42]	7.7
15x1	1.31 [1.24, 1.38]	0.33 [0.30, 0.37]	0.35 [0.31, 0.39]	6.6
30x30	1.44 [1.36, 1.51]	0.22 [0.18, 0.25]	0.25 [0.22, 0.29]	4.9
SEP	0.34 [0.27, 0.40]	0.12 [0.10, 0.14]	−0.02 [−0.04, 0.01]	−0.4

b) Inflection detection rule

Primary rule (IQR): first 5-breath window whose median exceeds the median of the last 20 s of recovery by more than one pre-transition interquartile range. Alternatives: +1 SD (sd1) and fixed +1 and +2 % reserve (fix1, fix2). The fixed thresholds as a fraction of each variable's own pre-transition IQR show how far below the breath-to-breath noise they sit.

Variable	Protocol	Pre-transition IQR, %	+1% as fraction of	+2% as fraction of

		reserve	IQR	IQR
f_R	5x4	10.2	0.10	0.20
f_R	15x1	8.4	0.12	0.24
f_R	30x30	8.1	0.12	0.25
f_R	SEP	8.1	0.12	0.25
V_T	5x4	10.0	0.10	0.20
V_T	15x1	8.2	0.12	0.24
V_T	30x30	8.5	0.12	0.23
V_T	SEP	9.0	0.11	0.22
$\dot{V}_E$	5x4	5.4	0.18	0.37
$\dot{V}_E$	15x1	5.5	0.18	0.37
$\dot{V}_E$	30x30	5.3	0.19	0.38
$\dot{V}_E$	SEP	4.4	0.22	0.45
$\dot{V}O_2$	5x4	7.7	0.13	0.26
$\dot{V}O_2$	15x1	6.8	0.15	0.29
$\dot{V}O_2$	30x30	6.5	0.15	0.31
$\dot{V}O_2$	SEP	6.6	0.15	0.30
$\dot{V}CO_2$	5x4	5.8	0.17	0.35
$\dot{V}CO_2$	15x1	5.8	0.17	0.35
$\dot{V}CO_2$	30x30	5.3	0.19	0.38
$\dot{V}CO_2$	SEP	4.9	0.20	0.41
HR	5x4	0.8	1.25	2.50
HR	15x1	1.6	0.63	1.26
HR	30x30	0.8	1.24	2.48
HR	SEP	0.9	1.15	2.30
Cadence	5x4	1.5	0.67	1.33
Cadence	15x1	1.5	0.67	1.33
Cadence	30x30	1.5	0.67	1.33
Cadence	SEP	1.8	0.57	1.14

Model latency (s) [95% CI] and prevalence (%) under each rule, f_R, V_T and HR:

Rule	5x4	15x1	30x30	SEP
f_R				
iqr	44.7 [42.2, 47.1] (92%)	12.7 [10.9, 14.4] (73%)	4.7 [3.2, 6.1] (58%)	6.0 [3.7, 8.3] (73%)
sd1	38.6 [36.2, 40.9] (94%)	12.0 [10.4, 13.7] (76%)	4.3 [3.0, 5.7] (65%)	6.0 [3.7, 8.2] (77%)
fix1	8.0 [7.1, 9.0] (100%)	3.1 [2.5, 3.8] (98%)	1.5 [1.0, 2.0] (94%)	1.8 [1.0, 2.7] (95%)
fix2	10.7 [9.6, 11.9] (100%)	4.6 [3.9, 5.3] (97%)	2.1 [1.5, 2.7] (91%)	2.4 [1.4, 3.4] (95%)
V_T				
iqr	34.7 [32.7, 36.7] (93%)	26.4 [24.6, 28.1] (44%)	10.5 [8.8, 12.3] (22%)	14.2 [12.3, 16.1] (80%)
sd1	35.7 [33.6, 37.9] (97%)	26.5 [24.7, 28.4] (49%)	10.4 [8.6, 12.2] (25%)	14.4 [12.4, 16.4] (81%)
fix1	11.4 [9.6, 13.1] (99%)	16.2 [14.7, 17.6] (86%)	6.3 [4.9, 7.7] (62%)	6.2 [4.6, 7.8] (99%)
fix2	13.2 [11.4, 15.0] (99%)	18.7 [17.2, 20.3] (82%)	7.6 [6.2, 9.1] (56%)	7.5 [5.8, 9.1] (99%)
HR				
iqr	10.6 [8.6, 12.6] (81%)	25.6 [23.8, 27.4] (71%)	11.0 [8.7, 13.3] (12%)	4.3 [2.4, 6.2] (78%)
sd1	8.3 [6.5, 10.1] (82%)	22.9 [21.3, 24.6] (73%)	11.4 [9.5, 13.2] (16%)	3.1 [1.4, 4.9] (79%)
fix1	11.0 [9.0, 13.0] (81%)	22.8 [21.0, 24.5] (72%)	12.5 [10.4, 14.7] (15%)	4.2 [2.3, 6.1] (79%)
fix2	13.5 [11.4, 15.7] (80%)	25.9 [23.9, 27.8] (71%)	10.6 [8.0, 13.3] (11%)	5.8 [3.7, 7.9] (78%)

Do the qualitative claims hold under each rule?

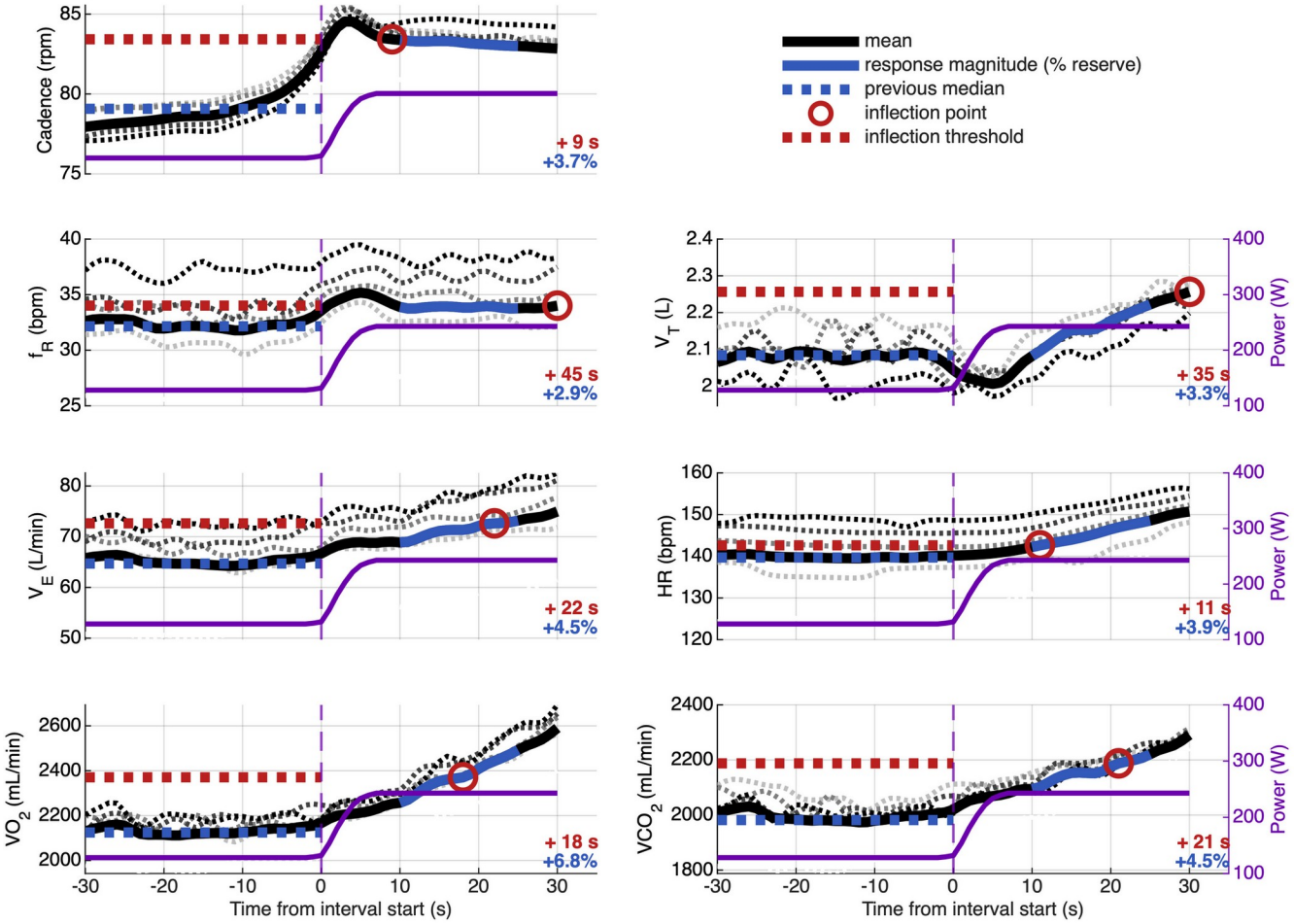
Rule	f_R first ventilatory variable in 15x1, 30x30, SEP	f_R slowest variable in 5x4	V_T latest in 15x1, 30x30, SEP	Cadence detectable
iqr	yes	yes	yes	yes
sd1	no	yes	yes	yes
fix1	yes	no	yes	no
fix2	yes	no	yes	no

c) Detectability over time on task

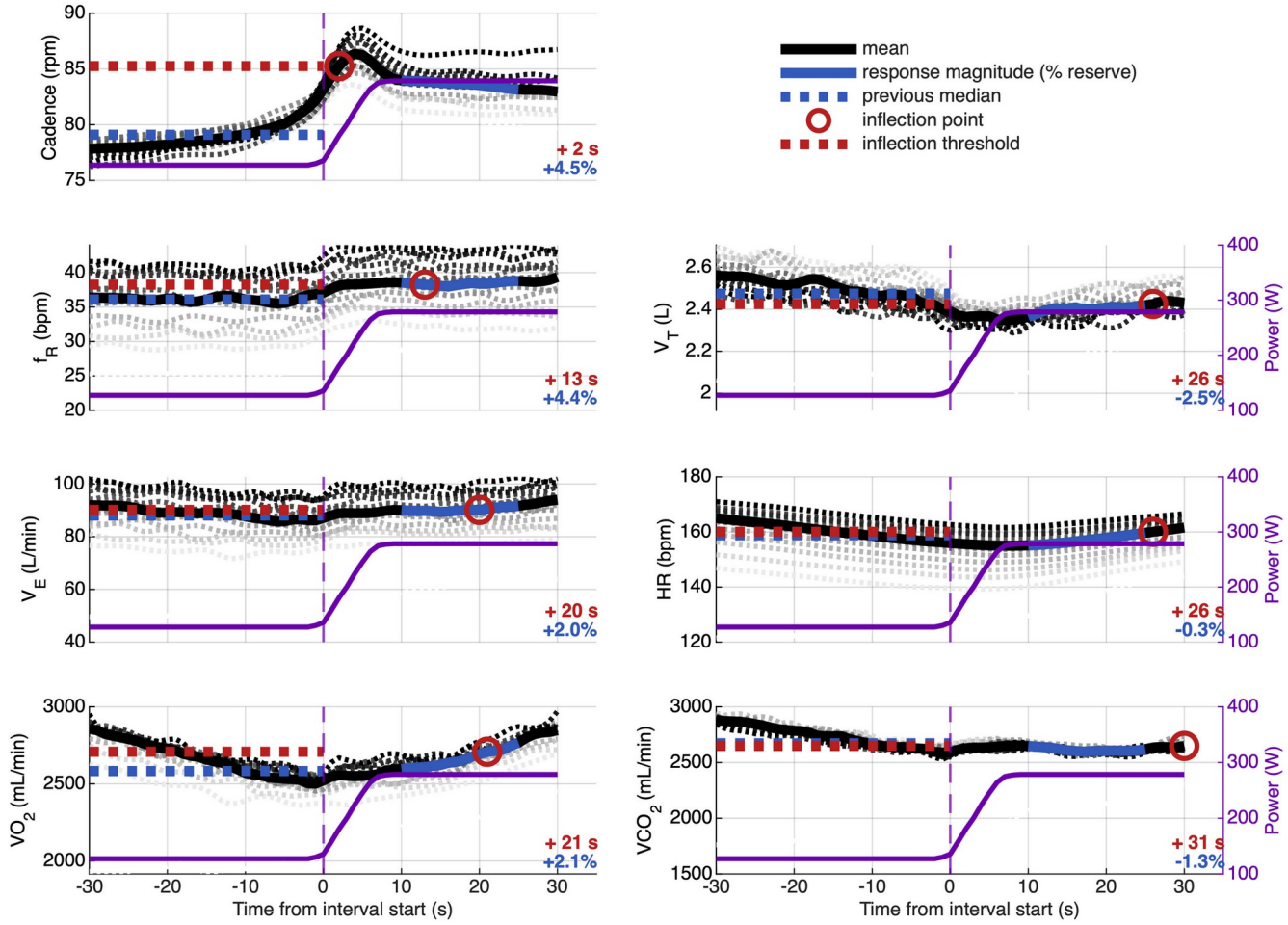
Detection rate (%) in the first, middle and last third of each protocol (all intervals), and the change in the odds of detection per minute from a logistic mixed model (odds ratio per min [95% CI], p_{BH}).

Protocol	First third	Middle third	Last third	OR per min [95% CI]	p_{BH}
f_R					
5x4	93	90	87	0.972 [0.937, 1.008]	0.207
15x1	79	68	71	0.987 [0.971, 1.003]	0.198
30x30	66	56	52	0.969 [0.960, 0.979]	<0.001
SEP	75	71	72	0.983 [0.967, 0.999]	0.093
V_T					
5x4	95	94	90	0.974 [0.933, 1.016]	0.302
15x1	45	41	47	0.997 [0.982, 1.011]	0.751
30x30	20	23	25	1.013 [1.002, 1.025]	0.083
SEP	79	82	80	1.002 [0.985, 1.020]	0.867
$\dot{V}_E$					
5x4	100	99	100	0.961 [0.820, 1.125]	0.751
15x1	84	79	79	0.980 [0.963, 0.999]	0.090
30x30	59	50	49	0.975 [0.965, 0.985]	<0.001
SEP	95	95	96	0.993 [0.962, 1.024]	0.751
$\dot{V}O_2$					
5x4	99	99	100	1.026 [0.905, 1.165]	0.767
15x1	95	93	92	0.970 [0.943, 0.998]	0.090
30x30	35	34	35	0.997 [0.987, 1.007]	0.732
SEP	95	97	98	1.033 [0.993, 1.075]	0.198
$\dot{V}CO_2$					
5x4	100	99	100	1.000 [0.807, 1.238]	0.999
15x1	70	65	63	0.981 [0.967, 0.996]	0.044
30x30	39	36	35	0.985 [0.975, 0.995]	0.018
SEP	98	99	97	0.972 [0.930, 1.016]	0.302
HR					
5x4	81	81	80	0.999 [0.969, 1.029]	0.966
15x1	75	68	68	0.976 [0.959, 0.994]	0.032
30x30	21	8	8	0.912 [0.897, 0.928]	<0.001
SEP	81	76	74	0.988 [0.969, 1.007]	0.302
Cadence					
5x4	75	77	79	1.024 [0.995, 1.054]	0.198
15x1	74	74	82	1.028 [1.009, 1.048]	0.018
30x30	61	63	69	1.028 [1.016, 1.040]	<0.001
SEP	82	89	86	1.022 [1.000, 1.044]	0.103

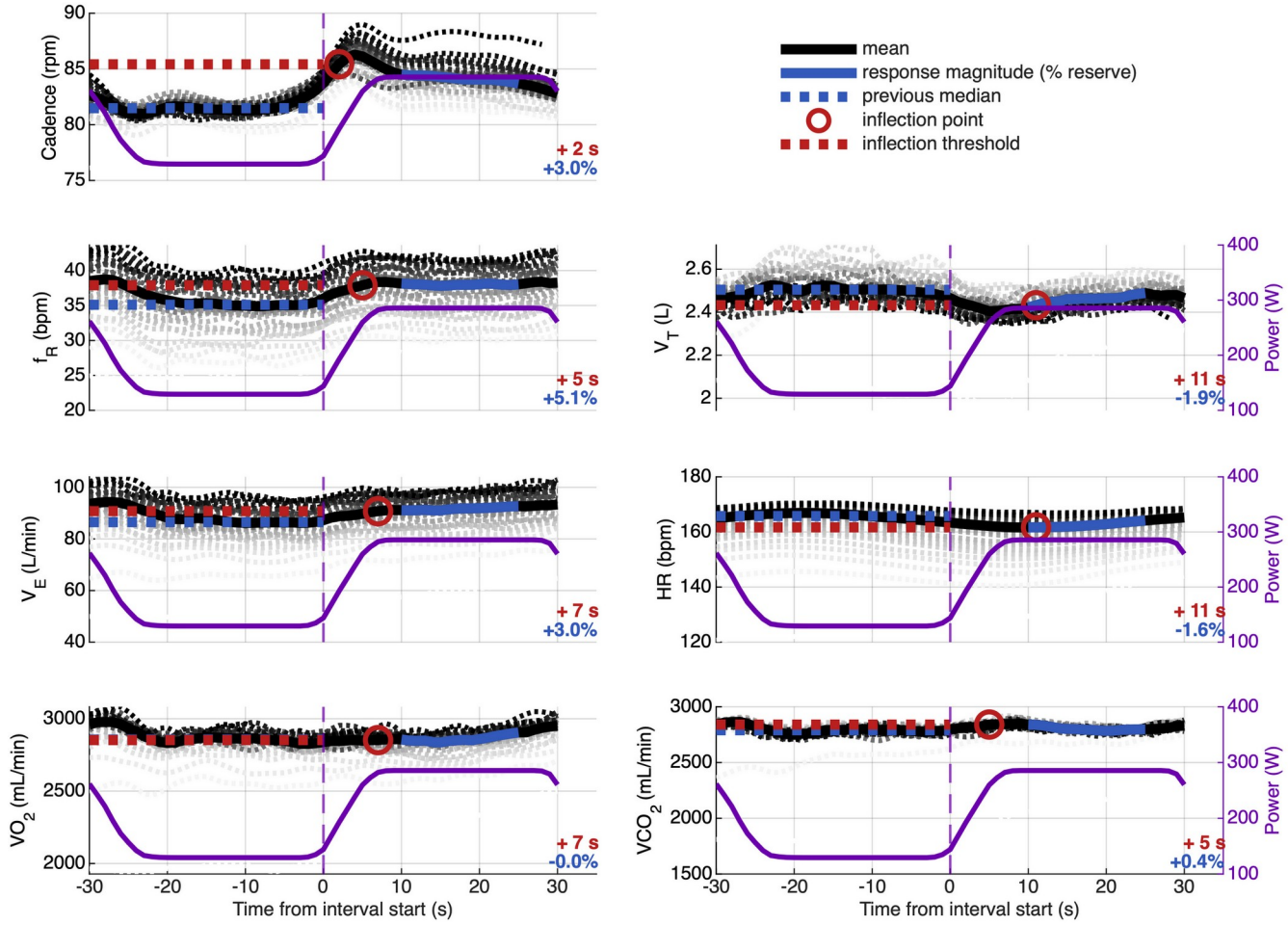
Supplemental Figures



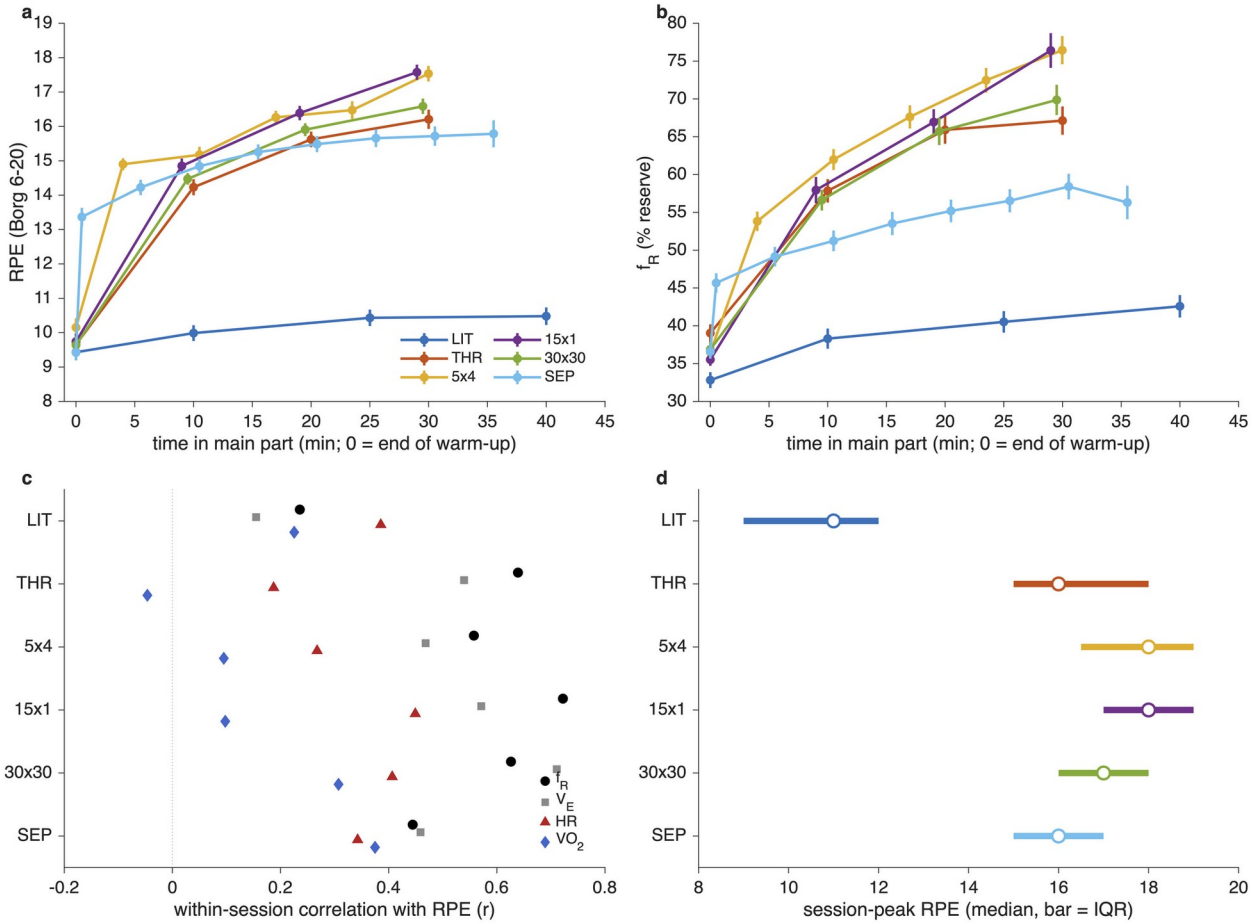
Supplemental Figure S1. Average responses to the recovery-to-work transition for all variables, participants and intervals in the 5x4 workout (n = 85 participants, intervals 1–5). Layout and symbols as in Figure 3: each dotted line is the mean of all participants for one interval (darker lines for later intervals), the solid line is the mean of all intervals, red circles mark the mean inflection point and blue labels the mean response magnitude (% reserve) in the 10–25 s window. Power output is shown on the right axis.



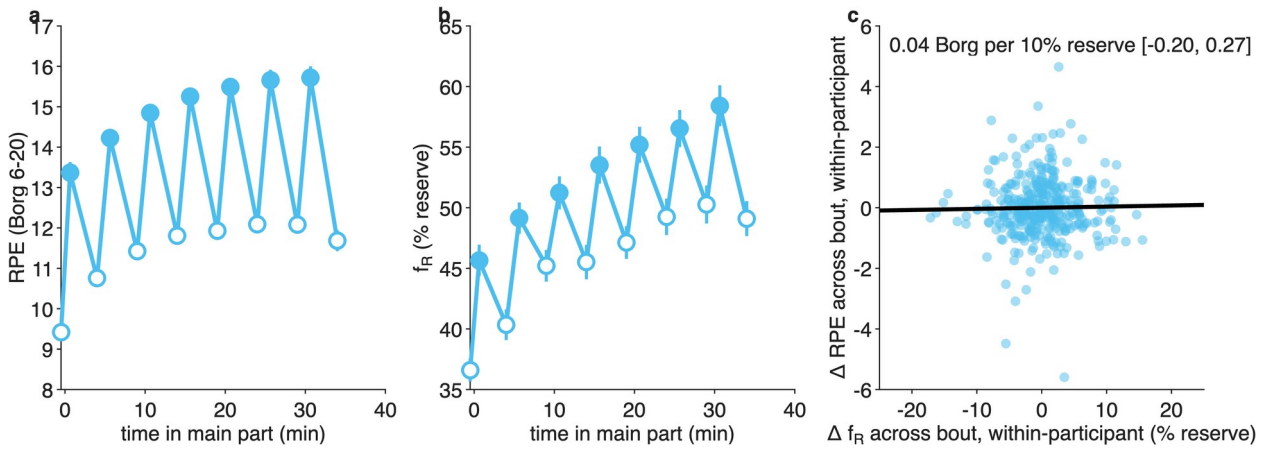
Supplemental Figure S2. As Supplemental Figure S1 for the 15x1 workout (n = 76 participants, intervals 1–15).



Supplemental Figure S3. As Supplemental Figure S1 for the 30x30 workout (n = 80 participants, intervals 1–30).



Supplemental Figure S4. Perceived exertion and respiratory frequency during the six workouts. a: RPE (Borg 6–20) and b: f_R (% reserve) at each rating time (mean ± SE across participants; time 0 = end of warm-up; SEP shows post-bout ratings). c: within-session correlation of RPE with f_R, $\dot{V}_E$, HR and $\dot{V}O_2$ for each workout. d: session-peak RPE (median, bar = interquartile range). n = 67–81 participants per workout with in-session ratings (a–c) and 77–84 with session-peak ratings (d).



Supplemental Figure S5. Perceived exertion and respiratory frequency within the SEP workout. a: RPE and b: f_R (% reserve) directly after each 40-s bout (filled) and 1 min before the next bout (open), mean ± SE. c: within-participant rise in RPE across each bout against the rise in f_R (355 bouts, 71 participants), with the mixed-model slope (0.04 Borg units per 10% reserve [−0.20, 0.27]).

References

Bakdash JZ, Marusich LR (2017) Repeated measures correlation. Front Psychol 8:456. https://doi.org/10.3389/fpsyg.2017.00456

Enders CK, Tofighi D (2007) Centering predictor variables in cross-sectional multilevel models: a new look at an old issue. Psychol Methods 12 (2):121-138. https://doi.org/10.1037/1082-989X.12.2.121