

1 **Audio-visual concert performances synchronize an audience's heart rates.**

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3 Anna M. Czepiel*^{1,2,3}, Lauren K. Fink^{2,4,5}, Mathias Scharinger^{6,7}, Christoph Seibert⁸, Melanie Wald-
4 Fuhrmann^{2,5}, & Sonja A. Kotz^{3,9}

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6 ¹Department of Psychology, University of Toronto Mississauga, Canada

7 ²Department of Music, Max Planck Institute for Empirical Aesthetics, Germany

8 ³Department of Neuropsychology and Psychopharmacology, Faculty of Psychology and Neuroscience,
9 Maastricht University, The Netherlands

10 ⁴Department of Psychology, Neuroscience & Behaviour, McMaster Institute for Music & the Mind, McMaster
11 University

12 ⁵Max Planck-NYU Center for Language, Music, and Emotion, Frankfurt am Main, Germany & New York

13 ⁶Research Group Phonetics, Department of German Linguistics, University of Marburg, Germany

14 ⁷Department of Language and Literature, Max Planck Institute for Empirical Aesthetics, Germany

15 ⁸Institute for Music Informatics and Musicology, University of Music Karlsruhe, Germany

16 ⁹Department of Neuropsychology, Max Planck Institute for Human Cognitive and Brain Sciences, Germany

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19 *Corresponding author

20 Email: a.czepiel@utoronto.ca

21 Anna M. Czepiel

22 Department of Psychology

23 University of Toronto Mississauga

24 3350 Mississauga Road, Mississauga

25 Canada

26 <https://orcid.org/0000-0002-7101-945X>

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28 **Supplementary Materials**

29 **Supplementary Table 1:** Outline of the sections. For Bach’s Prelude and Fugue, the sections were
 30 clear with double bar lines, repeat bar lines, or a change in thematic material, tempo and/or
 31 harmony. For Beethoven’s Sonata, section changes occurred mainly with changing material
 32 and/or double bar line. For Messiaen, section changes occurred with changes of tempo (indicated
 33 by the composer) and/or double bar lines. Supplementary Table 1 presents a brief description of
 34 each section.

Piece	Section	Bar	Metre	Tempo		Description
				M	SD	
Bach	1	1	12/8	88	5	First section of prelude, main theme of ascending semiquaver and triplet pattern followed by descending quavers.
	2	17	12/8	86	4	Repeat of first section of prelude - exact same music as in previous section.
	3	33	12/8	84	4	Second section: development of semiquaver-triplet-quaver theme.
	4	57	12/8	86	3	Repetition of introductory material (i.e., ascending and descending patterns as in bars 1-17) in the second section.
	5	73	12/8	84	4	Repeat the second section.
	6	97	12/8	82	11	Repeat of introductory material in the second section.
	7	113	2/2	88	9	Fugue in four voices. Musical material has a natural development of subject in a clear 2/2 pulse.
Beethoven	1	1	6/8	48	3	First section. Quiet, relatively clear quaver pulse.
	2	9	6/8	54	5	Second section. Bass has semi quaver Alberti bass.
	3	17	6/8	50	7	Dynamics changing loud, forte, reinforced chords.
	4	26	6/8	51	5	Quaver pulse in left hand, nice quiet melody in right hand, which gets louder over time.

	5	30	6/8	58	9	Triplet quaver pulse in left hand, with low pit low pitch right hand, followed by minor, followed by high-pitched demisemiquavers in right hand.
	6	44	6/8	58	5	Repetition of the first section material.
	7	56	6/8	53	6	Repetition of section 3 material.
	8	65	6/8	50	8	Quaver pulse LH, RH semidemi triplets, which speed up to hemidemisemiquavers, start quieter and lower in register, increase in pitch and dynamic.
	9	76	6/8	58	10	Closing section. Quaver pulse mostly with semitone intervals
Messiaen	1	1		86	8	Pres vif (quaver = 160). Pulsating semiquavers, occasional 'blasts' of acciaccatura quaver.
	2	2		60	11	Modéré (quaver = 138). Expressing
	3	3		71	15	Un peu plus vif (quaver = 160). Quaver trills in H, RH semiquaver triplet
		4		71	17	Bien modéré (mais de plus en plus véhément crotchet tied to semiquaver = 58. Repetitive 5 semiquaver, (2+2+1) falling motif, occasionally interrupted by accented slower semiquaver chords
		5		42	10	Très modéré, Tempo rubato (quaver = 104). Accented 4 note chords in an arching kind of manner
		6		70	10	Modéré (quaver = 138). Quaver, preceded by 5 semiquaver, and burst scalic upward patterns, followed by semiquaver pattern
		7		41	20	Similar to section 5.
		8		81	14	Similar to section 1.
		9		37	29	Starts similar to Section 5 and 7, followed by trills in LH, hemidemisemiquaver pulsations in RH.

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37 **Supplementary Table 2.** Results from Wilcoxon signed-rank tests between time-averaged
 38 synchrony across 30 second bins calculated with original (time-locked) data and synchrony
 39 calculated with control (circular-shifted) data.

	Heart			Respiration		
	Wilcoxon signed rank statistic	<i>p</i>	Effect size	Wilcoxon signed rank statistic	<i>p</i>	Effect size
SRC	1	<.001	.863	115	.331	.268
ISC	14	<.001	.786	9	<.001	.811
SRPC	97	.223	.371	186	.317	.140
ISPC	133	.893	.035	120	.391	.163

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41 **Supplementary Table 3.** Wilcoxon significance test, between pieces.

Synchrony measure	Piece	Wilcoxon	<i>p</i>
ISC-HR	Bach	66	0.0501
	Beethoven	12	< .001
	Messiaen	15	< .001
ISC-RR	Bach	48	0.00485
	Beethoven	17	< .001
	Messiaen	41	0.00109
ISPC- heart	Bach	144	0.592
	Beethoven	138	0.733
	Messiaen	76	0.175
ISPC- respiration	Bach	99	0.242
	Beethoven	136	0.951
	Messiaen	144	0.864
SRC-HR	Bach	4	< .001
	Beethoven	3	< .001
	Messiaen	15	< .001
SRC-RR	Bach	86	0.117
	Beethoven	83	0.0564
	Messiaen	166	0.663
SRPC- heart	Bach	144	0.581
	Beethoven	94	0.305
	Messiaen	63.5	0.0424
SRPC- respiration	Bach	123	0.665
	Beethoven	175	0.491
	Messiaen	174	0.509

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43 **Supplementary Table 4.** Wilcoxon significance test, between modality conditions.

Synchrony measure	Condition	Wilcoxon	p
ISC-HR	AO	34	< .001
ISC-HR	AV	21	< .001
ISC-RR	AO	18	< .001
ISC-RR	AV	20	< .001
ISPC-Heart	AO	180.	0.212
ISPC-Heart	AV	49.5	0.013
ISPC-Respiration	AO	139	0.988
ISPC-Respiration	AV	132	0.623
SRC-HR	AO	5	< .001
SRC-HR	AV	1	< .001
SRC-RR	AO	93	0.179
SRC-RR	AV	109	0.252
SRPC-Heart	AO	116	0.52
SRPC-Heart	AV	87	0.21
SRPC-Respiration	AO	143	0.893
SRPC-Respiration	AV	159	0.812

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46 **Supplementary Table 5.** Wilcoxon significance test for phase synchrony for
 47 observations where audience members rated higher than mid-point for ‘urge to move’
 48 (i.e., a rating of 4 and above on a 7-point scale, see Czepiel et al., 2023).

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Synchrony measure	Wilcoxon	p
ISPC- heart	69	0.495
ISPC- respiration	88	0.798
SRPC- heart	46	0.090
SRPC- respiration	94	0.984

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51 **Supplementary Table 6.** Linear mixed models comparing synchrony between
 52 modalities for maximal model (all random effects specified). These maximal models gave
 53 errors (see accompanying code).

<i>Predictors</i>	SRC-HR			ISC-HR			ISC-RR		
	<i>Estimates</i>	<i>CI</i>	<i>p</i>	<i>Estimates</i>	<i>CI</i>	<i>p</i>	<i>Estimates</i>	<i>CI</i>	<i>p</i>
(Intercept)	0.050	0.020 – 0.080	0.001	0.012	0.002 – 0.022	0.020	0.021	0.009 – 0.033	0.001
mod [AV]	0.009	-0.006 – 0.024	0.246	0.010	0.001 – 0.019	0.028	0.002	-0.009 – 0.013	0.698
Random Effects									
σ^2	0.01			0.00			0.01		
τ_{00}	0.00 _{mac:conc}			0.00 _{mac:conc}			0.00 _{mac:conc}		
	0.00 _{piece}			0.00 _{piece}			0.00 _{piece}		
	0.00 _{conc}			0.00 _{conc}			0.00 _{conc}		
τ_{11}	0.00 _{mac1.modAO}			0.00 _{mac1.modAO}			0.00 _{mac1.modAO}		
	0.00 _{mac2.modAV}			0.00 _{mac2.modAV}			0.00 _{mac2.modAV}		
ϱ_{01}									
N	2 _{conc}			2 _{conc}			2 _{conc}		
	3 _{piece}			3 _{piece}			3 _{piece}		
	16 _{mac}			16 _{mac}			16 _{mac}		
Observations	1075			1075			1152		
Marginal R ² / Conditional R ²	0.002 / NA			0.008 / NA			0.000 / NA		

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55 **Supplementary Table 7.** Linear mixed models for modality and time window for
 56 temporal epochs centred around section boundaries for maximal model (all random
 57 effects specified). These maximal models gave errors (see accompanying code).

<i>Predictors</i>	SRC-HR			ISC-HR			ISC-RR		
	<i>Estimates</i>	<i>CI</i>	<i>p</i>	<i>Estimates</i>	<i>CI</i>	<i>p</i>	<i>Estimates</i>	<i>CI</i>	<i>p</i>
(Intercept)	0.07	0.04 – 0.10	<0.001	0.04	0.02 – 0.06	<0.001	0.05	0.03 – 0.07	<0.001
mod [AV]	0.03	-0.00 – 0.06	0.085	0.03	0.01 – 0.05	0.001	-0.03	-0.06 – -0.00	0.037
win-10	-0.01	-0.04 – 0.02	0.357	-0.02	-0.04 – -0.00	0.017	-0.00	-0.03 – 0.03	0.825
win-5	0.02	-0.02 – 0.05	0.305	-0.00	-0.02 – 0.01	0.647	-0.00	-0.03 – 0.02	0.796
win [5]	-0.04	-0.07 – -0.01	0.015	-0.02	-0.04 – 0.00	0.066	-0.04	-0.06 – -0.01	0.009
win [10]	-0.04	-0.07 – -0.01	0.007	-0.03	-0.05 – -0.01	0.013	-0.03	-0.06 – -0.01	0.014
modAV:win-10	-0.00	-0.04 – 0.04	0.917	-0.02	-0.04 – 0.01	0.218	0.03	-0.01 – 0.07	0.156
modAV:win-5	0.01	-0.04 – 0.05	0.795	-0.01	-0.03 – 0.02	0.583	0.01	-0.02 – 0.05	0.495
mod [AV] × win [5]	-0.04	-0.08 – 0.01	0.089	-0.04	-0.07 – -0.02	0.002	0.04	0.00 – 0.08	0.032
mod [AV] × win [10]	-0.05	-0.10 – -0.01	0.015	-0.05	-0.07 – -0.02	0.001	0.04	-0.00 – 0.08	0.052
Random Effects									
σ^2	0.01			0.00			0.01		
τ_{00}	0.00	mac.conc		0.00	mac.conc		0.00	mac.conc	
	0.00	piece		0.00	piece		0.00	piece	
	0.00	conc		0.00	conc		0.00	conc	
τ_{11}	0.00	mac.win-10		0.00	mac.win10		0.00	mac.win-10	
	0.00	mac.win5		0.00	mac.1.modAV		0.00	mac.win-5	
	0.00	mac.1.modAV		0.00	mac1.win0		0.00	mac.win5	
	0.00	mac1.win0		0.00	mac2.win-10		0.00	mac.win10	
	0.00	mac2.win-10		0.00	mac3.win-5		0.00	mac1.win0	
	0.00	mac3.win-5		0.00	mac4.win5		0.00	mac2.win-10	
	0.00	mac4.win5		0.00	mac5.win10		0.00	mac3.win-5	
	0.00	mac5.win10		0.00	mac.modAO		0.00	mac4.win5	
	0.00	mac.modAO		0.00	mac.modAV		0.00	mac5.win10	
	0.00	mac.modAV					0.00	mac.modAO	
							0.00	mac.modAV	
ϱ_{01}									
ϱ_{01}									
N	2	conc		2	conc		2	conc	
	3	piece		3	piece		3	piece	
	16	mac		16	mac		16	mac	
Observations	645			645			690		
Marginal R^2 / Conditional R^2	0.148 / NA			0.133 / NA			0.027 / NA		

59 **Supplementary Table 8.** Linear mixed models of raw heart and respiration rate (HR,
60 RR)', at time window for temporal epochs centred around section boundaries for
61 maximal model (all random effects specified). These maximal models gave errors (see
62 accompanying code).

<i>Predictors</i>	Heart Rate			Respiration Rate		
	<i>Estimates</i>	<i>CI</i>	<i>p</i>	<i>Estimates</i>	<i>CI</i>	<i>p</i>
(Intercept)	61.79	52.18 – 71.40	<0.001	18.80	17.49 – 20.12	<0.001
win-10	0.45	0.06 – 0.85	0.024	0.15	-0.13 – 0.44	0.285
win-5	0.25	-0.14 – 0.64	0.213	-0.24	-0.52 – 0.05	0.104
win [5]	0.37	-0.02 – 0.76	0.064	0.10	-0.18 – 0.39	0.474
win [10]	0.53	0.14 – 0.92	0.008	0.07	-0.21 – 0.35	0.628
Random Effects						
σ^2	2.54			1.45		
τ_{00}	45.31	mac.conc		6.65	mac.conc	
	0.15	piece		0.44	piece	
	42.36	conc		0.00	conc	
τ_{11}	9.47	mac1.win0		0.00	mac.win-10	
	10.05	mac2.win-10		0.00	mac.win-5	
	9.81	mac3.win-5		0.00	mac.win5	
	9.86	mac4.win5		0.00	mac.win10	
	9.40	mac5.win10		0.00	mac1.win0	
	6.79	mac.modAO		0.00	mac2.win-10	
	16.86	mac.modAV		0.00	mac3.win-5	
				0.00	mac4.win5	
				0.00	mac5.win10	
				1.49	mac.modAO	
				0.38	mac.modAV	
Q01						
Q01						
N	2	conc		2	conc	
	3	piece		3	piece	
	16	mac		16	mac	
Observations	645			690		
Marginal R ² / Conditional R ²	0.013 / NA			0.013 / NA		