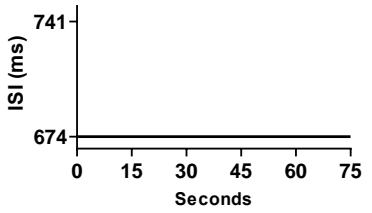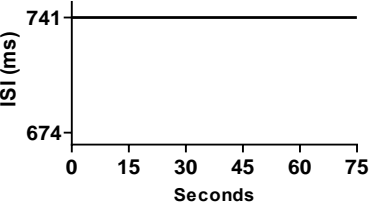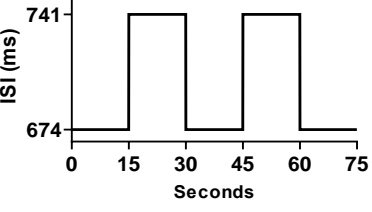# Supplementary Material

Sensorimotor Impairment in Aging and Neurocognitive Disorders: Beat Synchronization and Adaptation to Tempo Changes

Supplementary Table 1. Musician's performance. When recording the videos of the musician tapping synchronously with the auditory sequences, inter-tap interval and coefficient of variation were verified to ensure that the musician tapped with minimal error.

	Inter-tap interval (ms)	Coefficient of variation
	8.90	0.40
	1.01	0.05
	-0.11	0.00
	-0.85	0.02

Supplementary Table 2. Demographic and clinical information of patients who withdrew from the study during the experiment.

	N	Median [first quartile, third quartile] or frequencies (%)	Range
Age	7	88 [84, 94]	81-95
Gender (women)	7	5 (71%)	
Years of education	7	12 [7, 14]	5-14
Musical expertise (out of 28)	7	3 [2, 4]	0-4
Major NCD		6 (100%)	
Minor NCD		0 (0%)	
No NCD		0 (0%)	
MMSE (out of 30)	7	21 [20, 25]	17-29
ADL (out of 6)	7	5.5 [4, 6]	2-6
IADL (out of 4)	7	1 [0, 2]	0-4
GDS (out of 15)	6	4 [3, 7]	2-7
GAI (out of 5)	6	1 [1, 1]	0-4

NCD, neurocognitive disorder; MMSE, Mini-Mental State Examination; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; GDS, Geriatric Depression Scale; GAI, Geriatric Anxiety Inventory

Supplementary Table 3. Model summary and significance tests: consistency

	Wald χ^2	df	p	f^2
Audio	**76.437**	**1**	**<0.001**	**0.036**
Tempo stability	**756.336**	**1**	**<0.001**	**0.209**
Age	1.750	1	0.186	0.011
MMSE	**3.863**	**1**	**0.049**	**0.032**
Audio:Age	**4.283**	**1**	**0.038**	**0.002**
Tempo stability:Age	**8.579**	**1**	**0.003**	**0.010**
Audio:MMSE	0.460	1	0.497	<0.001
Tempo stability:MMSE	1.034	1	0.309	0.004
Sex	0.103	1	0.748	0.002
Years of education	0.531	1	0.466	0.015
Musical expertise	1.095	1	0.295	0.027

Significant results are highlighted in **bold**.
MMSE, Mini-Mental State Examination

Supplementary Table 4. Model summary and significance tests: asynchrony

	Wald χ^2	df	p	f^2
Audio	**248.075**	**1**	**<0.001**	**1.381**
Sex	0.328	1	0.567	1.032
Years of education	1.198	1	0.274	1.035
Musical expertise	2.455	1	0.117	1.045

Significant results are highlighted in **bold**.

Supplementary Table 5. Model summary and significance tests: consistency (complete model)

	Wald χ²	df	p	f²
Sex	0.121	1	0.728	0.002
Years of education	0.524	1	0.469	0.014
Musical expertise	1.127	1	0.289	0.026
Audio	**80.249**	**1**	**0.000**	**0.024**
Tempo	0.011	1	0.916	<0.001
Tempo stability	**810.620**	**1**	**0.000**	**0.213**
Segment	**11.364**	**1**	**0.010**	**0.004**
Age	1.717	1	0.190	0.011
MMSE	**3.843**	**1**	**0.050**	**0.033**
Audio:Tempo	1.024	1	0.311	<0.001
Audio:Tempo stability	**5.473**	**1**	**0.019**	**<0.001**
Audio:Segment	**18.214**	**1**	**0.000**	**0.007**
Tempo:Tempo stability	0.066	1	0.798	<0.001
Tempo:Segment	5.803	1	0.122	0.002
Tempo stability:Segment	**11.012**	**1**	**0.012**	**0.004**
Audio:Age	**4.500**	**1**	**0.034**	**0.002**
Tempo:Age	0.330	1	0.565	<0.001
Tempo stability:Age	**9.880**	**1**	**0.002**	**<0.001**
Audio:MMSE	0.579	1	0.447	<0.001
Tempo:MMSE	0.035	1	0.851	<0.001
Tempo stability:MMSE	0.815	1	0.367	<0.001
Audio:Tempo:Tempo stability	3.376	1	0.066	0.001
Audio:Tempo:Segment	1.966	1	0.579	<0.001
Audio:Tempo stability:Segment	5.127	1	0.163	0.002
Tempo:Tempo stability:Segment	3.463	1	0.326	<0.001
Audio:Tempo:Age	1.957	1	0.162	<0.001
Audio:Tempo stability:Age	**5.577**	**1**	**0.018**	**0.001**
Tempo:Tempo stability:Age	0.076	1	0.783	<0.001
Audio:Tempo:MMSE	**7.301**	**1**	**0.007**	**0.003**
Audio:Tempo stability:MMSE	0.070	1	0.791	<0.001
Tempo:Tempo stability:MMSE	0.622	1	0.430	<0.001
Audio:Tempo:Tempo stability:Segment	1.948	1	0.583	0.001
Audio:Tempo:Tempo stability:Age	1.524	1	0.217	0.002
Audio:Tempo:Tempo stability:MMSE	2.274	1	0.132	<0.001

The complete model was run to control for any possible confounding
effects. The fact that the effects of interest were significant in both
models suggests that they are not explained by factors such as tempo or
segment that are not included in the final model.
Significant results are highlighted in **bold**.
MMSE, Mini-Mental State Examination

Supplementary Table 6. Model summary and significance tests: asynchrony (complete model)

	Wald χ^2	df	p	f^2
Sex	1.209	1	0.271	0.003
Years of education	0.000	1	0.998	<0.001
Musical expertise	1.206	1	0.272	0.006
Audio	**942.673**	**1**	**0.000**	**0.228**
Tempo	**405.880**	**1**	**0.000**	**0.150**
Tempo stability	**14.052**	**1**	**0.000**	**0.023**
Segment	**257.757**	**1**	**0.000**	**0.063**
Age	0.519	1	0.471	0.001
MMSE	3.414	1	0.065	0.010
Audio:Tempo	**164.965**	**1**	**0.000**	**0.080**
Audio:Tempo stability	0.001	1	0.981	0.024
Audio:Segment	**53.955**	**1**	**0.000**	**0.041**
Tempo:Tempo stability	**627.589**	**1**	**0.000**	**0.355**
Tempo:Segment	**502.312**	**1**	**0.000**	**0.343**
Tempo stability:Segment	**138.652**	**1**	**0.000**	**0.115**
Audio:Age	3.280	1	0.070	<0.001
Tempo:Age	**5.261**	**1**	**0.022**	**<0.001**
Tempo stability:Age	**4.838**	**1**	**0.028**	**0.001**
Audio:MMSE	**6.248**	**1**	**0.012**	**0.002**
Tempo:MMSE	0.532	1	0.466	<0.001
Tempo stability:MMSE	3.512	1	0.061	<0.001
Audio:Tempo:Tempo stability	**47.736**	**1**	**0.000**	**0.052**
Audio:Tempo:Segment	**84.868**	**1**	**0.000**	**0.093**
Audio:Tempo stability:Segment	**124.403**	**1**	**0.000**	**0.112**
Tempo:Tempo stability:Segment	**502.271**	**1**	**0.000**	**0.624**
Audio:Tempo:Age	**4.400**	**1**	**0.036**	**0.001**
Audio:Tempo stability:Age	2.264	1	0.132	0.001
Tempo:Tempo stability:Age	2.816	1	0.093	<0.001
Audio:Tempo:MMSE	1.138	1	0.286	<0.001
Audio:Tempo stability:MMSE	1.363	1	0.243	<0.001
Tempo:Tempo stability:MMSE	0.183	1	0.668	<0.001
Audio:Tempo:Tempo stability:Segment	**154.493**	**1**	**0.000**	**0.015**
Audio:Tempo:Tempo stability:Age	2.864	1	0.091	0.001
Audio:Tempo:Tempo stability:MMSE	2.276	1	0.131	<0.001

As for consistency, the complete model was run to control for any possible
confounding effects. The fact that the effects of interest were significant in both
models suggests that they are not explained by confounding factors that are not
included in the final model.
Significant results are highlighted in **bold**.
MMSE, Mini-Mental State Examination

Supplementary Figure 1. Effects of segment and stability on consistency
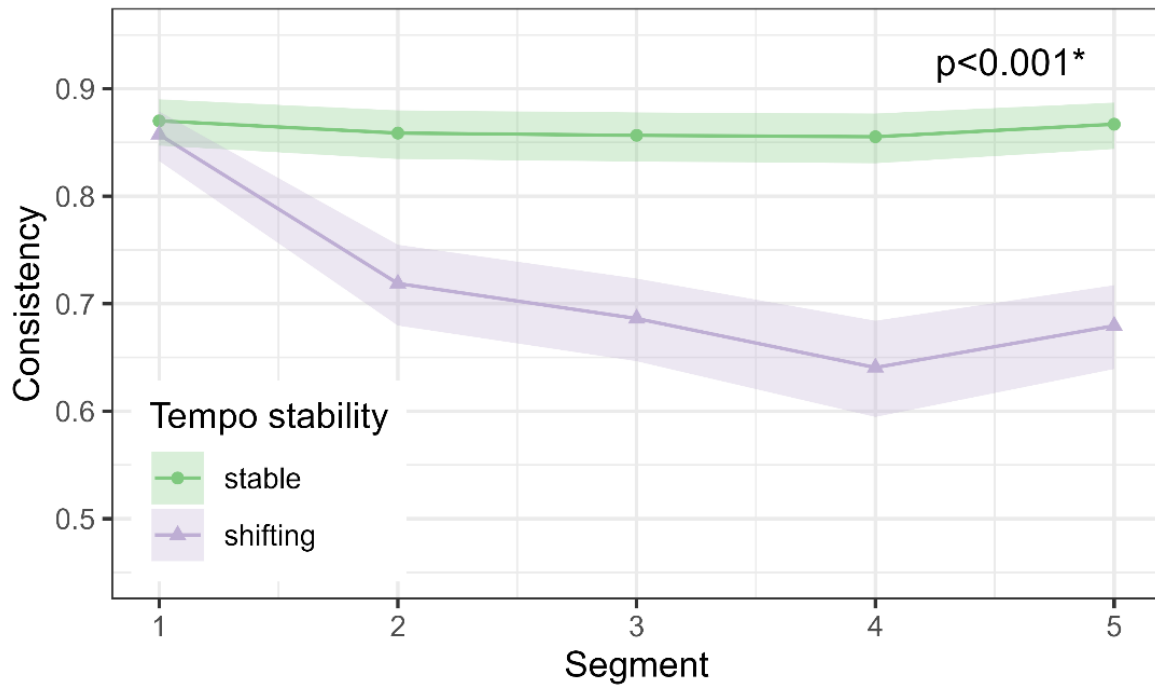
Consistency was calculated for the different segments in the presence and absence of tempo changes, highlighting the drop in performance as a result of changes in tempo.

Supplementary Figure 2. Distribution of MMSE
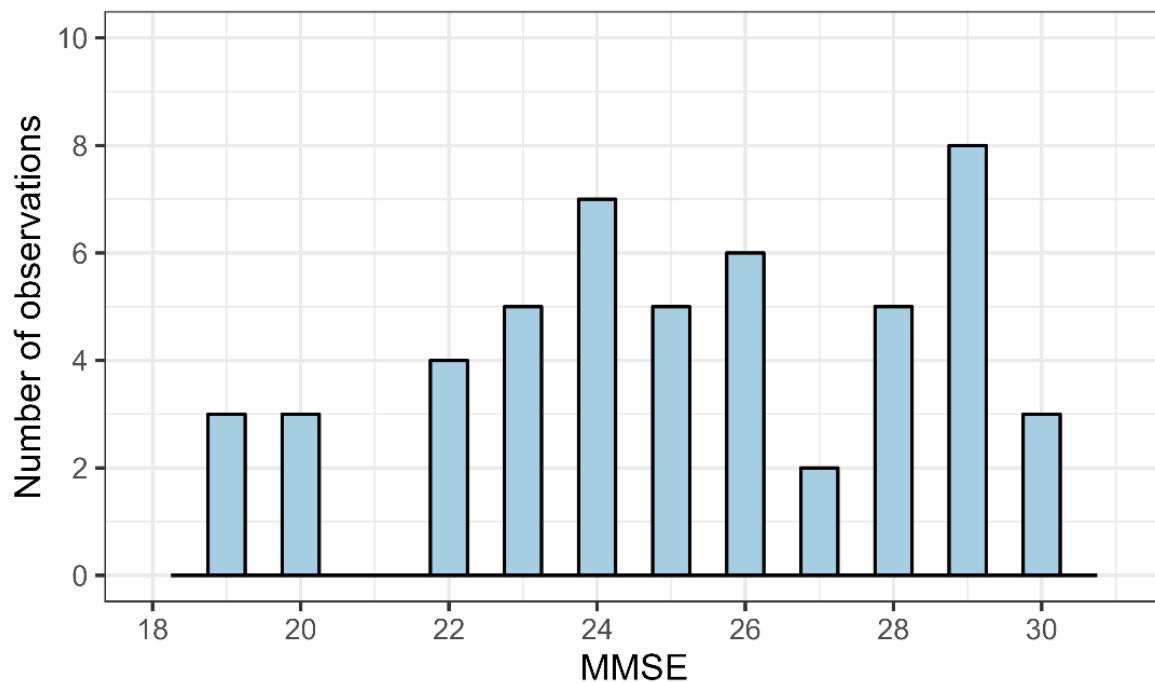
MMSE, Mini-Mental State Examination

Supplementary Figure 3. Effects of age and tempo stability and consistency