Supporting Information

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SI Analysis of Covariance

Behavioral Tests. Covarying for sex, we found Synchronizers had better phonological awareness [$F_{(2,25)} = 9.715$, $P = 0.001$] and had a trending advantage for auditory short-term memory [$F_{(2,32)} = 2.78$ $P = 0.077$]. Synchronizers also were faster at naming objects and colors [$F_{(1,32)} = 5.379$, $P = 0.027$] and performed better at both melody and rhythm discrimination tasks [$F_{(1,32)} = 5.423$, $P = 0.039$].

Speech Syllable Envelope Encoding. Synchronizers had more precise neural encoding of the speech syllable envelope for all speech stimuli [repeated measures ANOVA, with sex as a covariate: $F_{(1,32)} = 4.371$, $P = 0.045$]. There was no stimulus × group interaction [$F_{(1,31)} = 0.526$, $P = 0.668$], indicating that Synchronizers had better neural encoding of the speech envelope regardless of stimulus. Within the Synchronizers, we found that those who drummed more consistently had more precise encoding of the syllable envelopes in quiet [$r_{(19)} = 0.444$, $P = 0.044$].

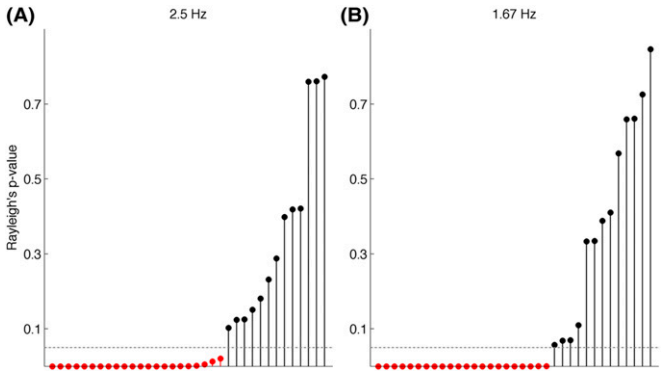

Fig. S1. Stem plots of individuals' Rayleigh's *P* values for the (*A*) 2.5-Hz and (*B*) 1.67-Hz drumming rates. The dashed gray lines indicate the threshold ($P = 0.05$) used for dichotomizing the synchronization groups. Synchronizers are plotted in red, and Non-synchronizers are plotted in black.

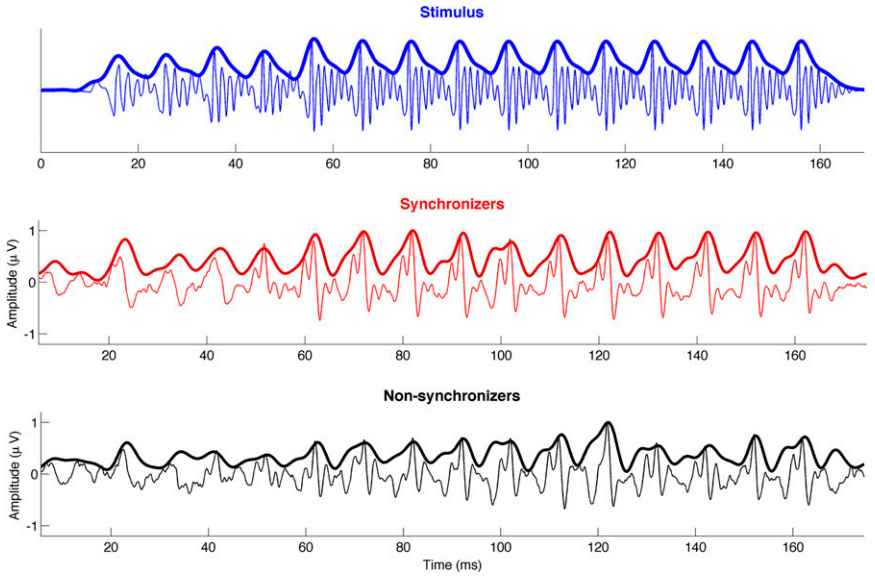

Fig. S2. The [da] stimulus with the envelope component (bold trace) overlaid along with groups' brainstem responses to [da] and respective overlaid filtered envelopes for both Synchronizers and Non-synchronizers.

Table S1. Participant demographics

Group	No. in group	Age, mo	Click wave V latency, s	Verbal IQ, scaled score	Nonverbal IQ, scaled score	Vocabulary, scaled score
Non-synchronizers	13; 3 females	50.23 (4.82)	5.68 (0.16)	13.07 (0.87)	12.38 (0.84)	106.85 (4.76)
Synchronizers	22; 15 females	53.73 (6.46)	5.68 (0.24)	13.32 (0.54)	12.95 (1.01)	110.42 (1.86)

Data are reported as mean (± SEM). Groups did not differ in age, auditory brain stem response click wave V latency, verbal intelligence quotient (IQ), nonverbal IQ, or receptive vocabulary. There was a higher proportion of males in the Non-synchronizer group; covarying for sex did not change the results, so statistics are reported without this covariate.

Table S2. Behavioral data for Synchronizers and Non-synchronizers

Group	Phonological awareness, raw score	Auditory short-term memory, raw score	Rapid naming: objects, s	Rapid naming: colors, s	Melodic discrimination, d'	Rhythmic discrimination, d'
Non-synchronizers	14.60 (5.44)	20.38 (10.33)	25.32 (7.54)	28.16 (17.09)	0.68 (0.56)	0.26 (1.08)
Synchronizers	20.50 (3.15)	27.18 (7.77)	20.20 (5.71)	20.51 (11.76)	1.08 (0.81)	1.06 (0.85)

Data are reported as mean (± SEM). Groups differed on each measure, with Synchronizers performing significantly better on each test.

Table S3. Results of hierarchical the three-step multilinear regression

Predictor	ΔR^2	β
Step 1	0.288	
Sex		−0.295
Age		−0.077
Verbal IQ		0.474
Nonverbal IQ		0.025
Vocabulary		−0.015
Step 2	0.216	
Sex		−0.200
Age		−0.135
Verbal IQ		0.615
Nonverbal IQ		0.146~
Vocabulary		−0.075
Rapid naming		0.544*
Auditory short-term memory		0.160
Step 3	0.301**	
Sex		−0.181
Age		−0.112
Verbal IQ		0.322
Nonverbal IQ		0.249
Vocabulary		0.237
Rapid Naming		0.649**
Auditory short-term memory		0.505~
Drumming consistency		0.383~
Rhythmic perception		−0.708*
Total R^2	0.805*	

Within the Synchronizers, language metrics alone do not significantly explain variability in neural envelope encoding precision, but the addition of drumming consistency and rhythmic perception metrics significantly improve the model, explaining 30.1% ($P = 0.013$) of neural envelope encoding variance over and above sex, age, IQ, and language metrics. Combined with demographic measures, this model predicts 80.5% of variance in neural envelope encoding precision ($P = 0.009$). ~$P < 0.075$, *$P < 0.05$, **$P < 0.01$.