SUPPLEMENTARY TABLES AND FIGURES

Term	Definition
Impulse	A recorded impact sound that was extracted from a recording of a rubber ball bouncing naturally on a wooden surface. Each impact sound produced one impulse.
Bounce sequence	A sequence of ***impulses*** that were placed temporally according to a set of parameters (i.e., Tau, number of impulses, and IIIo).
Starting Sequence (SS)	An optimized ***bounce sequence*** that was used for the Delay-add synthesis procedure to create rolling events. There were two: ***SS_200*** and ***SS_400***.
SS_200	An optimized ***bounce sequence*** that was used to create a continuum of sounds from bouncing to rolling. It contained 8 ***impulses***, a Tau of 5 and an IIIo of 200 ms.
SS_400	An optimized ***bounce sequence*** that was used to create a continuum of sounds from bouncing to rolling. It contained 8 ***impulses***, a Tau of 5 and an IIIo of 400 ms.
Impulse sequence	A sequence of ***impulses*** resulting from the Delay-add synthesis procedure, which added a ***bounce sequence*** to itself with jittered delays.
C_200	A continuum of 36 ***impulse sequences*** that were synthesized from ***SS_200*** using the Delay-add synthesis procedure.
C_400	A continuum of 36 ***impulse sequences*** that were synthesized from ***SS_400*** using the Delay-add synthesis procedure.
Temporal irregularity	The randomness in the time between ***impulses*** in the ***impulse sequence***. A feature that was analyzed to understand its perceptual nature.
Density	The number of ***impulses*** that occur per second time in the ***impulse sequence***. A feature that was analyzed to understand its perceptual nature.

Table S1. Definitions of terminology used throughout the article for readers to reference.

# of impulses in the sound	Pitch (Hz)	Harmonic Ratio	Centroid (Hz)	Spread (Hz)	Skewness
8	270.69	0.37	319.53	143.47	6.97
16	268.70	0.35	322.59	143.12	6.78
24	245.13	0.36	319.71	144.31	6.59
32	226.58	0.37	319.39	143.71	6.61
48	205.33	0.37	323.85	143.83	6.62
112	172.96	0.43	316.03	141.65	6.82
176	186.99	0.37	317.31	144.50	6.68
240	189.43	0.34	323.29	140.88	6.47
RANGES	[172.96, 270.69]	[0.34, 0.43]	[316.03, 323.85]	[140.88, 144.31]	[6.47, 6.97]

Table S2. Measures of pitch, harmonic ratio, spectral centroid, spectral spread, and spectral skewness for the core eight sounds that were subject to binary categorization, unitary ratings, and discrimination of density and temporal irregularity.

Sequence name	# of Delay-add	# of Impulses	Density (impulses/second)	SD	Tau	R^2
SS_400	0	8	6	0.067	5	1
C_400.16	1	16	12	0.047	13.31	0.372
C_400.24	2	24	15	0.028	16.67	0.0373
C_400.32	3	32	20	0.024	28.35	0.258
C_400.48	5	48	28	0.017	42.96	0.227
C_400.112	13	112	64	0.008	131.34	0.154
C_400.176	21	176	105	0.005	256.66	0.099
C_400.240	29	240	156	0.003	600	0.063
SS_200	0	8	12	0.033	5	1
C_200.16	1	16	24	0.022	12.53	0.401
C_200.24	2	24	30	0.013	20.41	0.352
C_200.32	3	32	40	0.011	26.19	0.296
C_200.48	5	48	56	0.009	50.83	0.190
C_200.112	13	112	128	0.003	187.14	0.124
C_200.176	21	176	210	0.0018	666.66	0.050
C_200.240	29	240	312	0.0012	1000	0.011

Table S3. Properties of *impulse sequences* that were selected for acoustic analyses, and perceptual assessments.

Pairings for Same-Different Discrimination Task (Exp. 6B, 6C, 7B and 7C)	
SS_400 vs. C_400.16	C_400.16 vs. SS_400
C_400.16 vs. C_400.24	C_400.24 vs. C_400.16
C_400.24 vs. C_400.32	C_400.32 vs. C_400.24
C_400.24 vs. C_400.40	C_400.40 vs. C_400.24
C_400.32 vs. C_400.40	C_400.40 vs. C_400.32
C_400.40 vs. C_400.48	C_400.48 vs. C_400.40
C_400.48 vs. C_400.80	C_400.80 vs. C_400.48
C_400.48 vs. C_400.112	C_400.112 vs. C_400.48
C_400.48 vs. C_400.176	C_400.176 vs. C_400.48
C_400.48 vs. C_400.240	C_400.240 vs. C_400.48
C_400.80 vs. C_400.112	C_400.112 vs. C_400.80

C_400.80 vs. C_400.144	C_400.144 vs. C_400.80
C_400.112 vs. C_400.144	C_400.144 vs. C_400.112
C_400.112 vs. C_400.176	C_400.176 vs. C_400.112
C_400.112 vs. C_400.208	C_400.208 vs. C_400.112
C_400.112 vs. C_400.240	C_400.240 vs. C_400.112
C_400.144 vs. C_400.176	C_400.176 vs. C_400.144
C_400.144 vs. C_400.208	C_400.208 vs. C_400.144
C_400.144 vs. C_400.240	C_400.240 vs. C_400.144
C_400.176 vs. C_400.208	C_400.208 vs. C_400.176
C_400.176 vs. C_400.240	C_400.240 vs. C_400.176
C_400.208 vs. C_400.240	C_400.240 vs. C_400.208

Table S4. The pairings presented to the listener during the same-different discrimination task in Experiment 6B (temporal irregularity) and 7B (density). Note that the very first pair was omitted in Experiment 6B and 7B. The omitted pairing was instead presented to a new set of listeners in Experiment 6C and 7C.

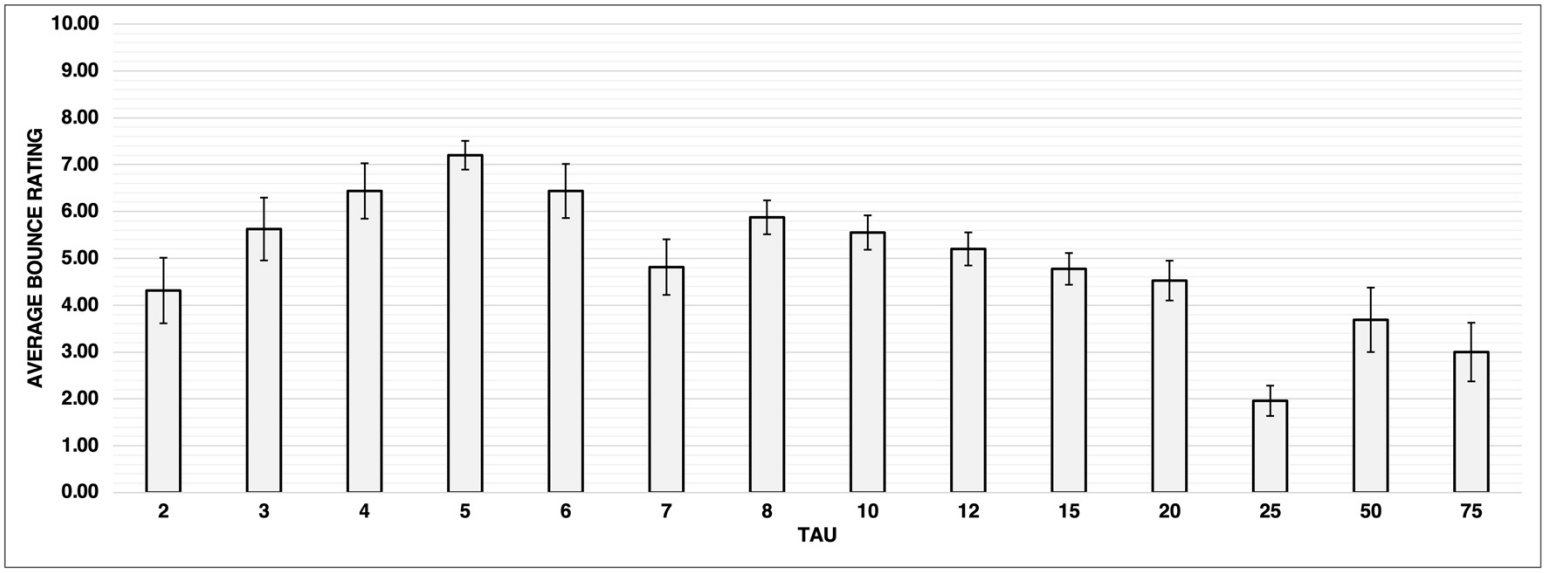

Figure S1. Likelihood that the sound conveys an object bouncing as a function of Tau. Tau is a single value that reflects the rate of change of the interval between impulses. Small Tau values indicate that the intervals between impulses are decreasing at a fast rate, and the impulses are located close together. Large Tau values indicate that the intervals between impulses are steady, and the impulses are located equally apart in time. Each of the sounds have an III_o of 400 ms, and the same number of impulses (6). Tau is the only parameter that is changing between the sounds. A rating of 10 corresponds to the sound being extremely likely to have conveyed an object bouncing, and a rating of 0 corresponds to the sound being not at all likely to have conveyed an object bouncing. Standard error of the mean is reflected by the error bars.

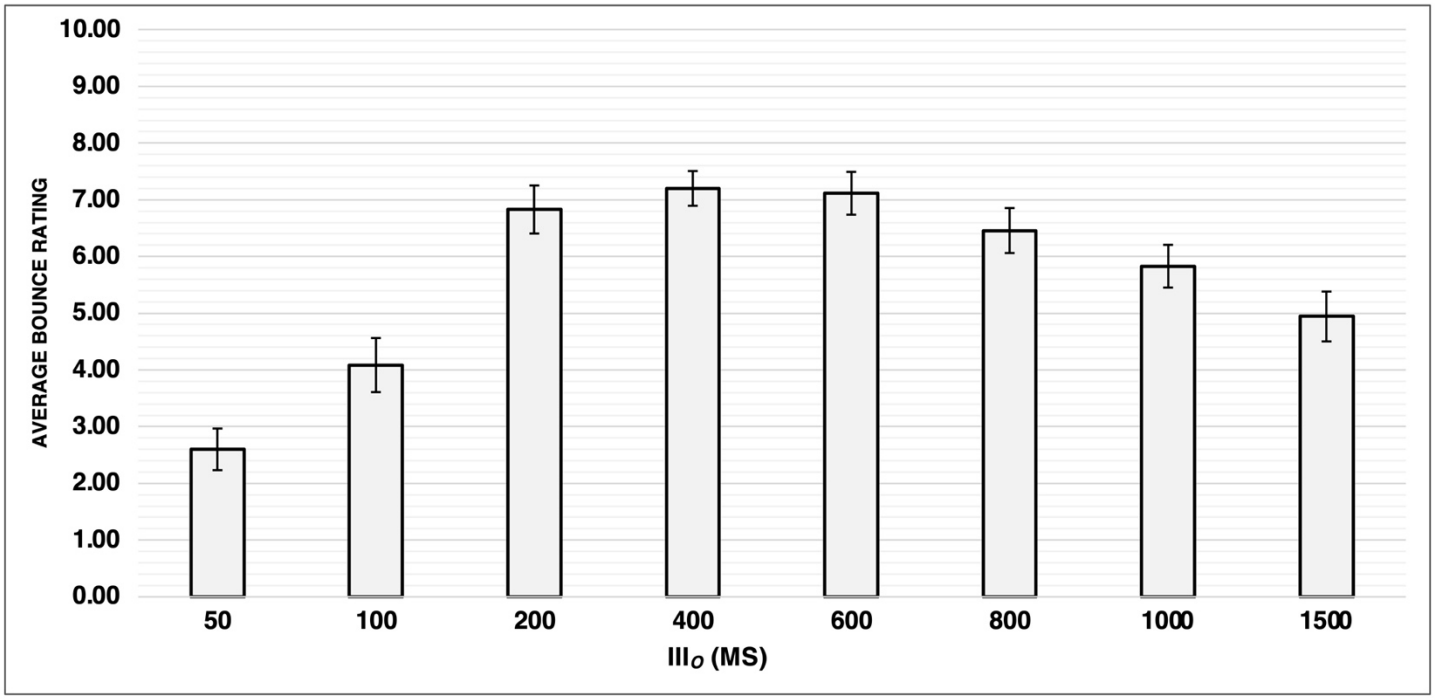

Figure S2. Likelihood that the sound conveys an object bouncing as a function of III_o. Each of the sounds have the same value of Tau (5), and the same number of impulses (6). III_o is the only parameter that is changing between the sounds. A rating of 10 corresponds to the sound being extremely likely to have conveyed an object bouncing, and a rating of 0 corresponds to the sound being not at all likely to have conveyed an object bouncing. Standard error of the mean is reflected by the error bars.

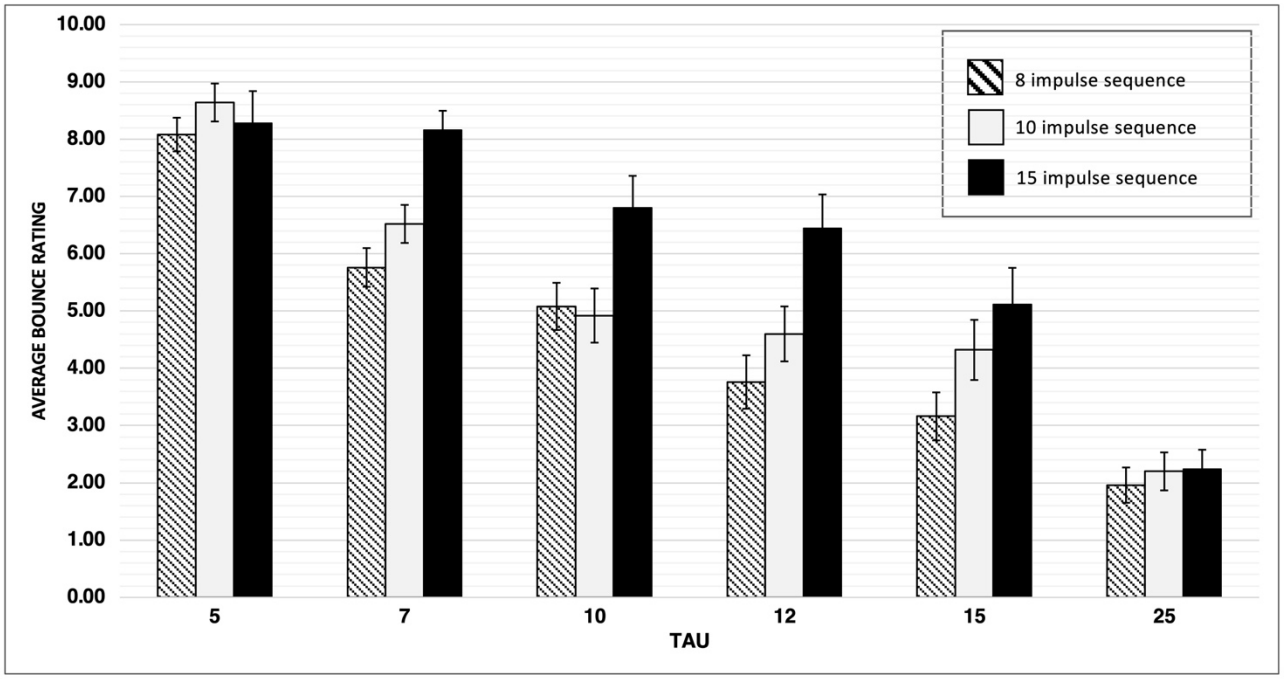

Figure S3. Likelihood that the sound conveys an object bouncing as a function of number of impulses in the sequence for sets of Tau values. Each of the sounds have an III_o of 400 ms. The stripped bars correspond to sounds with a total of 8 impulses in the sequence. The white bars correspond to sounds with a total of 10 impulses in the sequence. The black bars correspond to sounds with a total of 15 impulses in the sequence. A rating of 10 corresponds to the sound being extremely likely to have conveyed an object bouncing, and a rating of 0 corresponds to the sound being not at all likely to have conveyed an object bouncing. Standard error of the mean is reflected by the error bars.

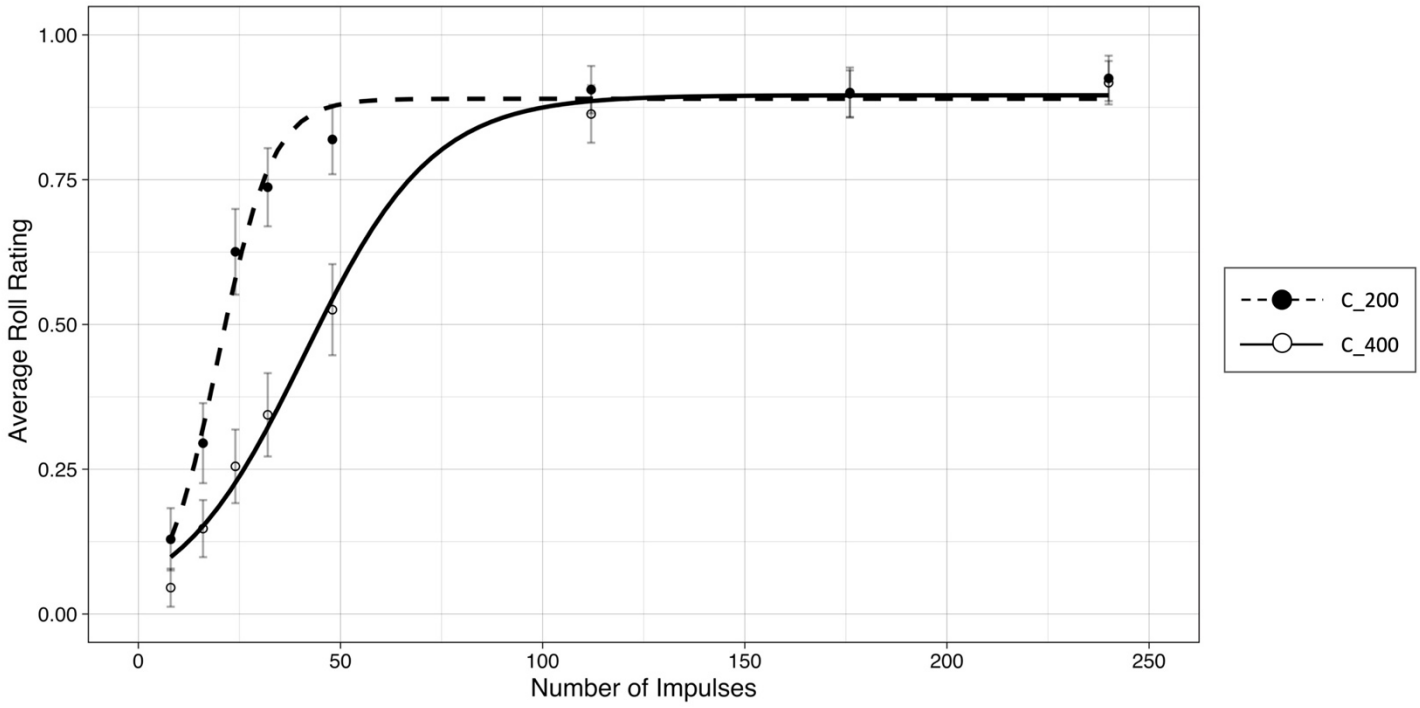

Figure S4. Average responses from the unitary ratings task in which listeners were asked to provide a rating, on a scale of 0 to 10, of how well the sound conveyed a bouncing event, and separately, how it conveyed a rolling event. The graph depicts the average proportion of roll ratings [1 refers to a rating of 10 on the 'roll' scale] as a function of the number of impulses in the sound. Standard error of the mean across participants is represented by the error bars at each data point.

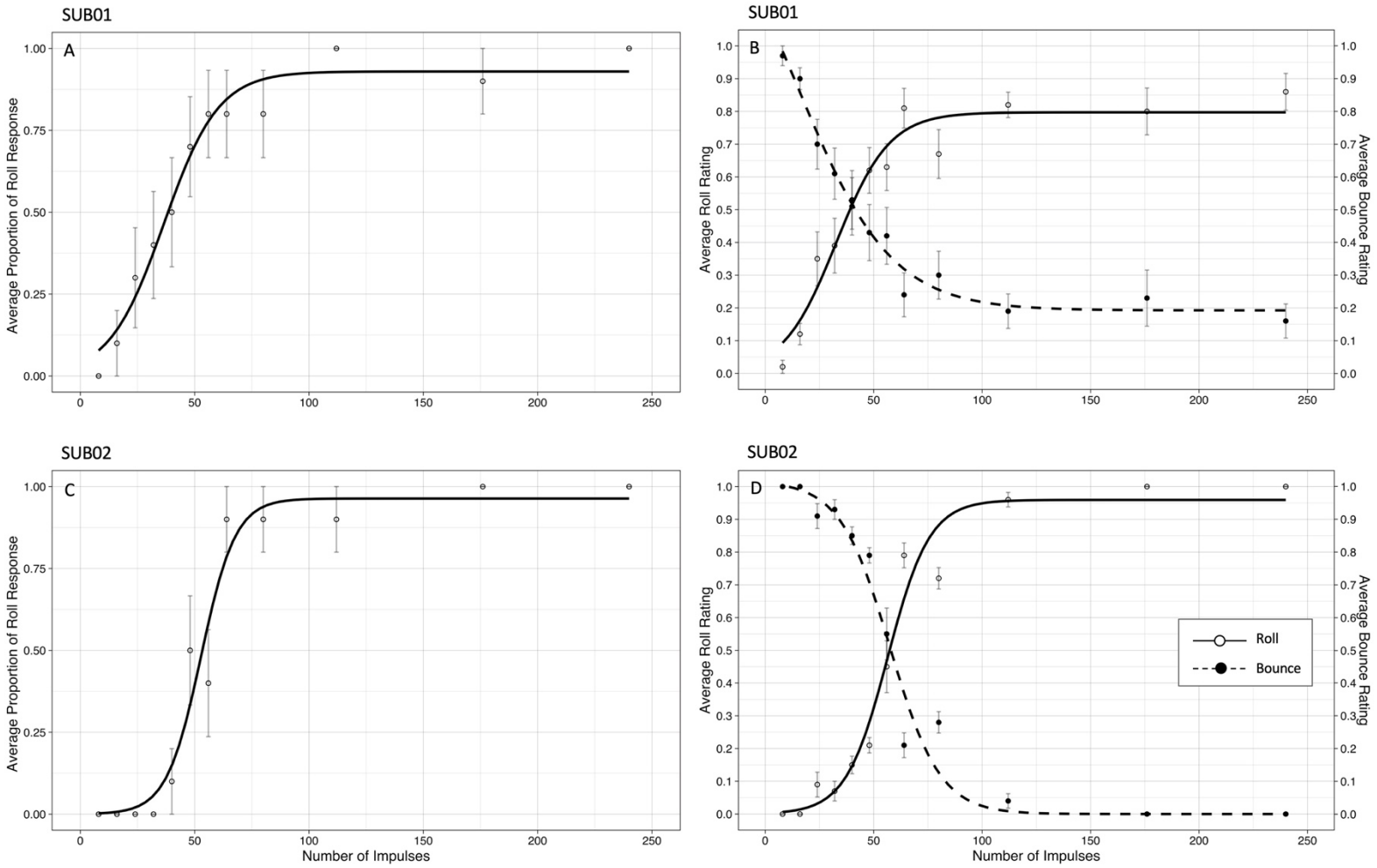

Figure S5. Two representative responses from listeners who completed both binary and unitary judgements. Panels A and B correspond to one single listener (Sub01), while Panels C and D correspond to a different, single listener (Sub02). Panels A and C depict the average proportion of roll responses, from the binary task, as a function of the number of impulses in the sound. Panel B and D depict the average roll and bounce ratings, from the unitary task, as a function of the number of impulses in the sound. The ratings from the 'rolling' scale are indicated with the solid line, while the ratings from the 'bouncing' scale are indicated with the dashed line. Standard error of the mean is reflected at each data point for each listener.