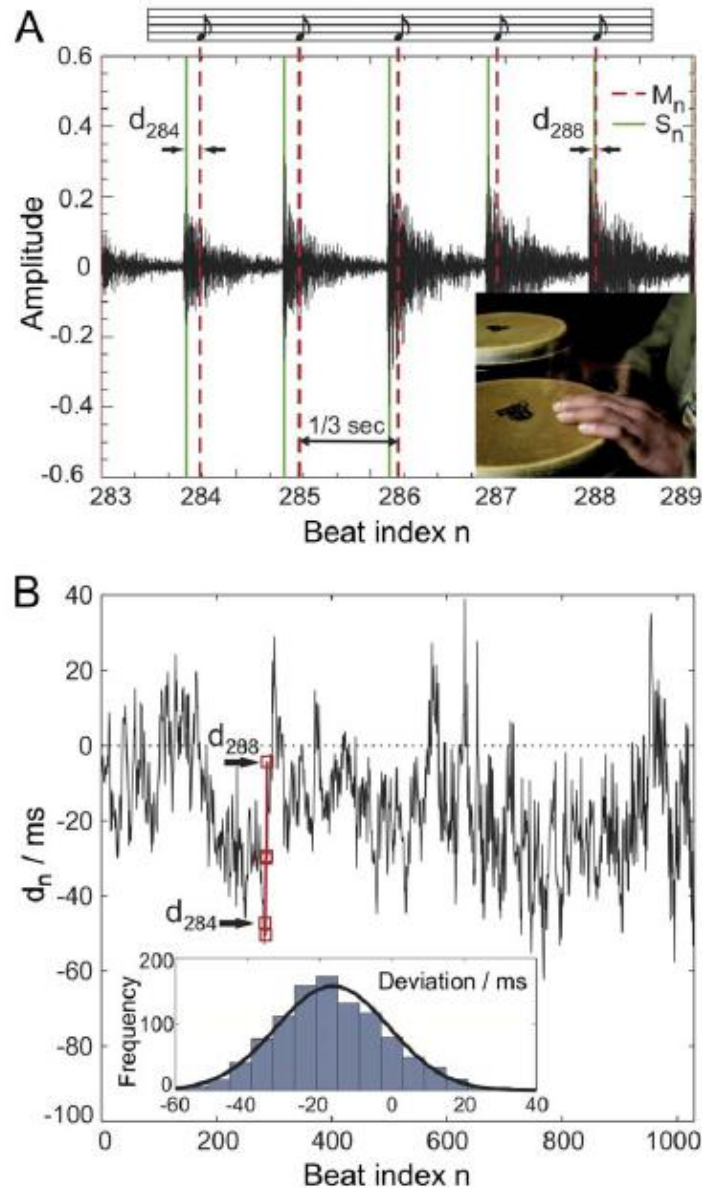


# $1/f^\beta$ Noise in Drummer's Timing of Beat!



A professional drummer was asked to drum 180 beats per minute ( $\Delta t = 1/3 = 0.333$  sec per beat) in sync with a metronome, but slightly anticipated the metronome's clicking by {a mean value of}  $\langle \delta t \rangle = -16.4$  ms.

Additionally, the drummer had a Gaussian-distributed width  $\sigma_{\Delta t} \sim 15.6$  ms about his mean time between beats, with  $\sim 1/f$  type fluctuations in the beat!

**Figure 1. Demonstration of the presence of temporal deviations and LRC in a simple drum recording.** A professional drummer (inset) was recorded tapping with one hand on a drum trying to synchronize with a metronome at 180 beats per minute (A). An excerpt of the recorded audio signal is shown over the beat index  $n$  at sampling rate 44.1 kHz. The beats detected at times  $S_n$  (green lines, see Methods) are compared with the metronome beats (red dashed lines). (B) The deviations  $d_n = S_n - M_n$  fluctuate around a mean of  $-16.4$  ms, i.e. on average the subject slightly anticipates the ensuing metronome clicks. Inset: The probability density function of the time series is well approximated by a Gaussian distribution (standard deviation 15.6 ms). Our main focus is on more complex rhythmic tasks, however (see Table 1). A detrended fluctuation analysis of  $\{d_n\}$  is shown in Fig. 2C (middle curve).

doi:10.1371/journal.pone.0026457.g001