

Beat it: how the brain perceives rhythm

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A toddler playing on a toy drum. Credit: Anthea Sieveking, Wellcome Images.

(PhysOrg.com) -- The brain uses distinct timing mechanisms to measure the duration between the intervals in a sequence of sounds, according to a study funded by the Wellcome Trust. Researchers from the Wellcome Trust Centre for Neuroimaging, UCL (University College London) and Newcastle University have found that distinct parts of the brain are involved in these timing mechanisms.

Human behaviour such as speech and movement requires precise coordination and timing. In a study published online today in the *Journal of Neuroscience*, the researchers - Sundeep Teki, Dr Manon Grube, Dr Sukhbinder Kumar and Professor Timothy Griffiths, a Wellcome Trust Senior Research Fellow - presented sequences of click sounds to 18 volunteers in a [magnetic resonance imaging](#) scanner.

The participants were required to judge whether the duration of the last

interval was shorter or longer than the penultimate interval. By varying the regularity of the preceding intervals (from very irregular to regular), the researchers were able to show that the brain recruits different mechanisms and areas for the timing of regular and irregular sequences of sounds.

The researchers found that a network comprising the basal ganglia was activated for the timing of regular sounds, whereas a network in the cerebellum was found to be activated for the timing of irregular sound sequences.

"The basal ganglia and [cerebellum](#) are primarily motor structures and are known to be involved in time perception, but we have shown for the first time that their role in time perception varies according to the rhythmic context of time intervals," explains Sundeep, a doctoral candidate at UCL.

"We found that the cerebellar network measures the absolute duration of individual time intervals, like a stopwatch, while the basal ganglia network is involved in the measurement of time relative to a regular beat or rhythm in the sounds - for instance, timing relative to a metronome."

Professor Griffiths adds: "Patients with movement disorders such as Parkinson's disease due to impairment of the [basal ganglia](#) network or ataxias due to cerebellar pathology show cognitive deficits in time perception. These results suggest that their timing deficits can be distinguished on the basis of rhythm."

More information: Teki S et al. Distinct neural substrates of duration-based and beat-based auditory timing. *J Neurosci* 9 March 2011

Provided by Wellcome Trust

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