Neuroscience research provides evidence the brain is strobing, not constant

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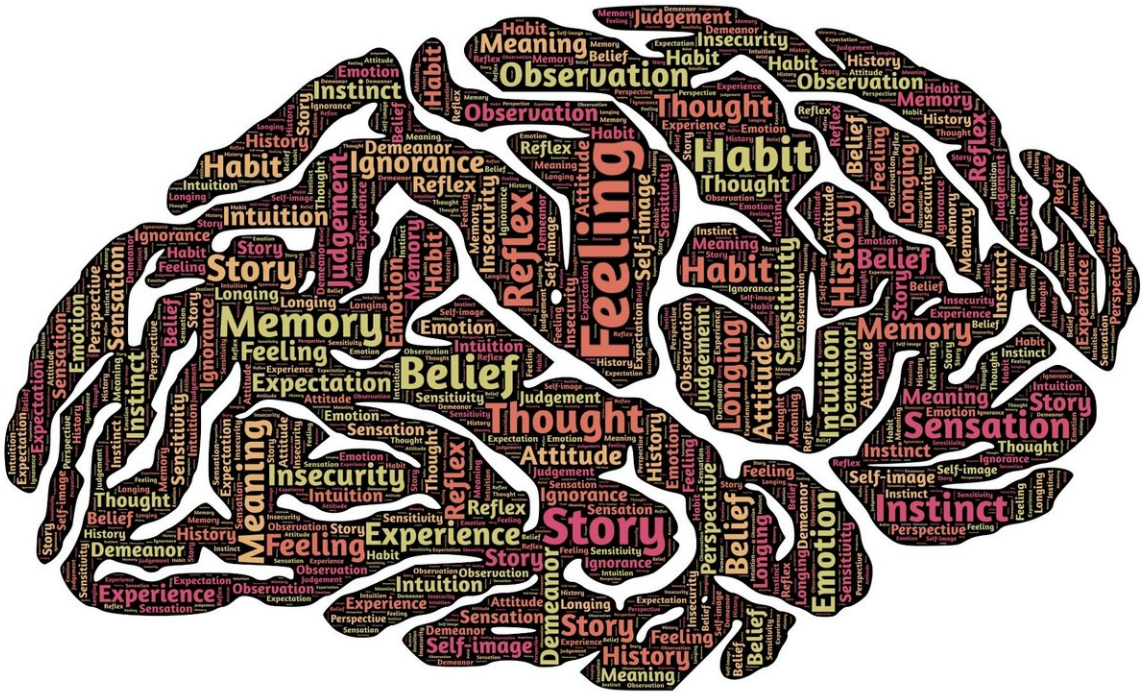

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It's not just our eyes that play tricks on us, but our ears. That's the

finding of a landmark Australian-Italian collaboration that provides new evidence that oscillations, or 'strobes', are a general feature of human perception.

While our conscious experience appears to be continuous, the University of Sydney and Italian universities study suggests that perception and attention are intrinsically rhythmic in nature.

This has profound implications for our understanding of human behaviour, how we interact with environment and make decisions.

A paper published today in *Current Biology* provides the important new evidence for the cyclical nature of perception.

Three key findings:

1. auditory perception oscillates over time and peak perception alternates between the ears - which is important for locating events in the environment;
2. auditory decision-making also oscillates; and
3. oscillations are a general feature of perception, not specific to vision.

The work is the result of an Italian-Australian collaboration, involving Professor David Alais, Johahn Leung and Tam Ho of the schools of Psychology and Medical Science, University of Sydney; Professor David Burr from the Department of Neuroscience, University of Florence; and Professor Maria Concetta Morrone of the Department of Translational Medicine, University of Pisa.

With a simple experiment, they showed that sensitivity for detecting weak sounds is not constant, but fluctuates rhythmically over time.

It has been known for some years that our sight perception is cyclical but

this is the first time it has been demonstrated that hearing is as well.

"These findings that auditory perception also goes through peaks and troughs supports the theory that perception is not passive but in fact our understanding of the world goes through cycles," said Professor Alais from the University of Sydney.

"We have suspected for some time that the senses are not constant but are processed via cyclical, or rhythmic functions; these findings lend new weight to that theory."

These auditory cycles happen at the rate of about six per second. This may seem fast, but not in neuroscience, given that brain oscillations can occur at up to 100 times per second.

"These findings are important as humans make decisions at the rate of about one-sixth of a second, which is in line with these auditory oscillations," said Professor Alais.

The study found a variation of oscillation between the two ears, first one ear is at peak sensitivity, then the other. The oscillation is so fast that we are normally unaware of it, but can be revealed in experiments using very fine-grained timing.

Why should the brain sample information in this cyclic fashion? Theories abound, but one popular idea - favoured by the authors of this study - is that it reflects the action of attention which appears to sample neural activity in rapid bursts.

The scientists are next focusing their attention on perceptions of touch and how this might make use of neural oscillations as part of a goal of characterising perception in general over all the senses.

"The brain is such a complex 'machine' one could say - it is a testament to science that we are starting to make sense of it - but a takeaway could be that there is so much we don't know," Professor Alais concludes.

"A decade ago, no one would have thought that perception is constantly strobing - flickering like an old silent movie

For the moment, this research shows one thing very clearly: our sensory perception of the world is fundamentally oscillatory, like a strobing light or a wave waxing and waning.

The strobing brain - how it works

When we peruse a scene, not all parts are equally important: some receive more attention than others and are prioritised in processing. This is an effective strategy, concentrating limited cognitive resources on specific items of interest, rather than diluting resources over the entire space.

Similarly, oscillating attention would produce an analogous result over time, with resources concentrated into small temporal epochs instead of being sustained in a uniform but thin allocation.

This strobing approach to attention would bind together relevant information at regular time points and allow new groupings of information to reassemble at other moments.

More information: Hao Tam Ho et al. Auditory Sensitivity and Decision Criteria Oscillate at Different Frequencies Separately for the Two Ears, *Current Biology* (2017). DOI: 10.1016/j.cub.2017.10.017