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New paper out in PLOS Biology! In analyzing over 20 million perceptual decisions, we found that humans & mice fluctuate between external and internal modes of sensory analysis.

Perception cycles through prolonged periods of enhanced and reduced sensitivity to external information. We asked whether fluctuations in perceptual performance are a noise-related epiphenomenon, or result from an adaptive mechanism of sensory analysis.

To this end, we investigated perceptual decision-making in two open datasets on perceptual decision-making in humans (https://nature.com/articles/s41562-019-0813-1) and mice (<https://elifesciences.org/articles/63711>).

We found that humans & mice fluctuated between alternating intervals of externally- and internally-oriented modes: During external mode, perception was more sensitive to external sensory information. During internal mode, perception was biased more strongly toward perceptual history.

These cross-species results suggest that fluctuations in the strength of serial dependencies may provide a new explanation for ongoing changes in perceptual performance and inter-individual differences in metacognitive performance.

Computational modeling explained dynamic changes in mode by 2 interlinked factors: (i), the integration of stimuli over time &, (ii), slow anti-phase oscillations in the impact of external sensory information versus internal predictions that are provided by perceptual history.

Between-mode fluctuations may generate unambiguous error signals that aligns internal predictions with the current state of the environment in iterative test-update-cycles.

Between-mode fluctuations may regulate the balance between feedforward versus feedback contributions to perception and thereby play an adaptive role in metacognition and reality monitoring.

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