

The Science of Intuition: Why It Works and How To Train It Dr. Jason Yuan

Intuition is not *random*. It's not just *luck* either.

And yes, that **gut feeling** you keep brushing off probably holds real value.

So let's dive into **what intuition really is and how you can strengthen your intuitive capacities**.

What is Intuition Really?

A recent article published in Nature titled *Pathfinding: a neurodynamical account of intuition* shares the latest framework on why intuition exists and how it works.

According to the paper, intuition is framed as “**an experience-based process leading to spontaneous hunches or hypotheses without explicit reasoning**”.

And importantly, it is **embodied** (processed in the body), and it's often felt as a **gut instinct** that we commonly know of.

Key takeaway #1: The Evolution of Intuition

The paper proposes that intuition evolved as a **pathfinding mechanism**, guiding organisms through uncertain environments.

Scientists say that just as our brains evolved to control movement by predicting what happens next, intuition seems to work the same way.

Intuition, insight, and analysis all derive from this **predictive capacity**.

The authors define **pathfinding** as: **Navigating spatial, cognitive, and social environments.**

Your brain does this by using cues like landmarks, mental maps, and automatic (implicit) decisions.

And certain neural systems underlie both navigation and memory = a system for both movement and abstract thought.

Intuition is described as a predictive emotion or a “**summary signal**” integrating multiple action-planning variables (**risk, effort, feasibility**) into a gut feeling.

So in essence, intuition acts like an inner compass, giving you a quick yes/no signal before you consciously think it through.

Key Takeaway #2: A Continuum View of Intuition, Insight, and Analysis

There are clear differences between intuition, insight, and analysis. And each plays a role in decision-making.

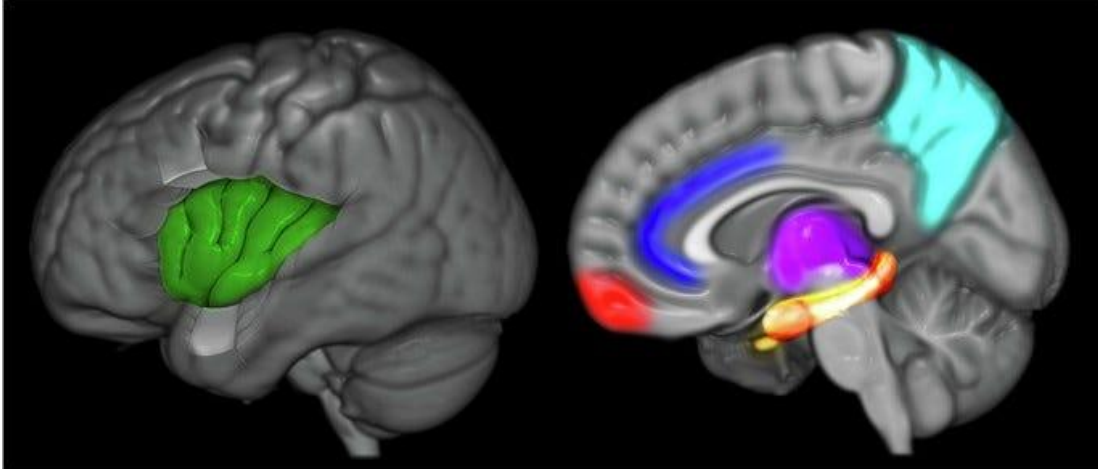
According to the paper, the authors propose this order: **intuition** → **insight** → **analysis**.

- Intuition: fast, embodied, binary signals (yes/no, coherent/incoherent).
- Insight: sudden explicit realization (“Aha!” moment).
- Analysis: deliberate, step-by-step reasoning.

So, in summary, intuition reduces uncertainty subconsciously. Insight captures it. And analysis reduces it consciously and explicitly.

Key Takeaway #3: Neural Correlates of Intuition

The paper highlights key brain regions repeatedly implicated in the intuition process:



Brain regions connected in the intuition process. Kotler *et al.* Pathfinding: a neurodynamical account of intuition. *Commun Biol* **8**, 1214 (2025).

- Orbitofrontal cortex: early integrator, gives coherence “hunches.”
- Anterior insula: links interoceptive body states (e.g, heart rate, respiration rate) to intuition.
- Hippocampus & entorhinal cortex: replay past/future paths, encode spatial/cognitive maps.
- Basal ganglia (caudate nucleus): expertise-based intuitive pattern recognition.
- Amygdala: adds emotional valence and risk assessment.
- Anterior cingulate cortex & precuneus: regulation, self-referential context.

These brain regions work together in a flexible (metastable) network, quickly switching between connecting as a group and working independently.

Key Takeaway #4: Attractor Landscapes

Unsolved problems are stored as “attractor landscapes” in the brain.

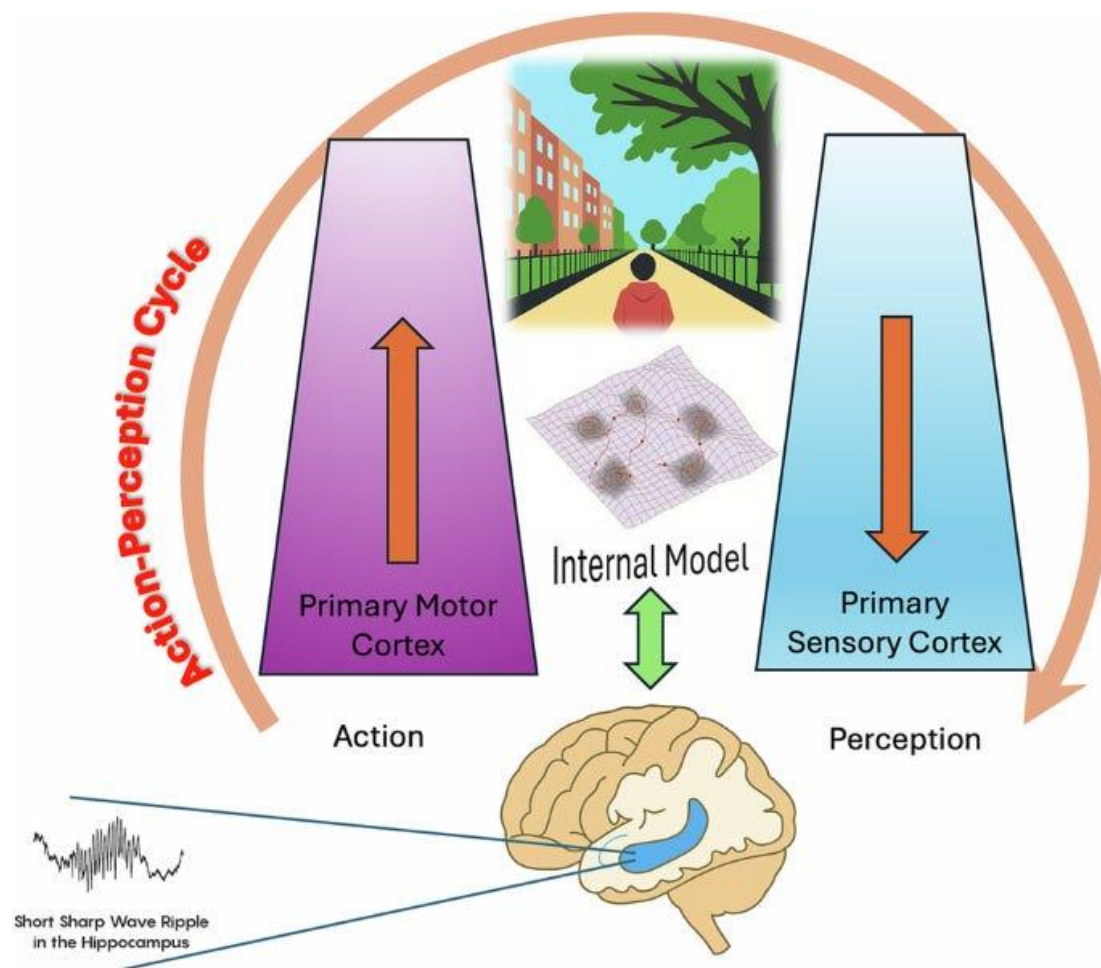
Later cues can reactivate them, triggering intuitions.

Example: A scientist sees an apple falling from a tree, sparking a solution to a long-standing problem.

This is explained by other studies (nonlinear neurodynamics) showing that **unresolved problems appear to bias brain states until a matching cue appears.**

Key Takeaway #5: The Embodied Basis of Intuition

Short Wave Ripples (SWR) are short bursts of synchronous hippocampal activity during sleep and wake.



How SWR replays past experiences and simulates future possibilities for the intuitive process. Kotler *et al.* Pathfinding: a neurodynamical account of intuition. *Commun Biol* **8**, 1214 (2025)

They function to:

- Replay past experiences in compressed form.

- Pre-play future trajectories (simulate possible paths).
- Facilitate creativity, decision-making, and abstract reasoning.
- Coordinate with the amygdala → emotional quality of intuitions.

And the proposed as a physiological mechanism of intuition: **situational pattern recognition guided by memory replay.**

Then, intuition acts as **embodied cognition** where sensorimotor aspects connect and shape cognitive models.

Interoceptive signals (heart rate, gut sensations, breath) contribute to the “felt sense” of intuition, pushing us to lean towards a certain action.

Example: Stock traders with better interoceptive awareness of their heart rate performed more successfully.

Key Takeaway #6: Theoretical Frameworks

Free Energy Principle (predicative modeling):

- Brains minimize prediction error (“surprise”) using active inference.
- Intuition = fast inference, reducing uncertainty using implicit models.
- Expertise builds better hierarchical models, improving intuition.

Metastability (flexibility at critical points):

- Brain regions simultaneously cooperate & maintain autonomy.
- Enables flexible switching between states, which is key for rapid, non-linear, intuitive judgments.
- Combined, these frameworks position intuition as embodied, predictive, and metastable pathfinding.

Alternative Views:

- Dual-process theories (System 1 fast vs. System 2 slow) partially overlap but are reframed here as a dynamic continuum, rather than 2 distinct systems.

- Associative learning: Intuition may also arise from expertise-based recognition without SWRs, but the authors argue that attractor landscapes + SWR replay provide a deeper mechanism.

5 Potential Ways to Improve Your Intuition

While the authors don't explicitly give a manual to improve one's intuition, here are some approaches that may support intuition based on the prior research and the current proposed mechanisms:

- **Get More Experience**
 - The authors note research showing intuition gets more accurate with subject expertise (e.g., playing a board game, activating the caudate nucleus for intuitive moves)
 - Repeated exposure and skill-building in a domain train the neural models that intuition draws from.
- **Get Good Sleep**
 - SWRs replay experiences and simulate possible futures.
 - Because many of these processes happen during rest and sleep, giving your body downtime is likely important for supporting intuition.
- **Hold Onto Those Unsolved Problems**
 - When you struggle with a problem and set it aside, the brain stores it as an “attractor landscape.” Later, new cues can trigger an intuition
 - This means that frustration + incubation + later exposure is part of training intuition.
- **Tune Into Your Body**
 - Interoceptive awareness (heartbeat, gut, breathing) feeds into intuitive judgments
 - Research cited shows that traders with better heart rate awareness performed better, implying that training body awareness (through meditation, breathwork, and somatic practices) may sharpen intuition.

- **Stretch Your Brain**
 - Intuition thrives when the brain operates at the edge of stability and flexibility, able to connect diverse networks quickly
 - Practices that increase cognitive flexibility (creative play, open-minded states, meditation) may therefore foster stronger intuitions.

An Intuitive Summary

Intuition is a fast, dynamic, and experience-based hypothesis often felt in the body as a gut instinct.

- It has evolved as a pathfinding system, helping the brain predict and act under uncertainty.
- It sparks quick yes/no signals, insight delivers “Aha!” moments, and analysis provides slow, step-by-step reasoning.
- Multiple brain regions work together in a flexible network to generate intuition.
- Unsolved problems shape brain states and can resurface as intuition when triggered by new cues.
- Sharp Wave Ripples and interoceptive signals (heartbeat, gut, breath) ground intuition in memory replay and bodily awareness.
- Theoretical Frameworks explain intuition as a predictive, embodied, and flexible mode of the brain.
- Potential Ways to Improve It: Build expertise, get quality sleep, embrace unsolved problems, train body awareness, and foster cognitive flexibility.

