Perceiving Motion: From Nesiitoons to Narrative

The Functions, Mechanisms, and Psychology of Movement.

A comprehensive exploration of Chapter 8, tracing the cognitive path from retinal stimulation to complex social interpretation.

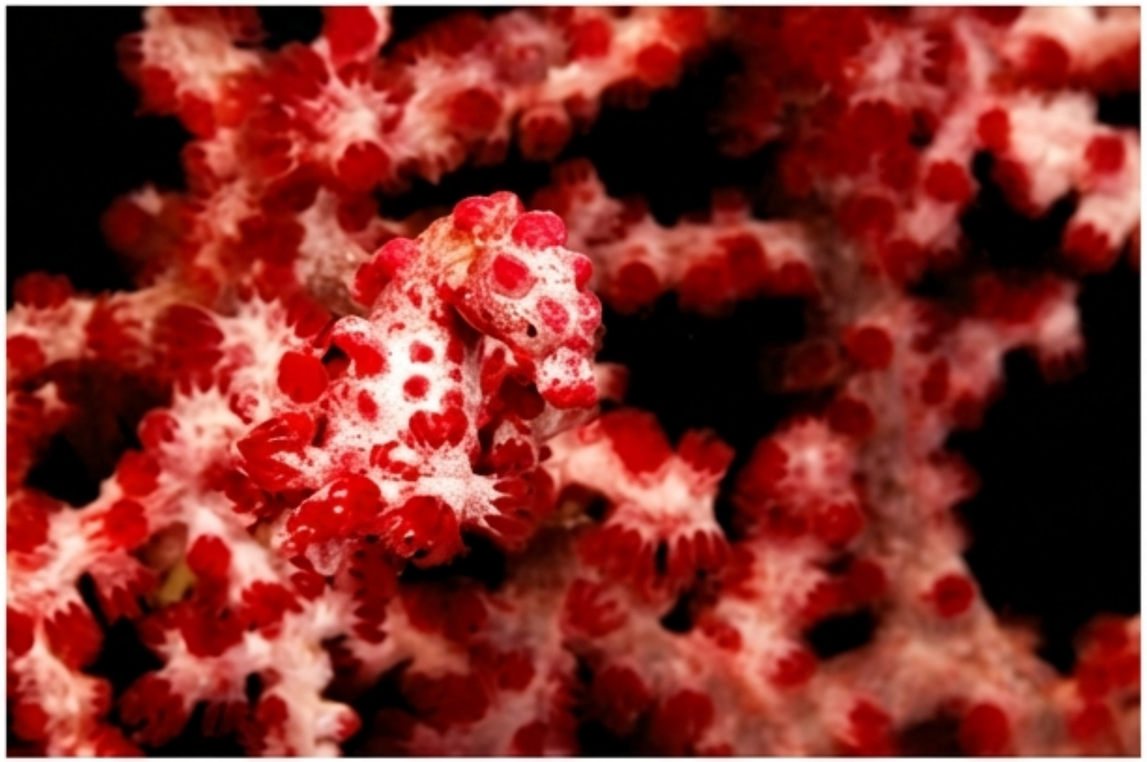
The Survival Function: Breaking Camouflage.

Core Concept: Motion as Attentional Capture

Motion is a primary mechanism for Attentional Capture. Perfect camouflage is rendered useless the moment an object moves.

Examples: Predator & Prey and Clinical Case

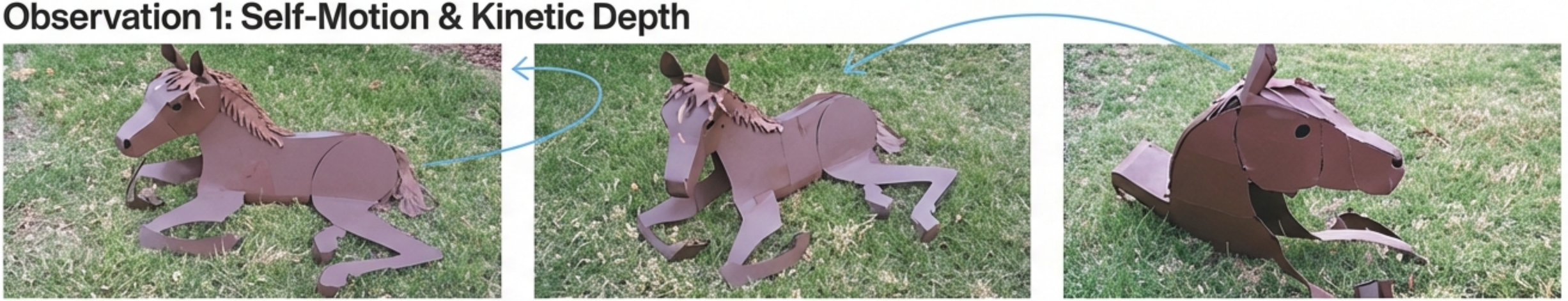
Predator & Prey: Movement separates figure from ground. Case of L.M.: Life without motion perception is dangerous (e.g., pouring tea becomes impossible).



Static camouflage fails immediately upon movement. Even these highly adapted species are instantly detected by the visual cortex when they move.

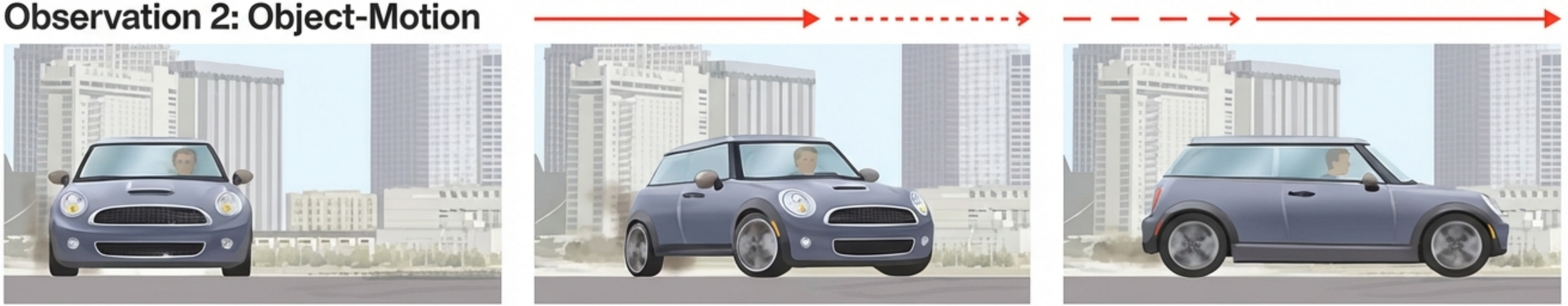
Structure from Motion: Revealing 3D Form

Observation 1: Self-Motion & Kinetic Depth



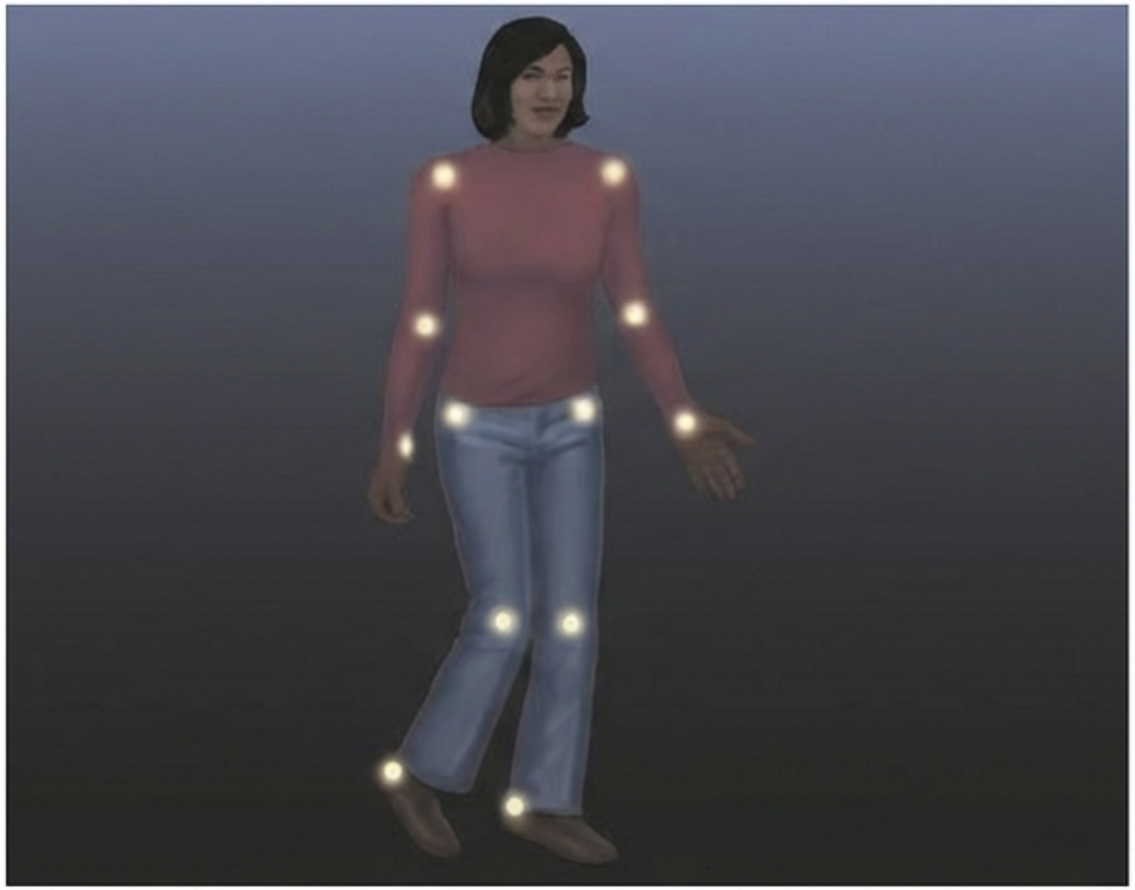
Multiple viewpoints from self-motion reveal the sculpture's three-dimensional structure.

Observation 2: Object-Motion



As we move around a stationary object, or an object moves relative to us, the visual system integrates these views to construct a 3D volume.

Social Perception and Event Boundaries.



Johansson’s Point-Light Walkers: Observers instantly distinguish human activity from simple dots.

Biological Motion

- Point-Light Walkers: Joint motion alone reveals gender, mood, and action within milliseconds.
- Event Perception: Motion segments time; changes in velocity mark “event boundaries”.
- Intent: Trajectory and speed distinguish aggression from greeting.

When Do We Perceive Motion? Real vs. Illusory.

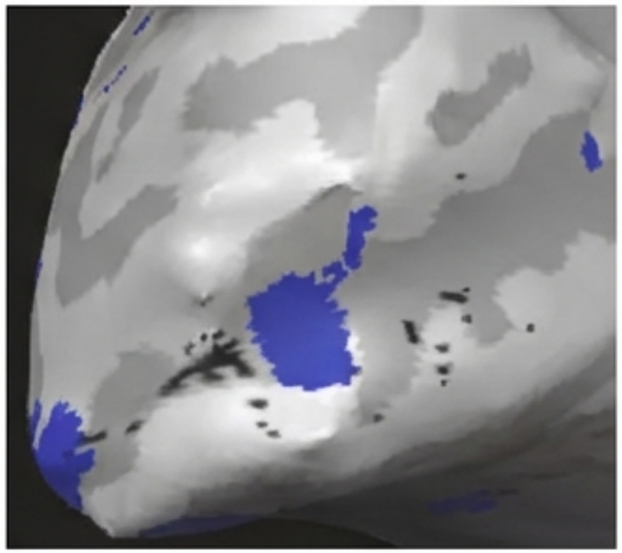
Apparent Motion: Stationary stimuli flash in succession.

Motion Aftereffects: Fatigued neurons cause stationary scenes to drift.

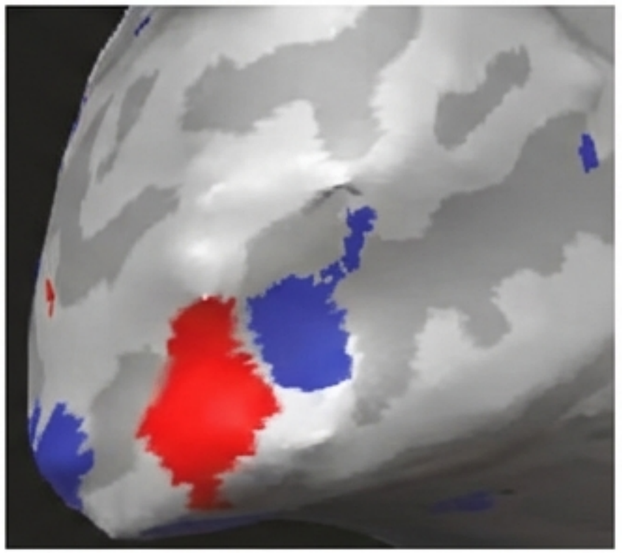
Types of Motion

1. Real Motion
2. Apparent Motion
3. Motion Aftereffects (Waterfall Illusion)
4. Induced Motion (Clouds moving past the moon).

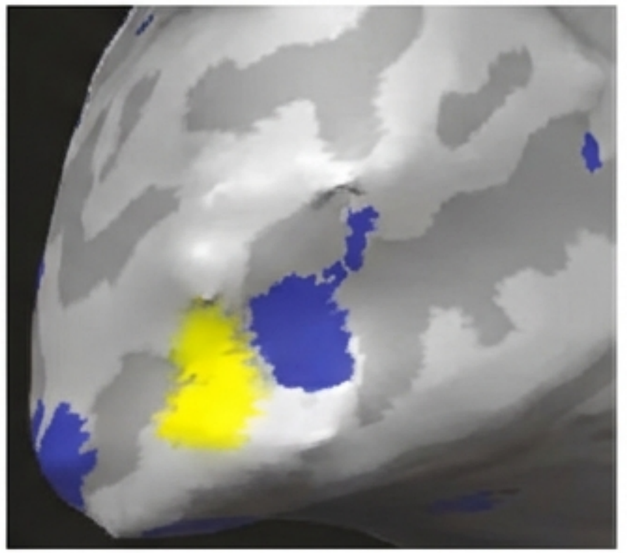
The Brain on Motion: Real vs. Apparent.



Control
(Separate Flashes)



Real Motion
(Continuous Path)



Apparent Motion
(Illusory Path)

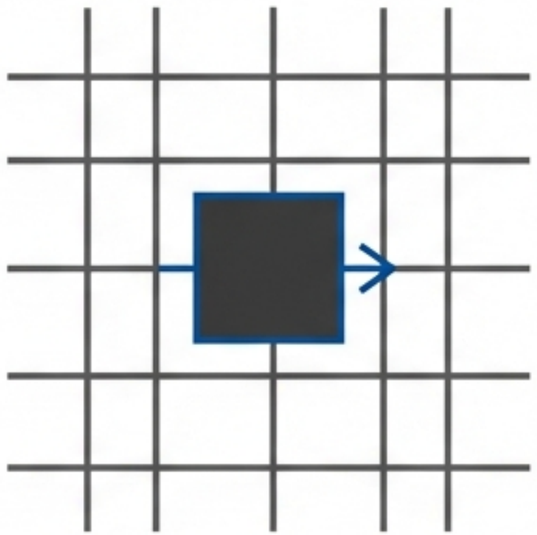
Larsen et al. (2006): In Apparent Motion (right), the brain activates neurons representing the empty space between flashes, indistinguishable from Real Motion.

Explaining Motion: The Ecological Approach.

Local Disturbance in the Optic Array.

An object covers and uncovers the background as it moves.

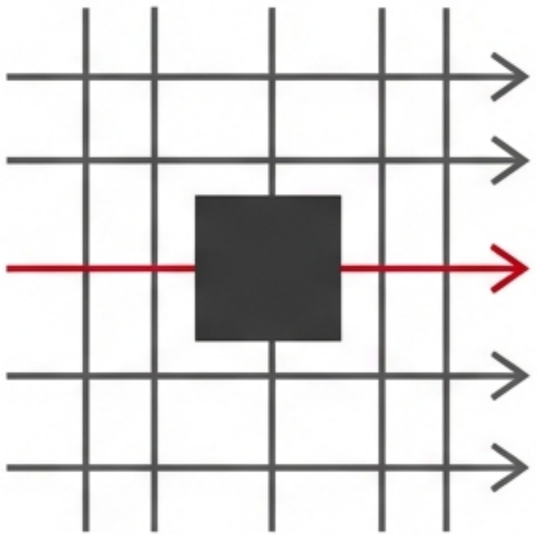
Result: We perceive the object moving.



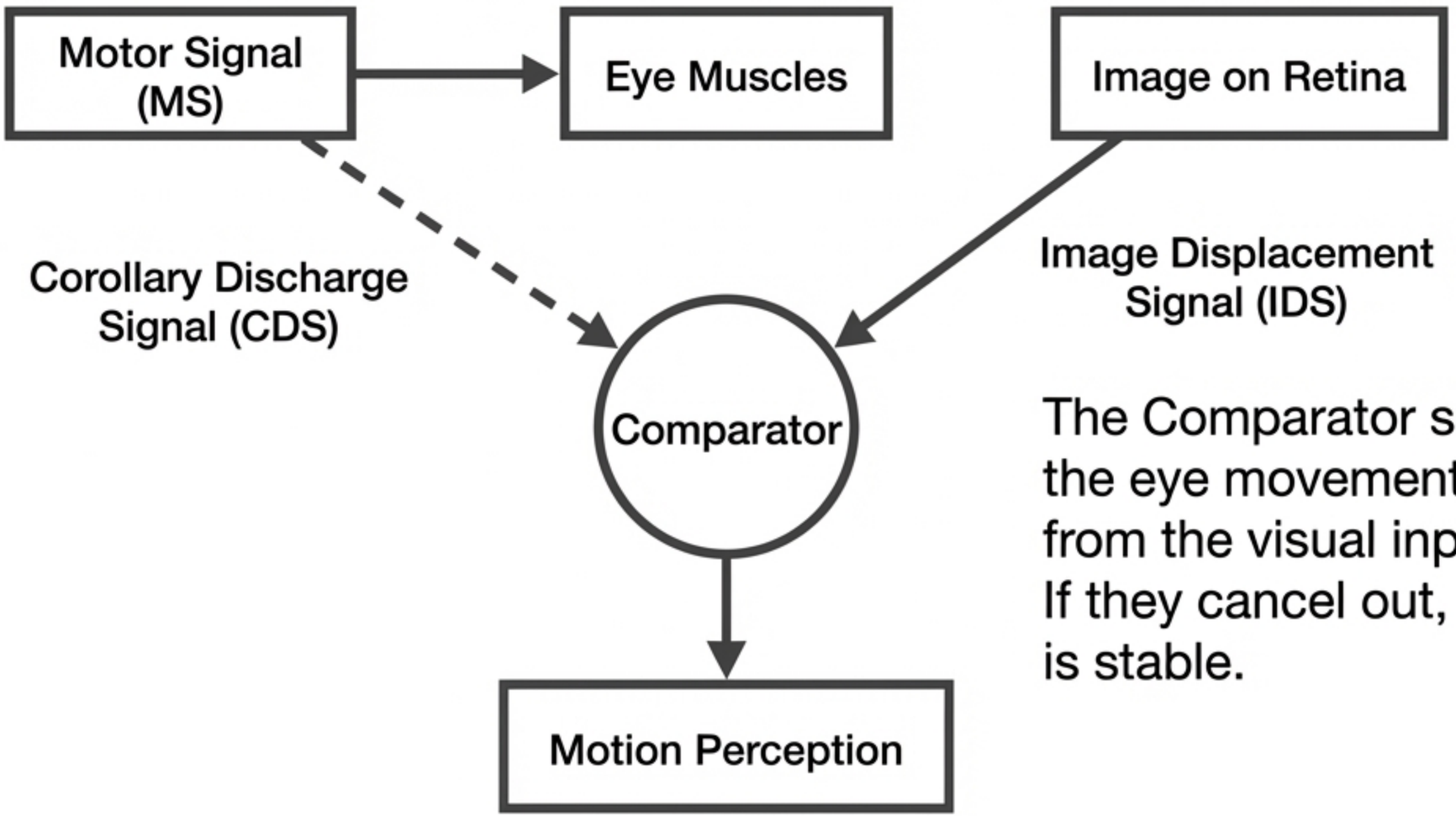
Global Optic Flow.

The entire scene moves at once at once (e.g., scanning eyes across a room).

Result: We perceive the environment as stationary and ourselves as moving.

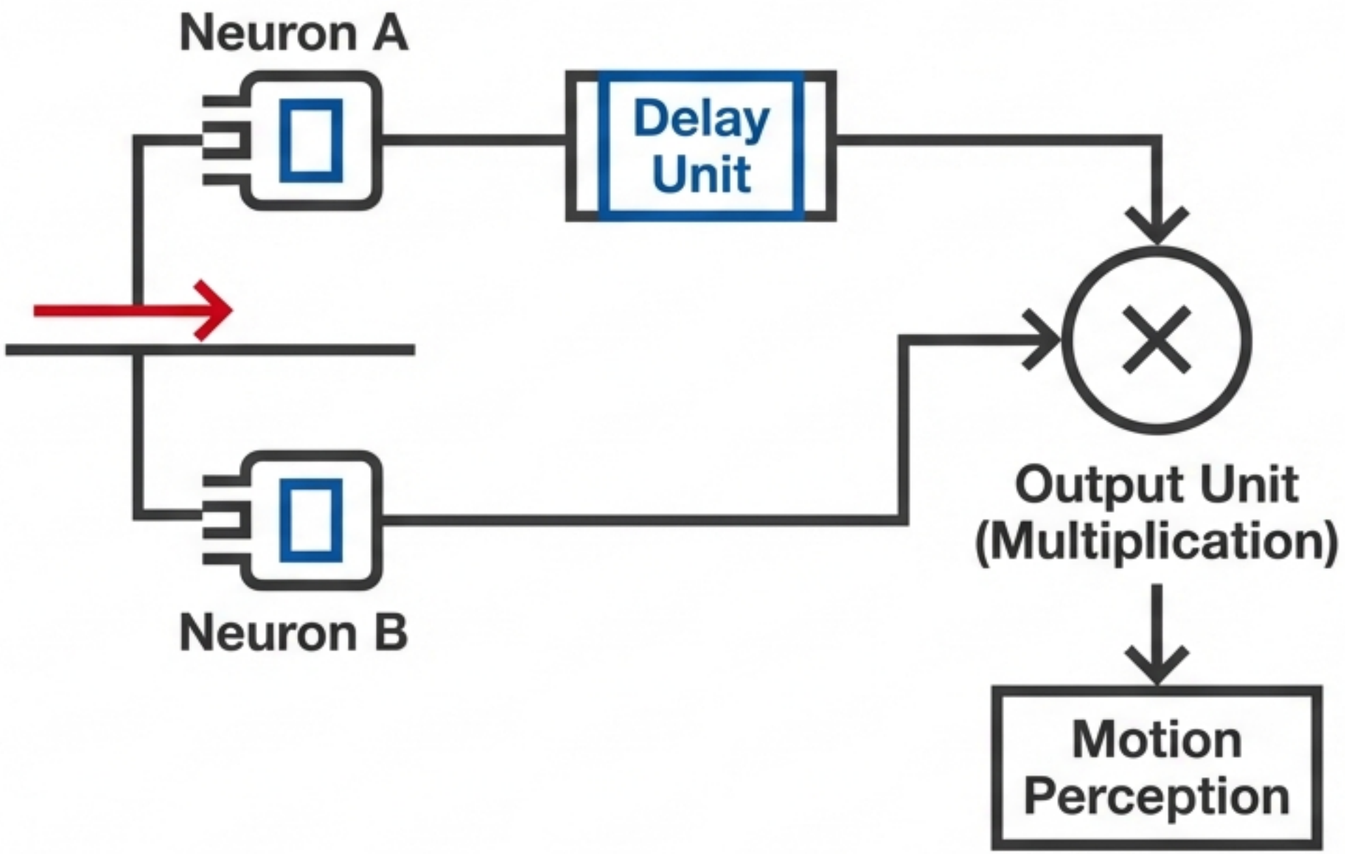


The Corollary Discharge Theory



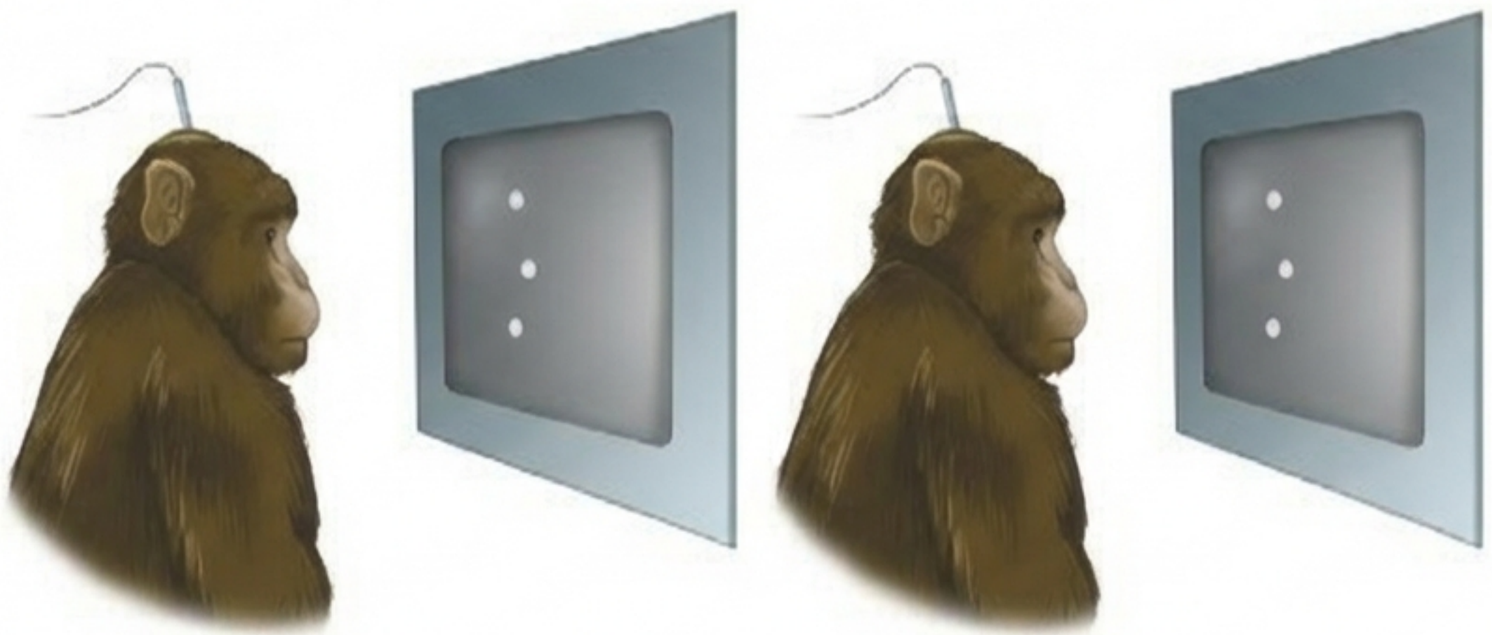
The Comparator subtracts the eye movement (CDS) from the visual input (IDS). If they cancel out, the world is stable.

Neural Mechanisms: The Reichardt Detector.



A simple circuit for direction selectivity. The Delay Unit pauses the signal from A so it arrives at the Output simultaneously with the signal from B, causing the neuron to fire only for specific speeds and directions.

The Motion Center: MT Cortex and Coherence.



Newsome's Coherence Experiment.

Stimulus: Moving dots with varying coherence (0% to 100%).

Finding: As coherence increases, MT neurons fire more rapidly, and perceptual accuracy improves.

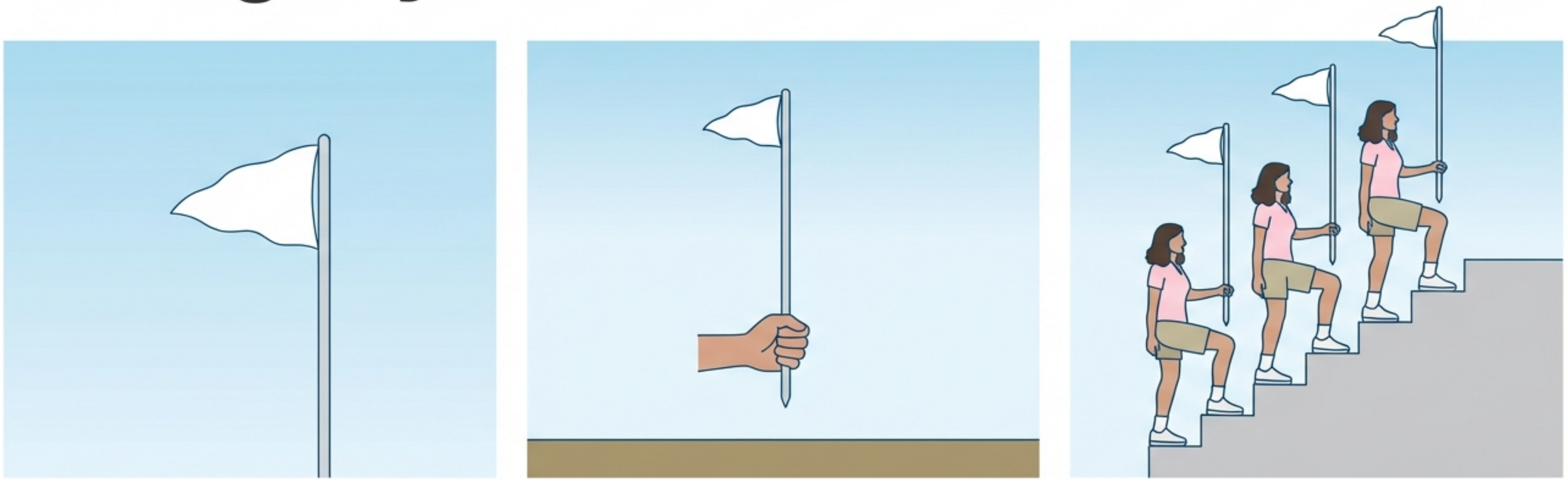
Conclusion: Perception of motion is directly linked to the firing rate of MT neurons.

Proving Causality: Microstimulation and TMS.

1. Microstimulation: Stimulating “downward” neurons caused a monkey to see diagonal motion when viewing rightward dots.

2. TMS (Transcranial Magnetic Stimulation): **Temporarily disrupting MT cortex in humans creates temporary Akinetopsia (motion blindness).**

The Aperture Problem: Ambiguity at the Neural Level.



The Challenge: Individual neurons view the world through a tiny “aperture” (receptive field). A vertical pole moving horizontally looks identical to a pole moving diagonally when the ends are hidden. The single neuron cannot tell the difference.

Solving the Aperture Problem.

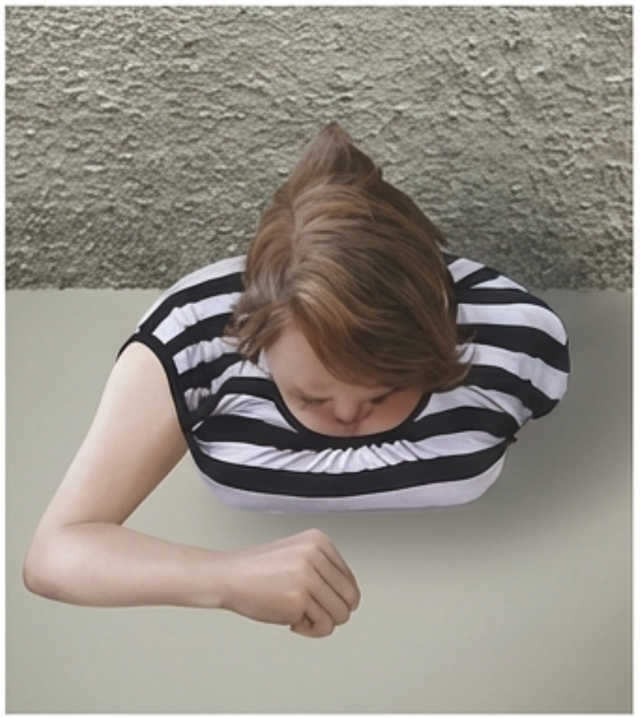
Solution 1: Terminators.

The brain tracks the ends of objects (the tip of the pencil) to determine true direction.

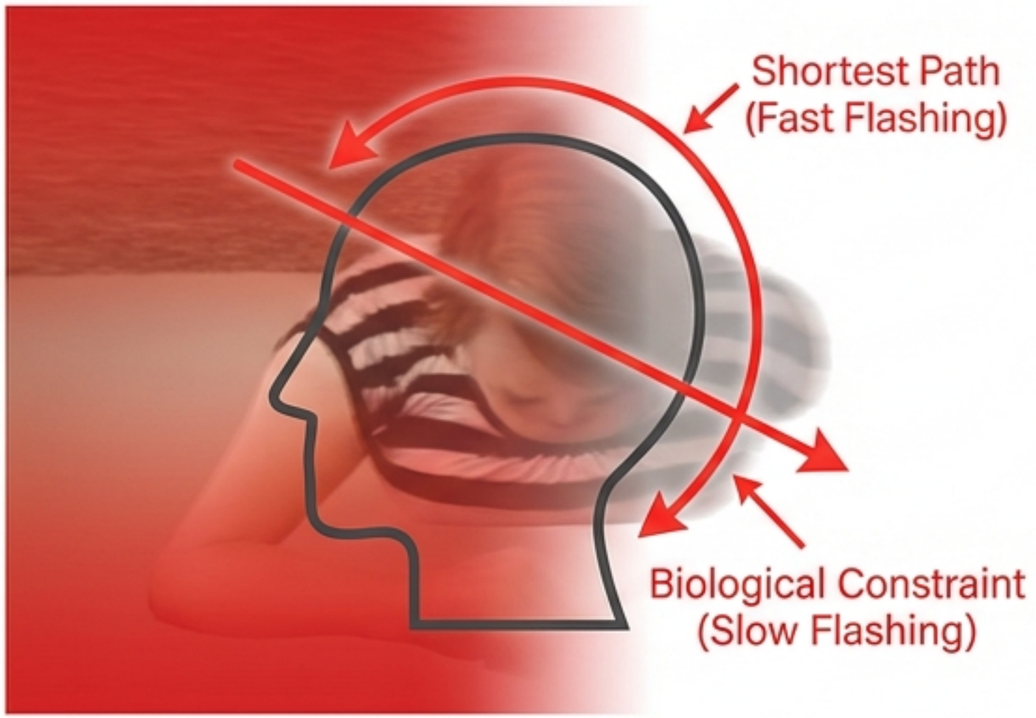
Solution 2: Neural Pooling.

MT cortex neurons integrate signals from many V1 neurons to solve the geometry within 140ms.

Apparent Motion of the Human Body.



Experiment Setup: Top-Down View



The Shortest Path Constraint vs. Biological Constraints.
Fast flashing: The brain sees the hand pass THROUGH the head (shortest path).
Slow flashing: The brain sees the hand go AROUND the head (biological constraint). The cortex knows solid objects cannot pass through skulls.

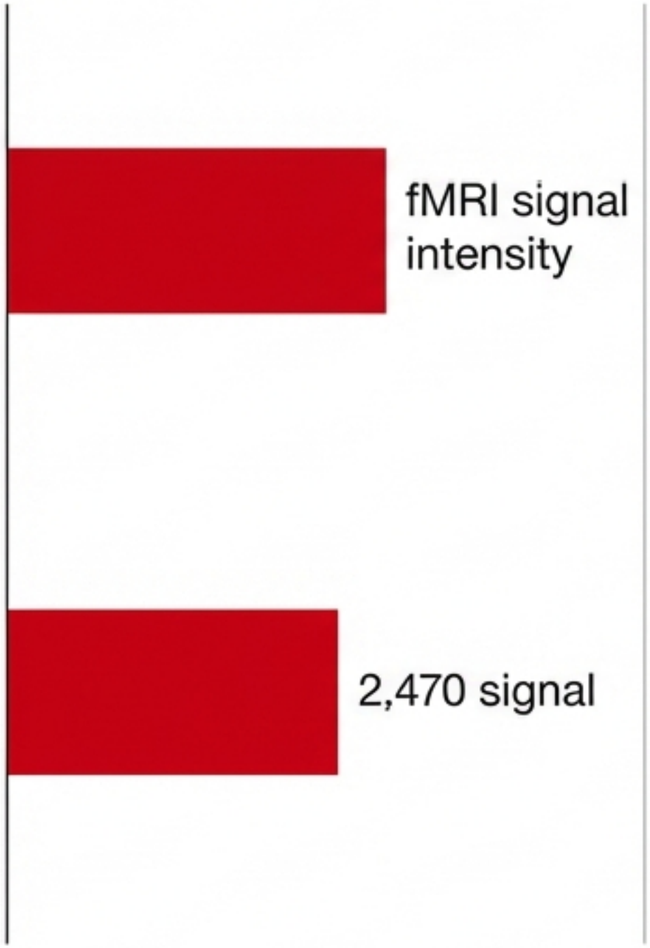
Experiment Setup: Hand Position

Implied Motion and Representational Momentum.

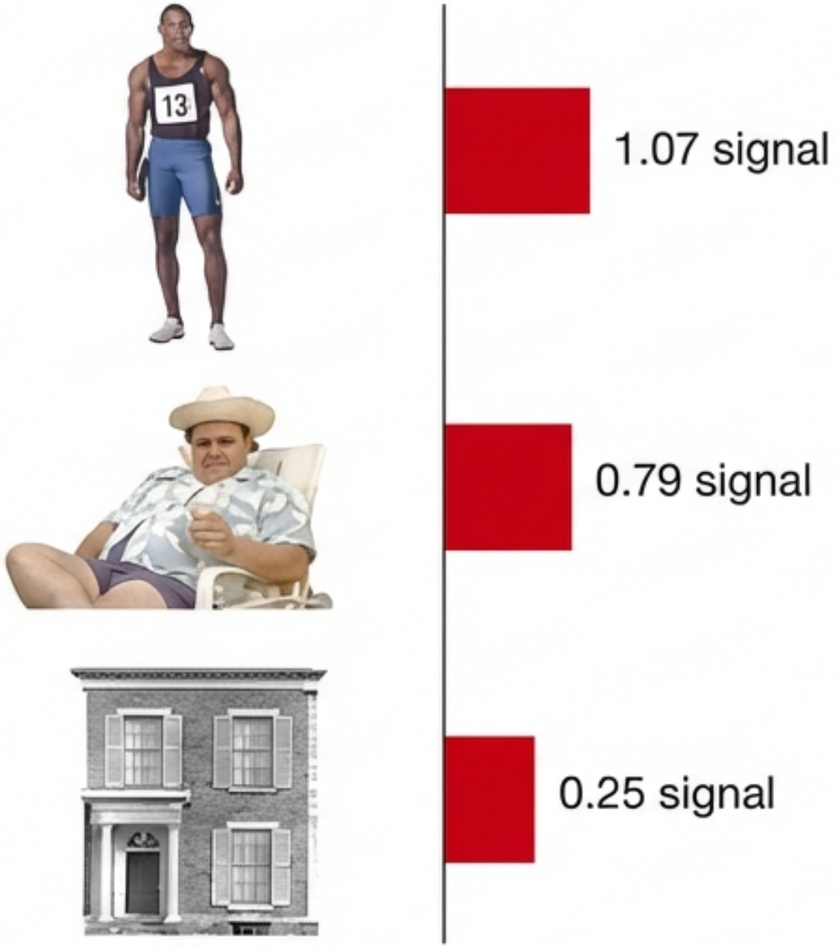
Representational Momentum. When asked to recall the middle image, observers consistently remember the boy being closer to the ground (right image) than he actually was. The brain “plays the video forward,” predicting the future position.

The Brain's Response to Stillness.

High Implied Motion



Low/No Motion



fMRI signal intensity in MT cortex is highest for static images that imply action.

Conclusion: Motion is a Construct

Function: Melvitica Now Display Bold
Motion is essential for survival, navigation, and social connection.

Mechanism: Helvetica Now Display Bold
Perception relies on complex neural computations—from Reichardt detectors to Corollary Discharge—that construct reality rather than recording it.

Psychology: Helvetica Now Display Bold
The brain predicts the future (Representational Momentum) and understands biology, filling in gaps to create a seamless dynamic world.

Motion is one of the central phenomena in our lives and, therefore, in perception as well.