



Psychological Reality: Why We See the World the Way We Do

Video Transcript

Learning systems

Behavior can be organized in remarkably powerful ways, even without involving much cognition. Across many species, evolution has produced hardwired, pre-programmed mechanisms that reliably guide action. We see this in the fixed action patterns of the greylag goose. We see it again in the frog's selective vision, and in the cat's feature-detecting brain. Together, these mechanisms show how organisms orient themselves in the world. They assign value to what they encounter — approaching what is beneficial and avoiding what is harmful. Behavior is regulated through internal motivational states, and through perceptual systems that already filter for relevance.

The frog, for example, does not see the world as a neutral visual scene. Even at the level of the eye, information is selectively processed before it ever reaches the brain. Hubel and Wiesel showed that this logic continues in the cortex. There, neurons extract specific features and organize them hierarchically into increasingly meaningful units.

Much of animal life can be navigated by such built-in programs — reflexes, instincts, and fixed action patterns. For many ecological situations, this is entirely sufficient. The problem, however, is that these programs remain rigid. When environments become unpredictable, behavior must change within a single lifetime. At this point, fixed programs are no longer enough.

In evolutionary terms, this kind of flexibility reflects two different timescales of change. One operates across generations. The other unfolds within an individual's lifetime. These are known as phylogenetic adaptation and ontogenetic adaptation. The shift from the first to the second marks the emergence of learning.

The sea slug *Aplysia* offers one of the simplest and clearest demonstrations of this evolutionary innovation. When touched on its siphon, it withdraws its gill reflexively — a hardwired defense response. But repeat the harmless touch many times, and the response fades — the animal learns that the stimulus is not a threat. This process is called habituation. It reduces unnecessary reactions and conserves energy. Conversely, if the touch is paired with a mild electric shock to the tail, the withdrawal becomes stronger and longer lasting—a process called sensitization. The animal now learns that the context predicts danger.



These two primitive forms of learning — habituation and sensitization — mark an important shift. They represent the earliest neural adaptations for behavioral flexibility. Even in *Aplysia*, learning modifies existing neural circuits. The nervous system doesn't need to evolve a new behavior — it simply adjusts what is already there.

So, learning, in its most fundamental form, is a neural adaptation to a changing environment.

From these elementary mechanisms, learning extends into more complex systems that link stimuli and outcomes. Organisms begin to anticipate. They connect what happens now with what is likely to happen next. Learning changes in a fundamental way. It becomes associative. It no longer merely adjusts the strength of reflexes. Instead, it allows behavior to reflect regularities in the environment

At this point, cognition becomes predictive.