Agents use sophisticated event models to predict characteristics of their environments. As events unfold over time, agents implicitly and rapidly adjust their predictions based on these models, which can produce feelings of surprise and suspense.

Surprise, or unsigned prediction error, tracks the difference between current and previous predictions. According to Event Segmentation Theory (EST), surprise can drive the segmentation of ongoing experience into distinct events. Surprise can also trigger learning that updates subsequent predictions about the structure of the world, and can benefit memory for immediately preceding events.

Suspense occurs when the agent anticipates that an upcoming event will strongly influence their environment. We used sports games to understand how suspense influences memory, physiology, and neural activation patterns in humans.

### Operationalizations:

**Predictions:** “win probability” from an expert basketball analyst (https://kenpom.com/) updated after each change in possession.

**Surprise:** average value of the derivative of the win probability time course. We also compute signed prediction error if the subject prefers which team wins.

**Suspense:** 1) Find instances in a large set of games with a particular game state (amount of time remaining and difference in win probability between the teams) and 2) calculate, for each state, the variability in the belief change produced by the following state.

### Take-home messages

Surprise and suspense derived from real-world sports games map onto behavioral, physiological, and neural measures. Surprise predicts ISCs across primary sensory and higher-level cortical regions. Surprise predicts pupil area changes. Surprise and pupil area changes predict memory. Results confirm predictions of EST: Games with more surprise and suspense have greater surprise and pupil area changes. vmPFC and V1 transitions predict memory. vmPFC transitions predict memory. vmPFC transitions predict memory.

### References