A novel framework linking insight to general brain mechanisms

Mnemology Lab

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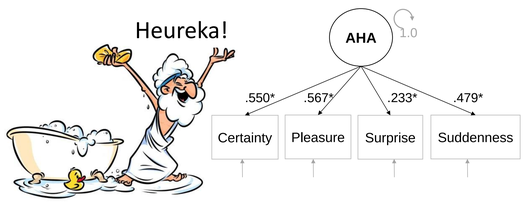
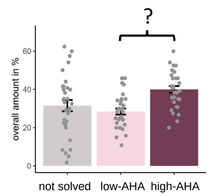
INTRODUCTION

Sudden insights are among the most fascinating human experiences, combining cognitive breakthroughs with the distinctive "AHA“ or “Eureka” moment—characterized by surprise, pleasure and certainty about the solution’s correctness.[3]



Why are we surprised and certain about thoughts we generate ourselves? What explains the phenomenology of the AHA experience?

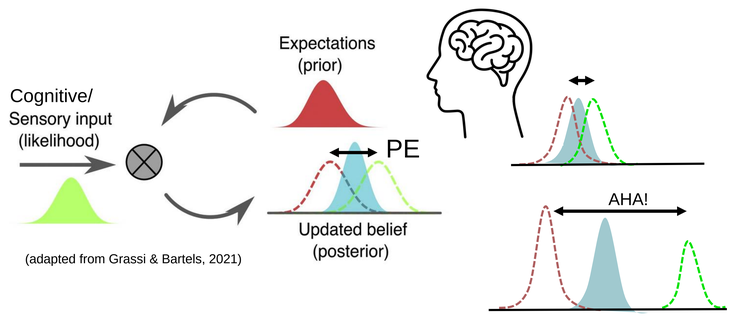
Mooney image

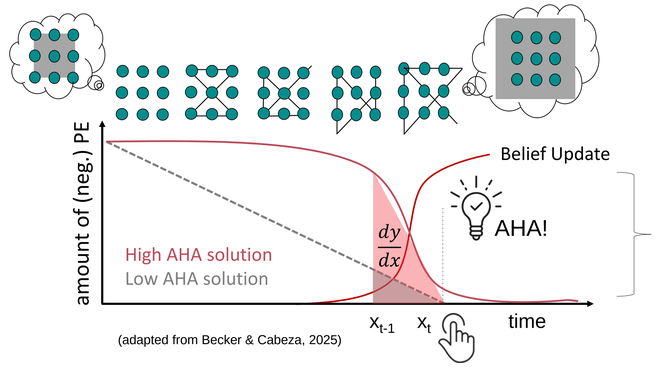


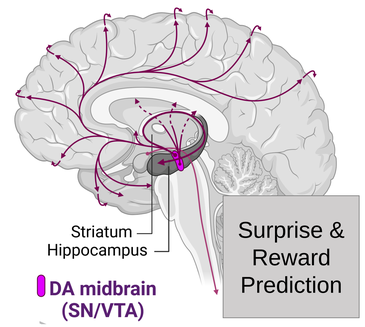
Cognitive theories[7] have explored the processes leading to insight, while neuroscience has focused on locating insight in the brain, but neither has fully addressed this question. The insight-as-prediction-error hypothesis offers a novel explanation, linking the phenomenology of insight to predictive processing and the concept of prediction error (PE). [1,3,4,5,6]

INSIGHT-AS-PREDICTION-ERROR HYPOTHESIS

Derived from Predictive processing accounts

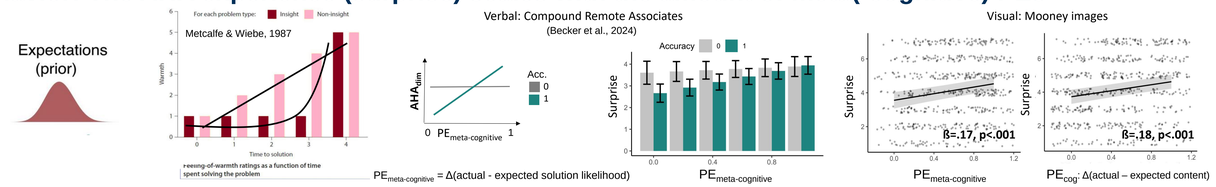




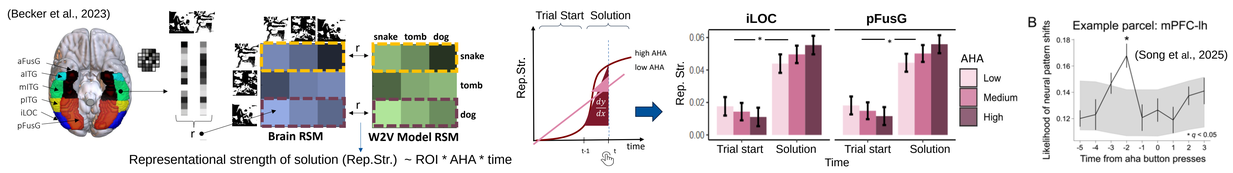


EMPIRICAL EVIDENCE

Behavior: The AHA experience (surprise) scales with the amount of meta(-cognitive) PEs

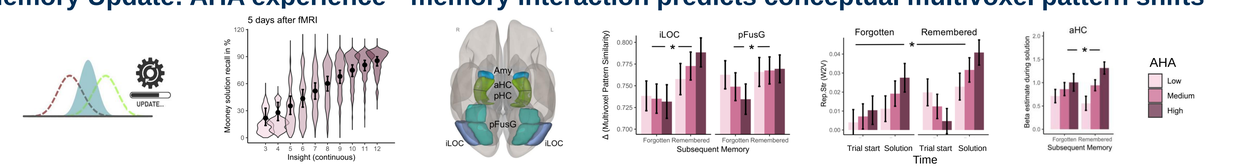


Brain: The AHA experience is associated with stronger conceptual shifts in multivoxel patterns



Representational strength of solution (Rep.Str.) ~ ROI * AHA * time

Memory Update: AHA experience * memory interaction predicts conceptual multivoxel pattern shifts



CONCLUSION

Insight-as-prediction-error hypothesis reconceptualizes insight as an emergent phenomenon that arises when the brain drastically updates its prior expectations (belief) as reflected in changes in multivoxel pattern similarity. This update is experienced as surprising, pleasing and certain.

This links insight to broader brain and learning frameworks (predictive processing).

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