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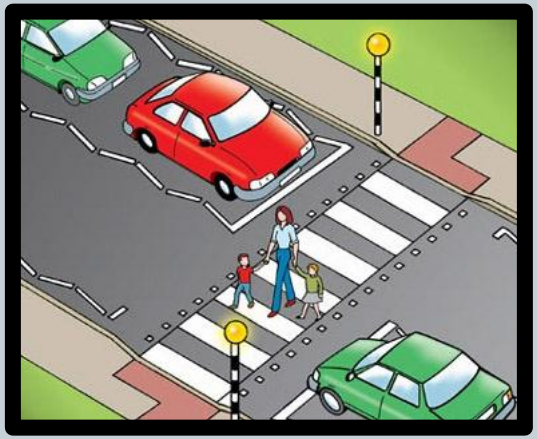
Planning Mobility for City's Sustainability

COGNITIVE PERSPECTIVES ON ROAD SAFETY: A PROPOSAL

Krishna Prasad Miyapuram
Cognitive Science & Computer Science
Indian Institute of Technology Gandhinagar

Behaviour at the Cross Roads



Technology

Human

Cognitive Engineering

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Inter-connecting Cognition & Safety

- Heterogenous traffic
  - Density
  - Conveyance
- Rule violations
  - Parking
  - Crossings
- Infrastructure
  - Congestions
  - Climatic conditions

Understanding Human Behaviour for better Solutions !!

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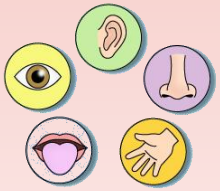
Cognitive Processes

Decision making

Top-Down Effects

Bottom-Up Effects

Learning



Attention

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Learning

- Learning is defined as a change in behavior
  - is essential for survival in an uncertain environment.
  - An adaptive organism must learn to predict the upcoming stimuli in order to prepare behavioural

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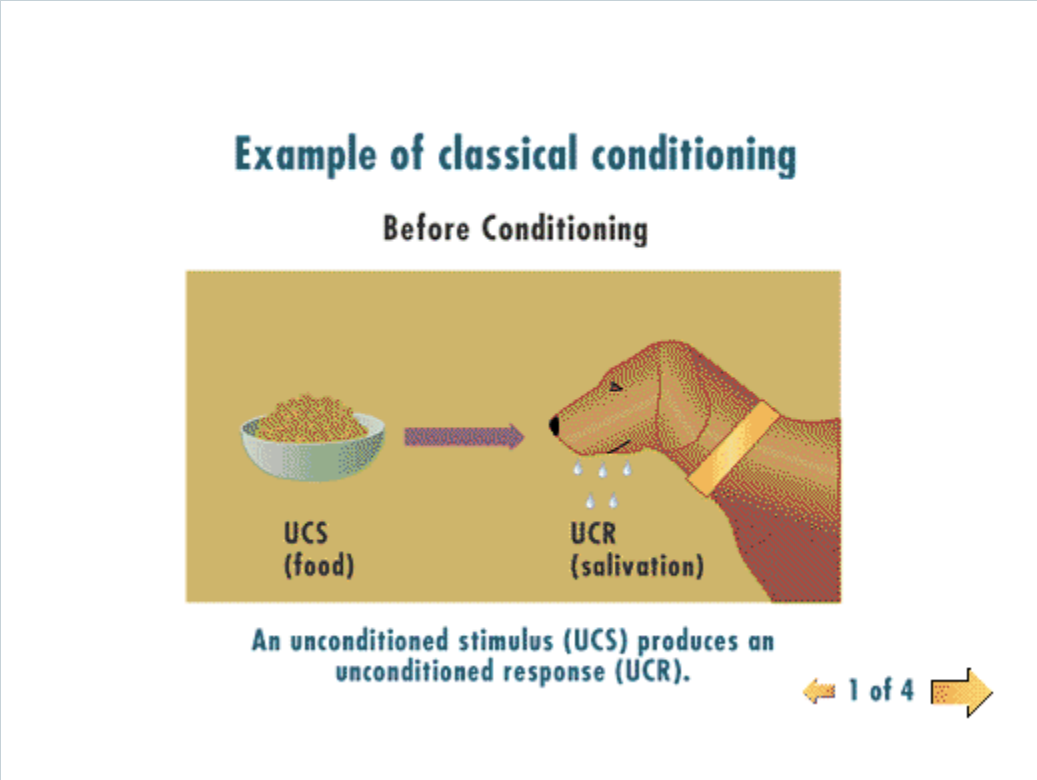
Associative Learning



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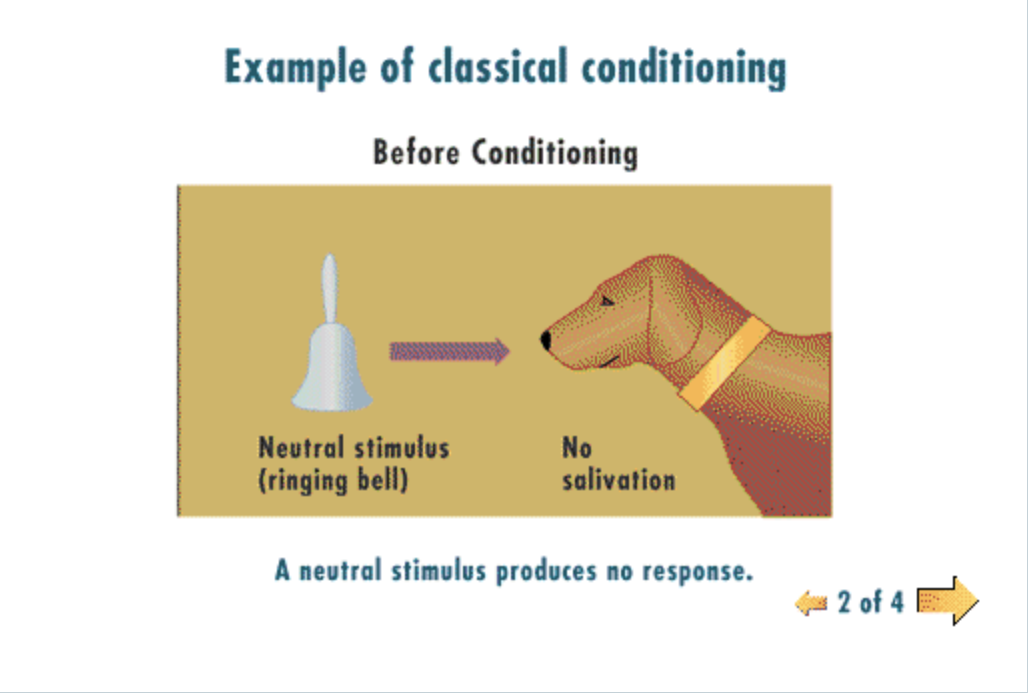
Associative Learning



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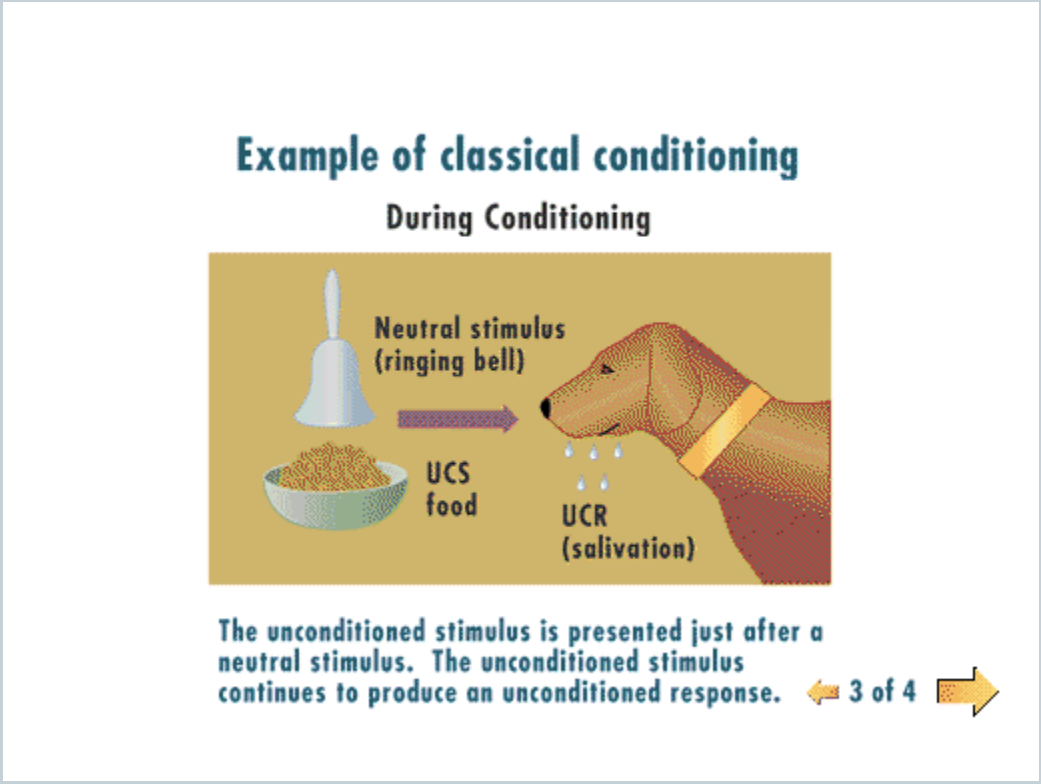
Associative Learning



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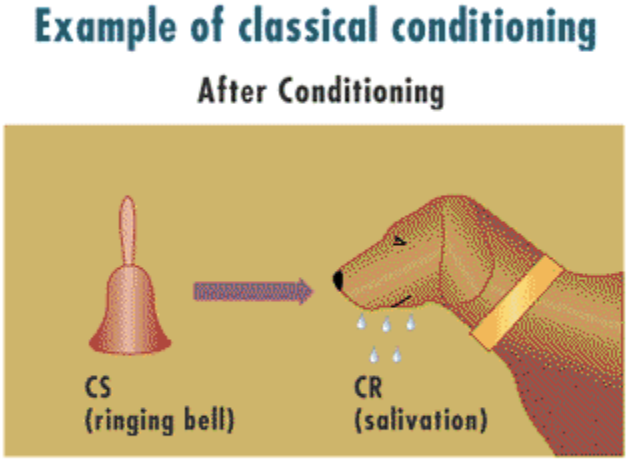
Associative Learning



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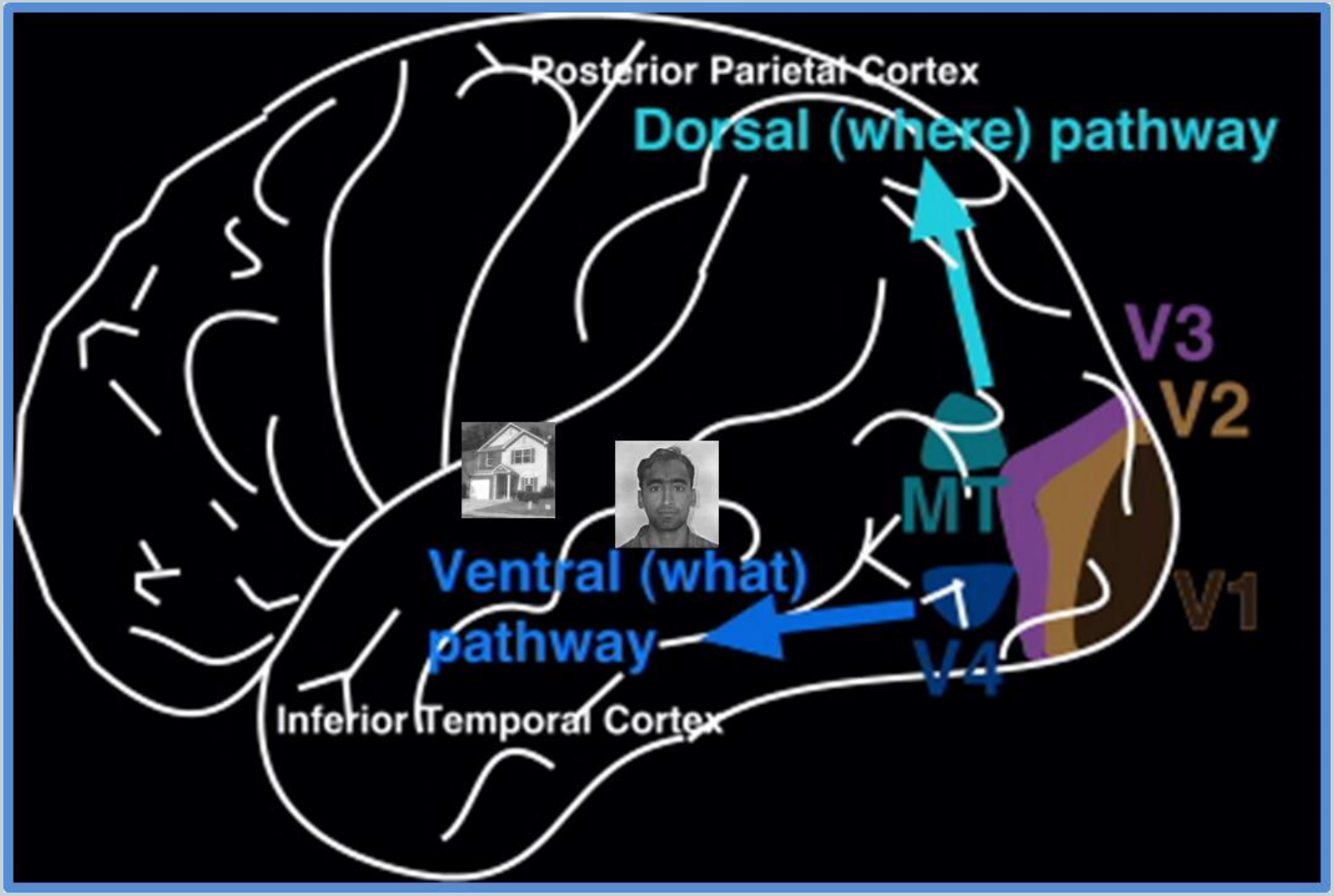
What and Where



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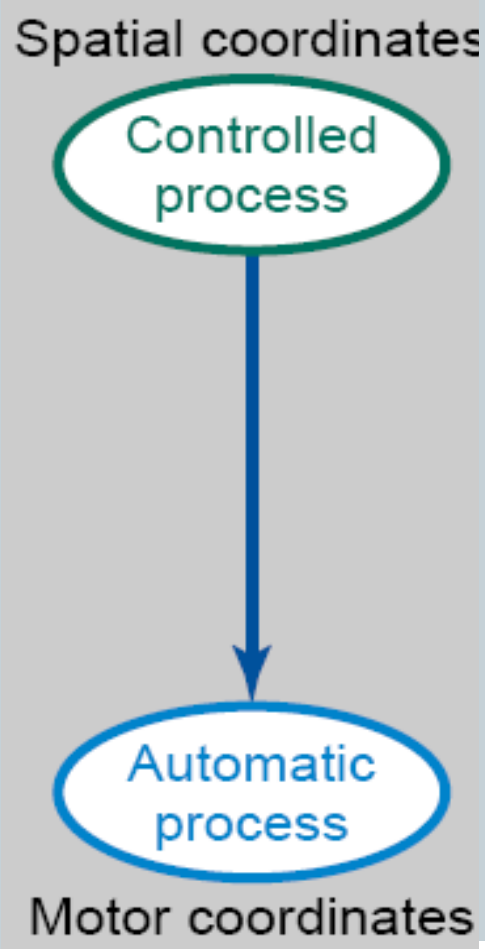
Stages of Learning

- Skill Learning progresses from
- an early, slow and deliberate stage
- to a late, fast, and automatic stage



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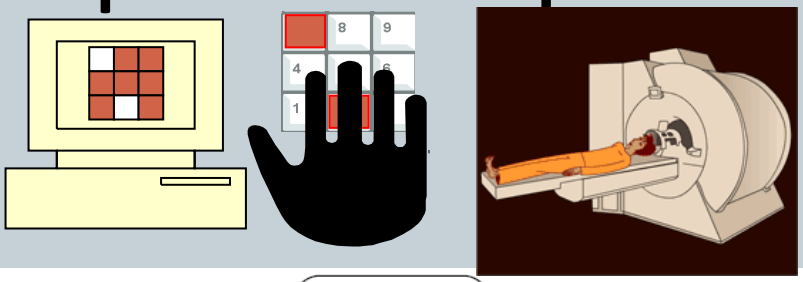
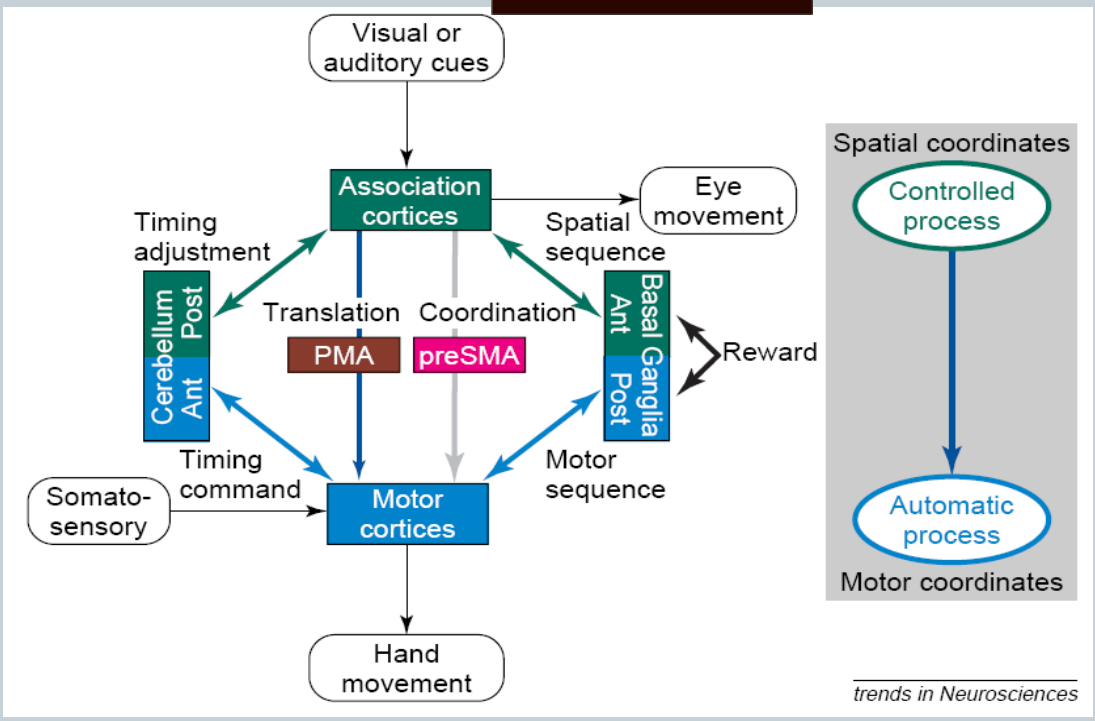
Sequence representations





Hikosaka et al., 1999

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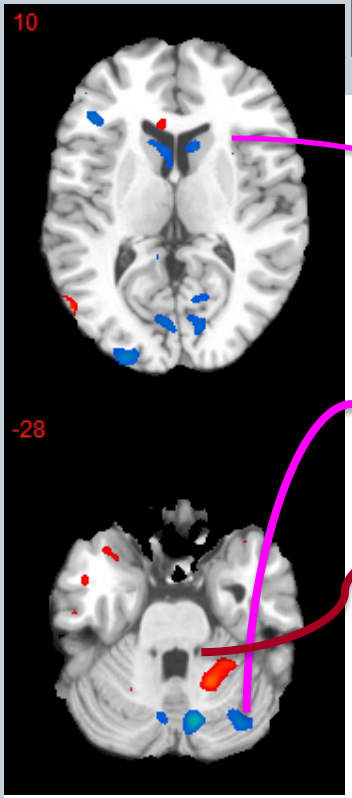
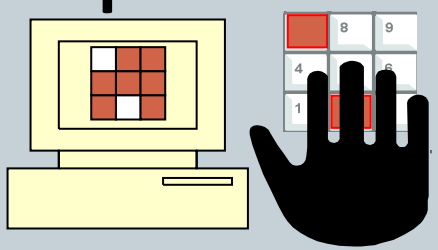
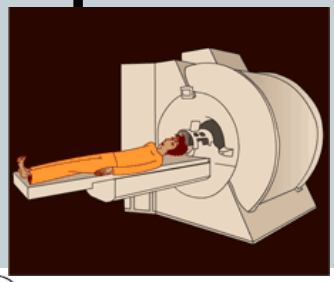
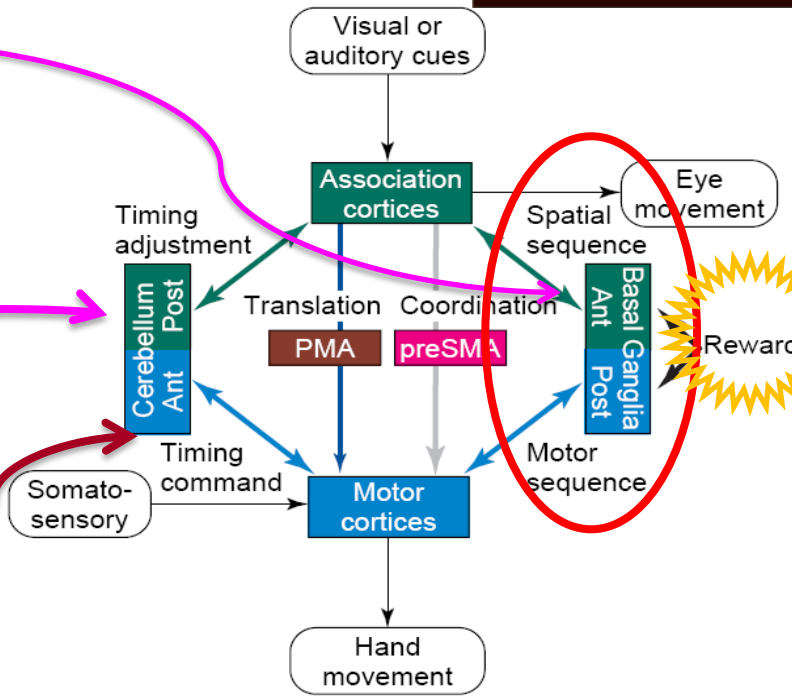
Sequence representations



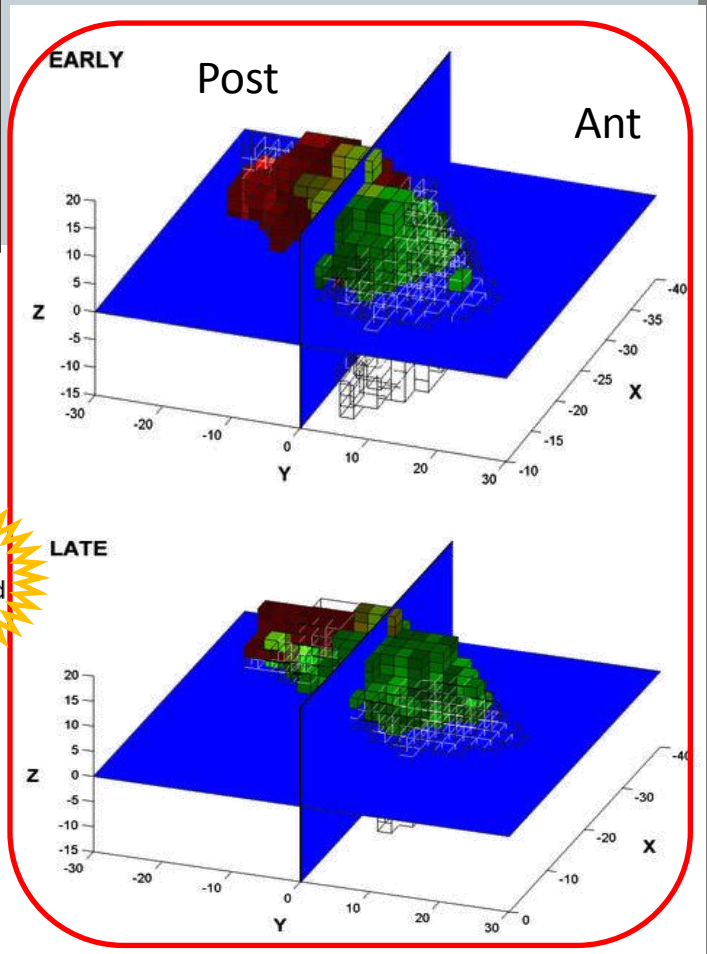
Miyapuram et al., in prep







Hikosaka et al., 1999



Bapi et al., 2006

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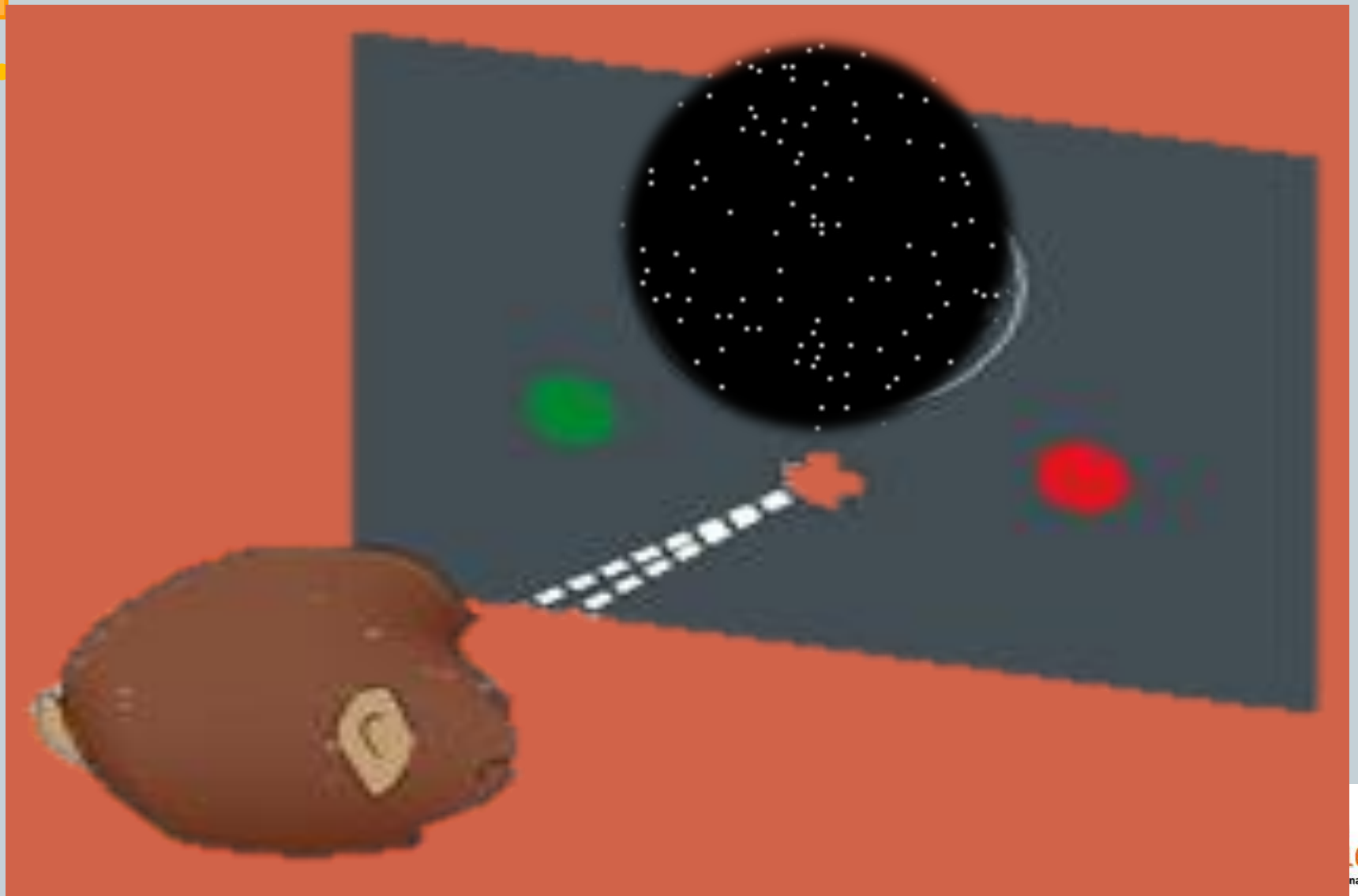
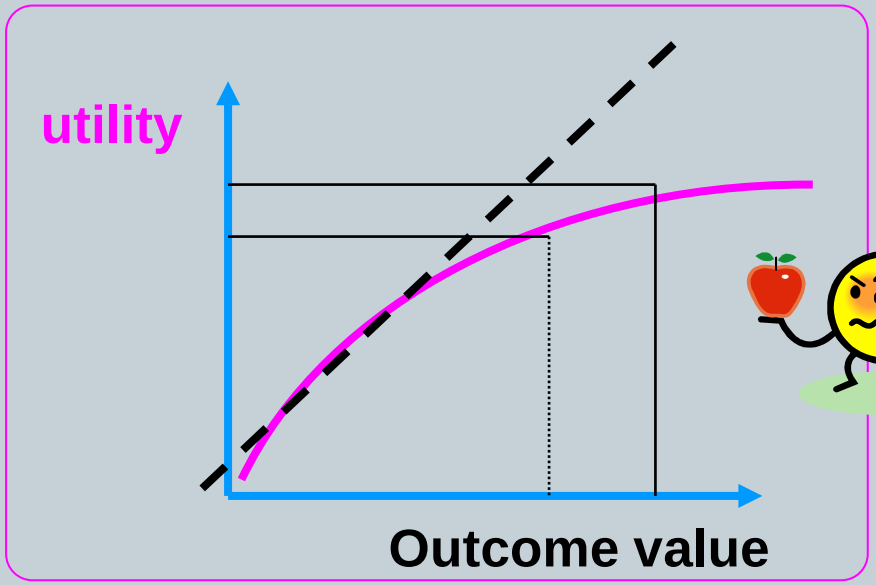
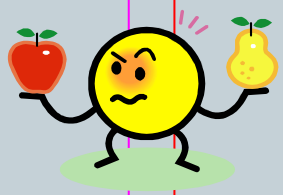
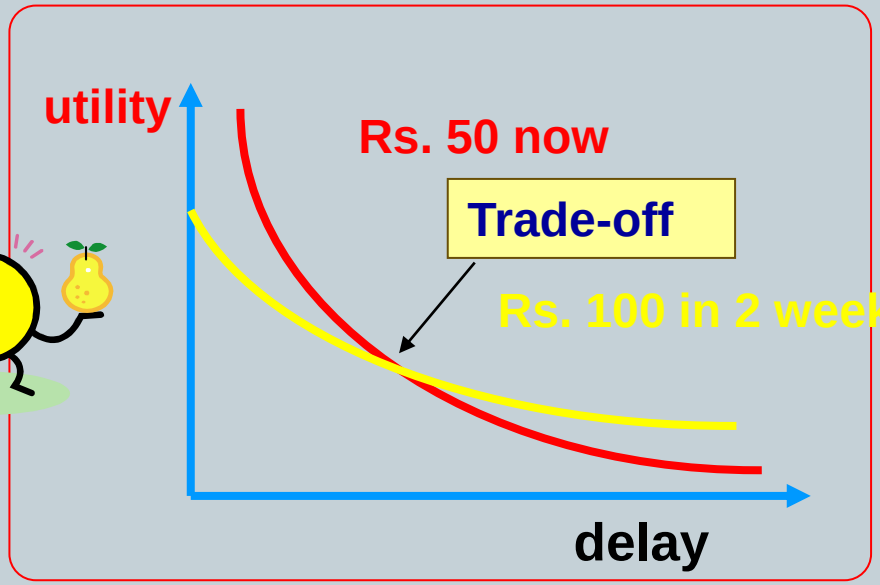
Decision making



Microeconomics







Rule Violations:
Frequent Short – term gain Vs. Infrequent Penalty

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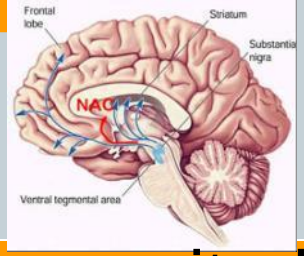

magnitude

Small

Medium

Large

-0.8 0 0.8 s

Reward

Tobler, Fiorillo & Schultz, 2005

probability

p=0.0

p=0.25

p=0.5

p=0.75

p=1.0

1 sec

CS Reward

Fiorillo, Tobler & Schultz 2003

m x p

0.0 ml

CS

0.025 ml

CS

p=0.5 x 0.05 ml

0.075 ml

CS

p=0.5 x 0.15 ml

0.15 ml

CS

p=1.0 x 0.15 ml

0.25 ml

500 ms

CS

p=0.5 x 0.5 ml

The Power of Simulation

- Imagery: Mental States like those that arise during perception but occur in the absence of immediate sensory input.

	Perception	Imagination
Reward		
No Reward		

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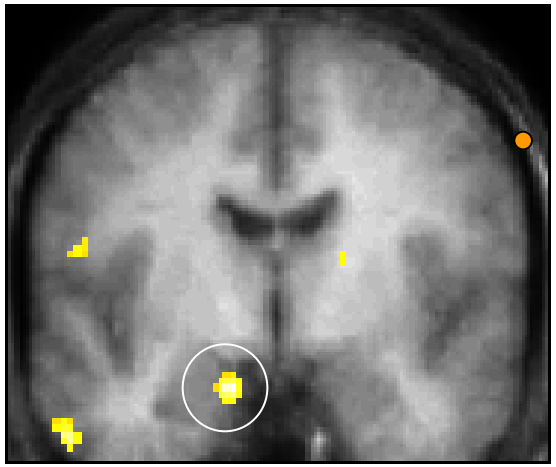
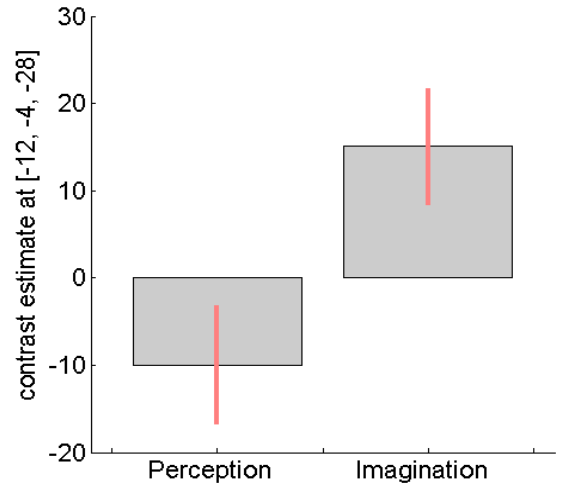
Imagination

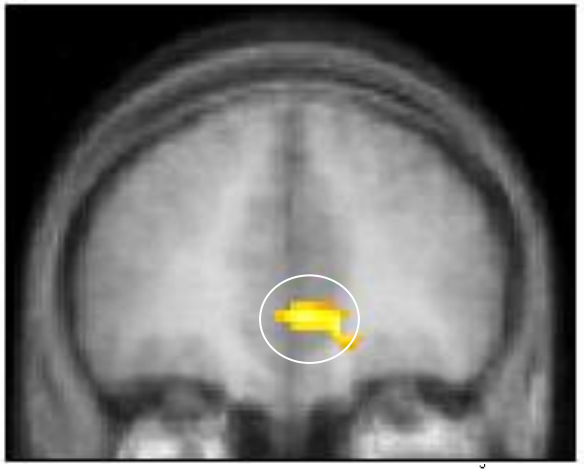
Parahippocampal gyrus

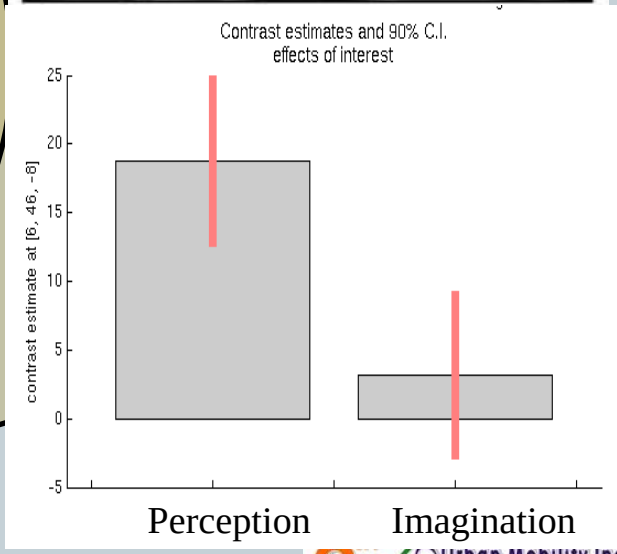




Midbrain

medial orbitofrontal cortex





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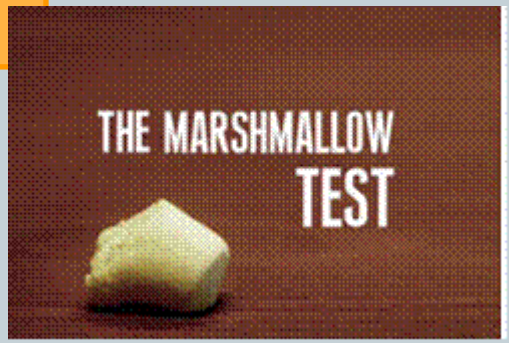
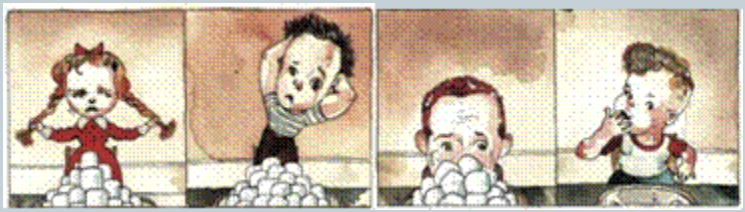
Delayed Gratification





Children who are able to pass the marshmallow test enjoy greater success as adults.

Mischel et al. (1989)

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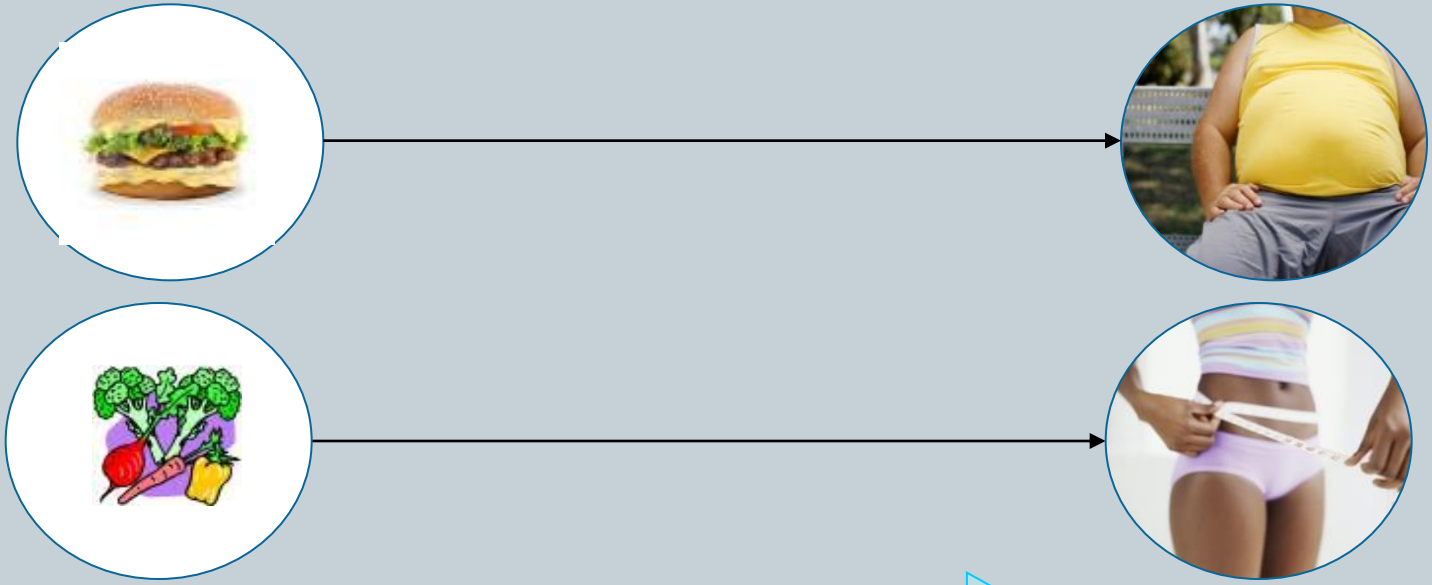
Price elasticity of calories

High-fat highly liked product now (immediate reward = taste)
OR
Still being slim in 6 months (delayed reward = health benefit)



Now → **Time** → **Later**

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Thank you

Cognitive Engineering

- Think from the Human perspective when we have multiple Technology Solutions

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