Learning

&

Memory

Definitions

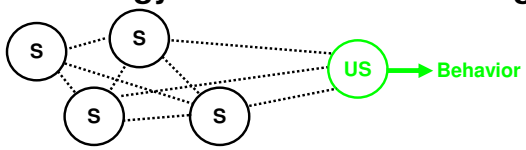
- Learning: is shown if there is a change in behavior with experience.
  - But not always (physical training? Fatigue?)
  - And sometimes not, or not immediately (Latent learning, modulatory learning)
- Memory: retaining learnt information

Types of learning

- Habituation & sensitization
- Associative learning
  - classical conditioning
  - operant conditioning
- Imprinting

- Social/observational learning
- Insight learning (?)

Terminology in associative learning



- US – unconditioned stimulus
- CS – conditioned stimulus
- CR – conditioned response
- S-R association – stimulus-response a.
- S-S association – stimulus-stimulus a.

Types of learning

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What is studied -

- Conditions, content, and effects of learning
- Rats, pigeons, honey bees, Aplysia
- Lab experiments in 'Skinner boxes' – pressing or pecking keys or computer screens
- Compound stimuli, time course of learning, generalization

What do we know…

- **Blocking** (cues with no additional predictive value not learned), **overshadowing** (when learned in combination, less reaction to individual cues), **potentiation** (reaction increases after learning combination), **interference** (with short interstimulus intervals)
- Extinction and re-learning
- Not everything is learned equally well in any context – no general-purpose machinery!

Specific learning abilities

Bees learn some colors better than others, and colors more easily than shapes

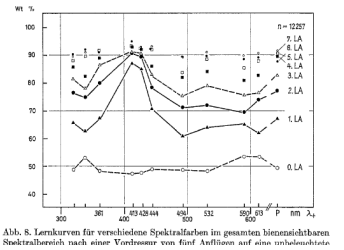


Abb. 8. Lernkurven für verschiedene Spektralfarben im gesamten bienensichtbaren Spektralbereich nach einer Vordressur von fünf Anflügen auf eine rotbelassichte

% correct after different numbers of training trials as dependent on wavelength

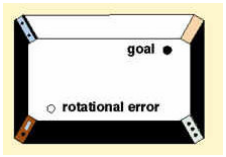
Menzel 1967

Specific learning abilities

- Pigeons easily learn to associate a sound with shock, or a visual cue with food, but not vice versa (also selective blocking)
- Rats learn to associate a taste with illness several hours later, whereas other stimuli are not associated with this
- Food-storing birds can remember many spatial locations, but have no better memory for other cues than other birds

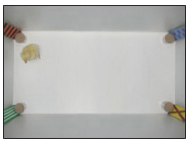
The society of mind

- (Learning) modules act in parallel
  - Example: the geometric module (thought to apply when disoriented)

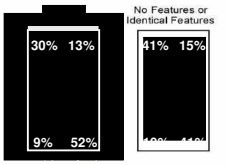


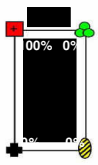
Evidence for a geometric module

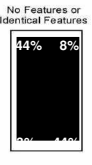
also human toddlers



also human adults







The society of mind

- (Learning) modules act in parallel
  - the geometric module
  - visual processing (vs. other modalities)
  - …
  - sexual behavior ?
  - foraging behavior ?

Learning & constraints

The society of mind

- How many modules are there?
- How do they interact?

- What is the benefit of modularity (encapsulation)?

Learning

What do we know…

- No general-purpose learning machinery
- Not just associative learning with rewards
- Representations of stimuli/contexts formed in animal mind → thoughts?

- [Species differences? Brain processes? Evolution? Ontogeny?]

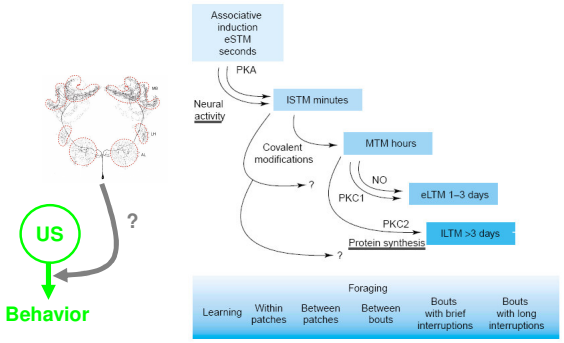
Learning & Memory

Brain processes in learning

- Memory stages: working, reference (short-term, long-term)

Learning & Memory

Brain processes in learning



Evolution of learning

What are the costs,

and what are the benefits of learning?

When do you expect learning to evolve?