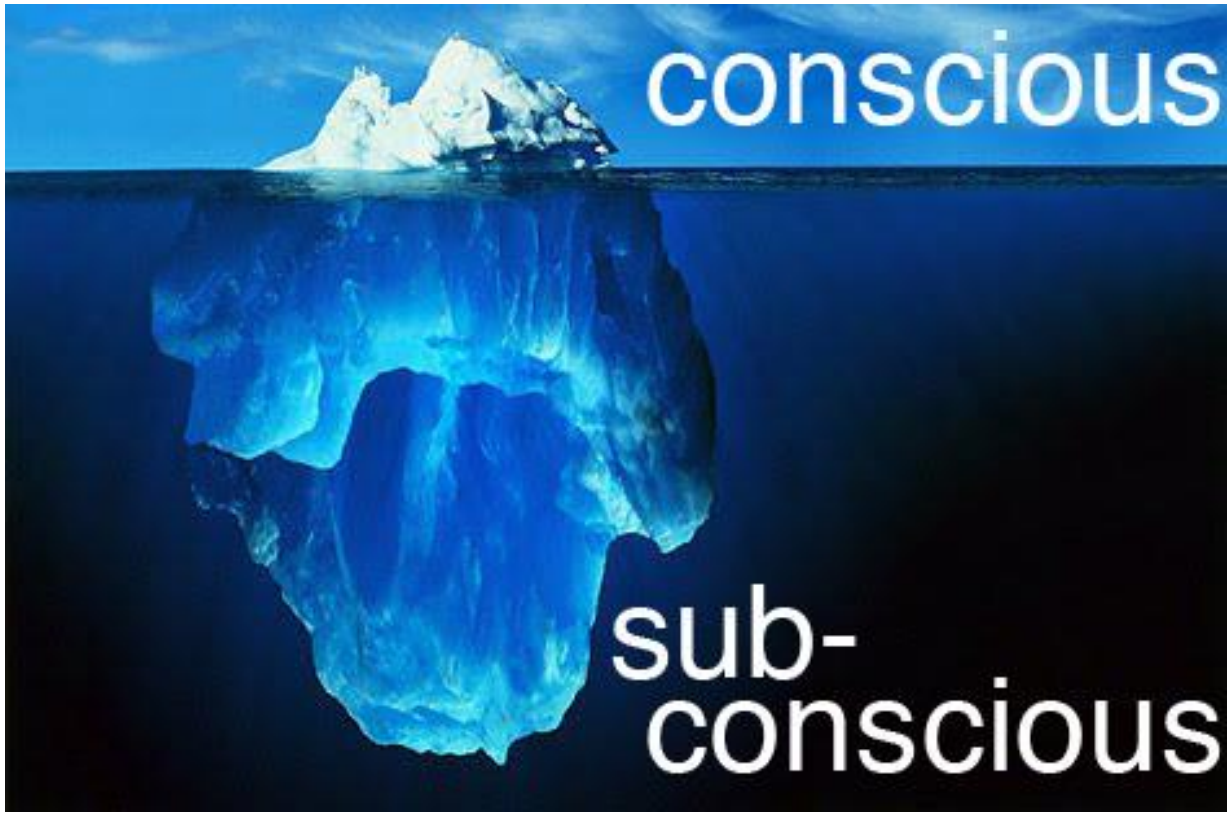
Lecture 5
Learning to Predict

11/8/2022

Thursday



The behavioral and biological processes for classical conditioning are the basic building blocks, the biological alphabet, from which more complex forms of learning emerge in all species, including humans.

Learning in online classes vs offline classes

Higher-Order / Second-Order Conditioning

Electric can opener

Conditioned stimulus (CS)

+

Food

Unconditioned stimulus (UCS)

=

Salivation

Unconditioned response (UCR)

Squeaky cabinet door

Second-order stimulus

+

Electric can opener

Conditioned stimulus (CS)

=

Salivation

Conditioned response (CR)

Squeaky cabinet door

Second-order stimulus

=

Salivation

Conditioned response (CR)

Compound Conditioning and Overshadowing

- **Compound conditioning:** conditioning in which two or more cues are present together, usually simultaneously, forming a compound CS

Tone + light → eye-blink (CR)

- **Overshadowing:** an effect seen in compound conditioning when a more salient cue within a compound acquires more association strength than does the less salient cue and is thus more strongly associated with the US

tone (loud) + light (dim)→ eye-blink

Tone (soft) + **light (bright)** → eye-blink

E.g. Packaging + Price → purchasing a product

Blocking effects

Kamin's Blocking Effect

Temporal Overshadowing:

Group	Phase 1	Phase 2	Phase 3 (test)
Control group	Rat sits in chamber; no training	Tone + light → eyeblink (CR)	only light or only tone → medium CR
Experimental "pretrained" group	Light → eyeblink	Tone + light → eyeblink (CR)	only tone → little or no CR (learning is "blocked")

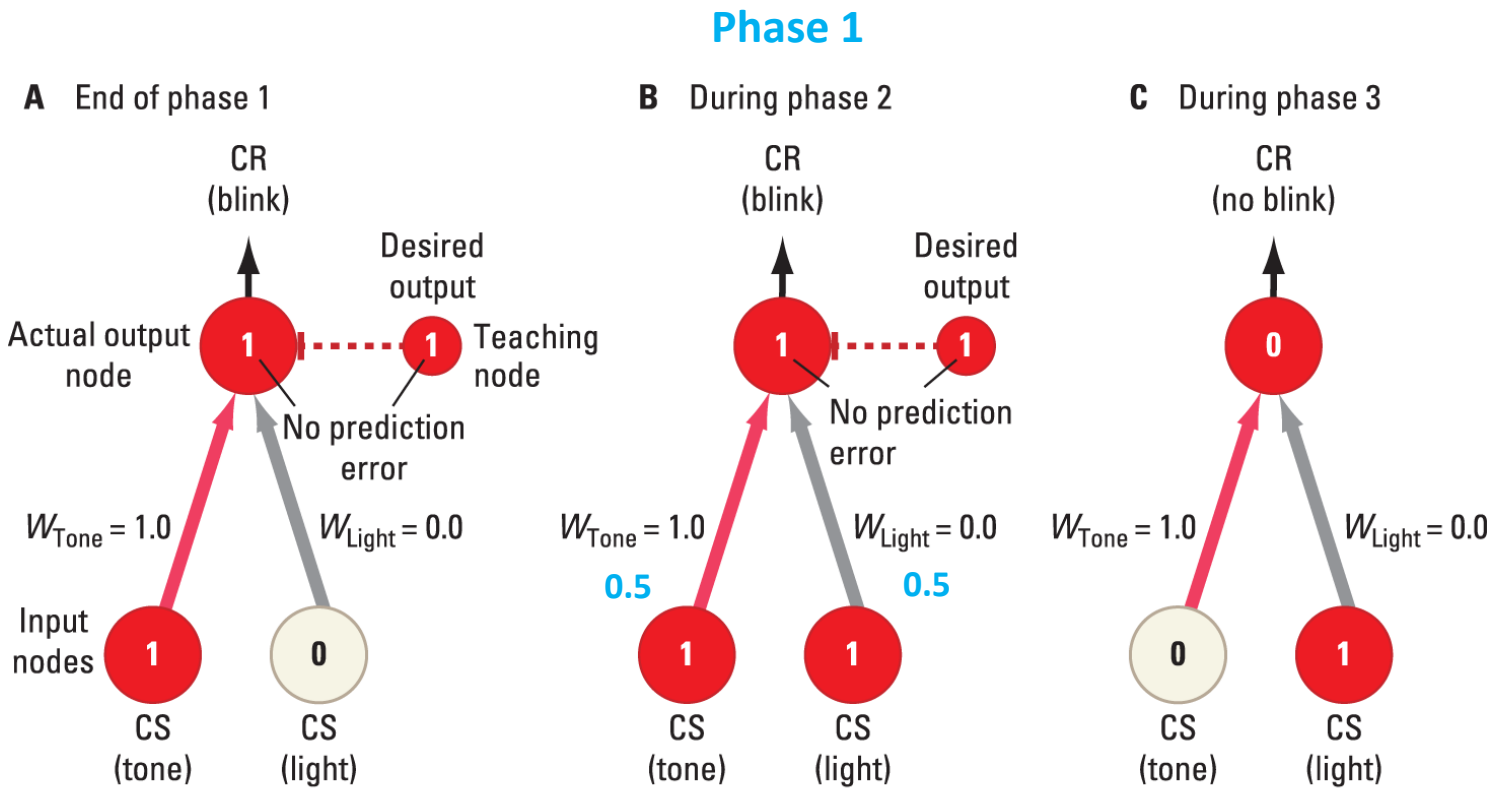
For a stimulus to become associated with a US, it must impart reliable, useful, and nonredundant information

The ability of the tone to predict eye-blink is lowered or lost

E.g. Packaging + Price → purchasing a product

The Rescorla–Wagner Model of Conditioning

- changes in CS–US associations on a trial are driven by the discrepancy (or error) between the animal's expectation (or prediction) of the US and whether the US actually occurred
- This error is sometimes referred to as the **prediction error**
- weights associated with one cue can indirectly influence the weights accruing to other, co-occurring cues
- Made surprising predictions about how animals would behave in *new* experimental procedures



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A Phase 1 training

Category A

Category B

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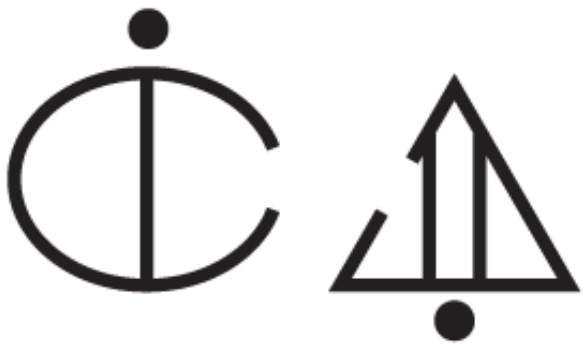
B Phase 2 training



Category A

Category B

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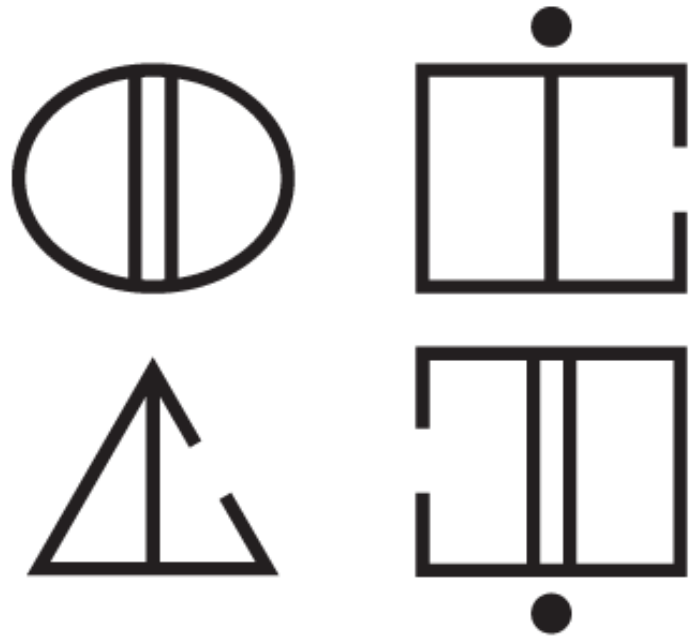
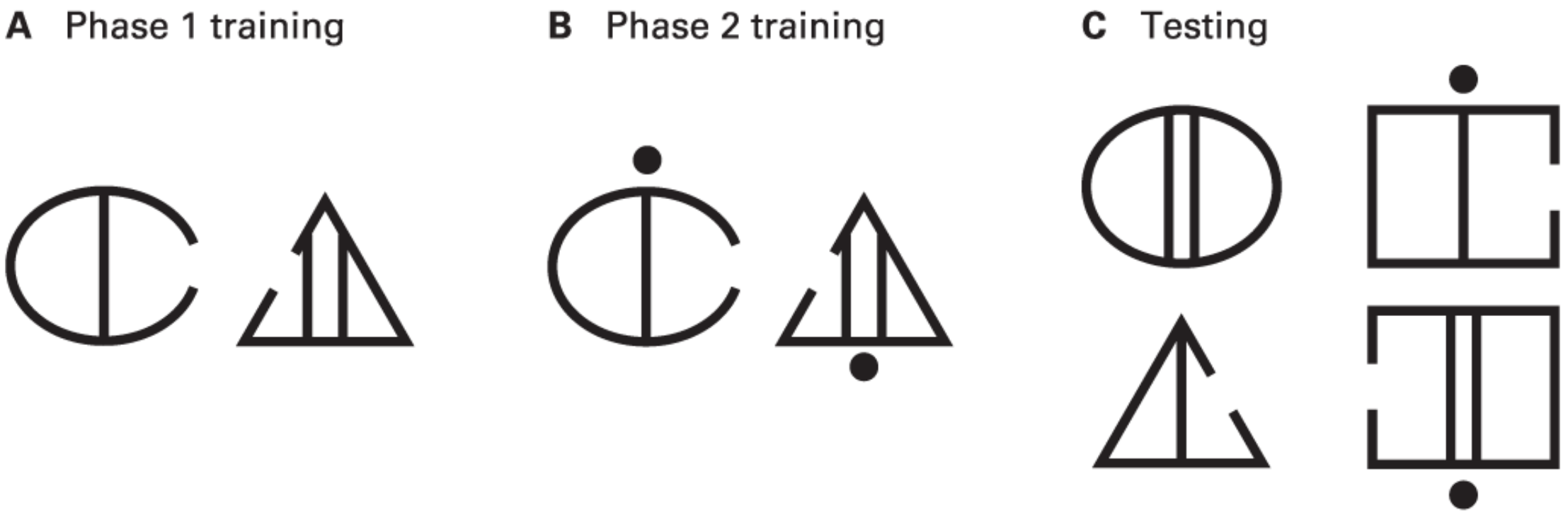
C Testing



Category Learning Task – redundant cues – blocking effect?



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The Latent Inhibition

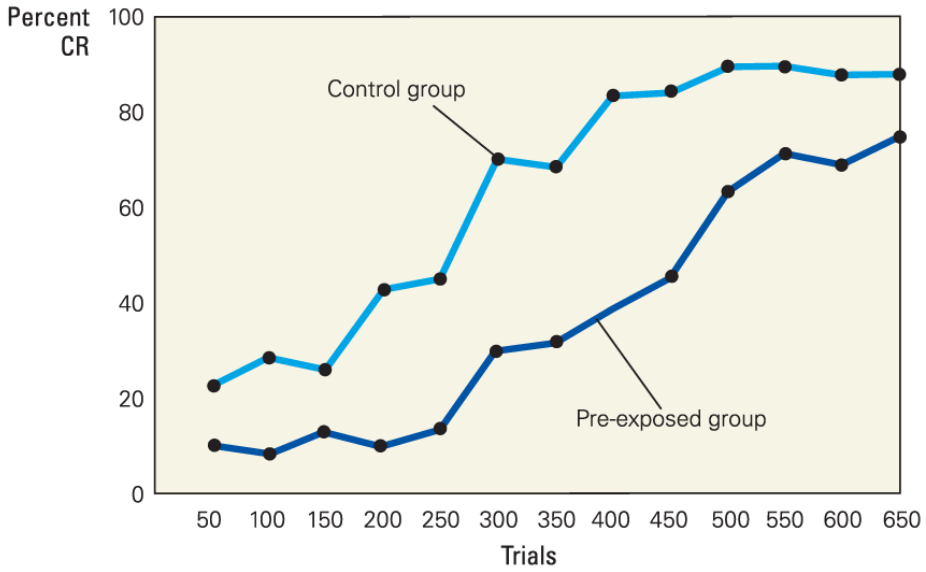
Group	Phase 1	Phase 2
Control group	No activity	Tone CS → airpuff US
Experimental "pretrained" group	Tone → but no airpuff	

Difference?

Latent inhibition: a conditioning paradigm in which prior exposure to a CS retards later learning of the CS–US association during acquisition training

Both error prediction and categorization models failed to predict latent inhibition

People without a hippocampus do not show latent inhibition



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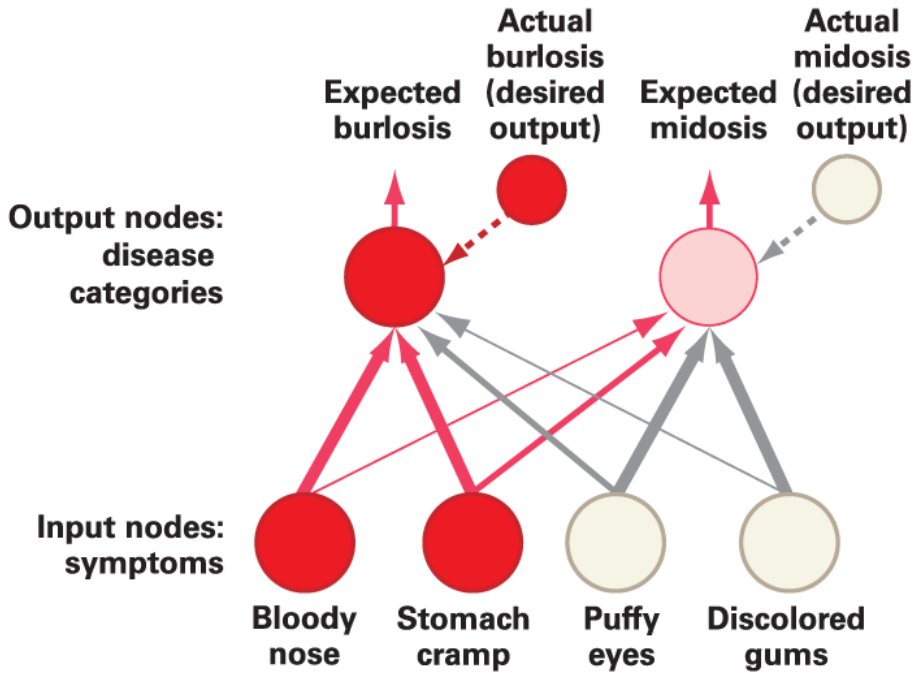
Gluck and Bower's Probabilistic Categorization Task



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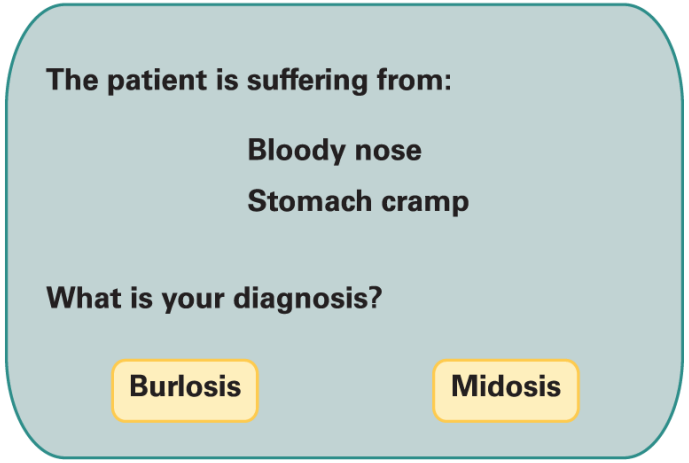

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The same basic network model used by Rescorla and Wagner but the main difference is that the disease-category learning model has more possible outcome categories and more possible input cues.

On a particular learning trial, a research participant would see a listing of symptoms (e.g., bloody nose and stomach cramps), make a diagnosis, and then be given feedback about whether the diagnosis was correct

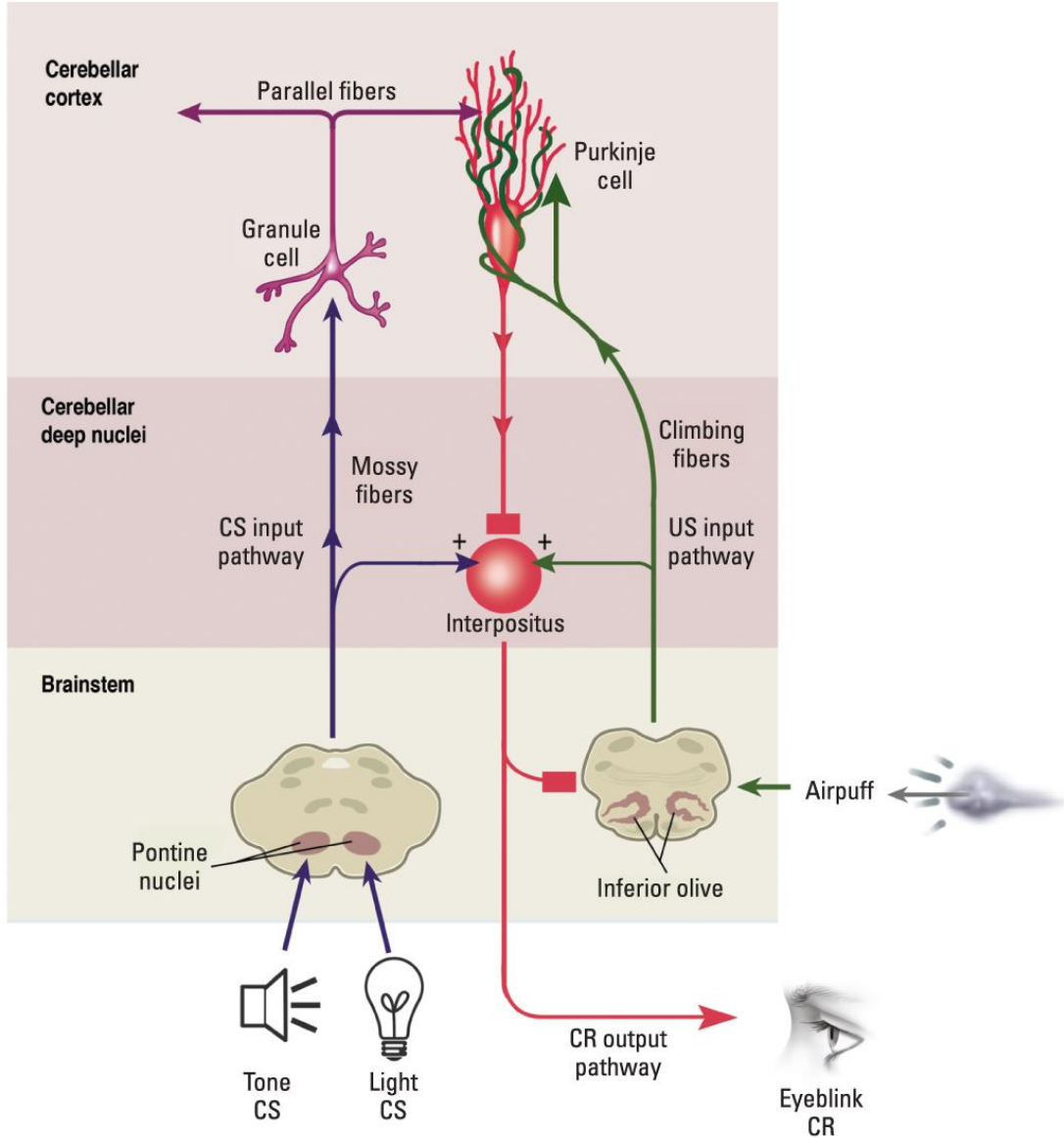
The model correctly predicted the percentage of participants who would classify each of the 14 possible symptom charts as being midosis versus burlosis; it also predicted how well the participants were later able to make judgments about the probabilities of the two diseases when they knew only one of the symptoms.

Attentional Approach to Stimulus Selection

- **US modulation theory:** Any of the theories of conditioning that say the stimulus that enters into an association is determined by a change in how the US is processed *(Example: Rescorla–Wagner model)*

- **CS modulation theory:** Any of the theories of conditioning that say the stimulus that enters into an association is determined by a change in how the CS is processed *(Example: Mackintosh model)*

- *people and animals have a limited capacity for processing incoming information (Mackintosh, 1975). This limited capacity means that paying attention to one stimulus diminishes (and hence modulates) our ability to attend to other stimuli.*



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- A recovering drug addict attends therapy sessions in which cue-exposure therapy is used. The addict is exposed to drug-related stimuli (e.g., photos of common drug-taking environments, drug paraphernalia) in the therapy center several times a week for an extended period of time.
- Why might this treatment fail?

Tolerance to Addictive Drugs

- An addict's tolerance to drugs of abuses develop through automatic compensatory responses
- One way this happens is through conditioning
  - Environmental cues (people, places, etc.) act like CSs associated with the drug (the US)
  - The intense craving felt in response is the CR resulting from the body's conditioned compensatory response of lowering the levels of the brain chemicals enhanced by the drug in anticipation of the drug's arrival

Extinguishing a Drug Habit (part 1)

- Addiction can be partially reduced through Pavlovian extinction: rats that became addicted to alcohol showed significant extinction through repeated nonreinforced exposure to experimentally manipulated cues that had previously been paired with administration of alcohol

Extinguishing a Drug Habit (part 2)

- Outside the laboratory it can be extremely difficult to extinguish a habit
- Boulton's work suggests three principles that can help guide anyone trying to extinguish a habit or an association
  - Cue-exposure therapy should be conducted in as many different contexts as possible
  - The extinction training should be spread out over time, rather than conducted all at once
  - Whenever possible, the cue-exposure therapy should take place in the same contexts in which the original drug habits were acquired