Learning to Predict..contd

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

Group	Phase 1	Phase 2	Phase 3 (test)
Stock Prediction	Doris → stock market	Doris & Herman → stock market	*Hire Herman?* "No way; don't need him."
Medical Diagnosis	Janae eats chocolate → stomach ache	Janae eats chocolate & licorice → stomach ache	*Could the licorice be causing the stomach ache?* "Unlikely; Janae should enjoy licorice but avoid chocolate."

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	Tone → eyeblink	Tone + light → eyeblink (CR)	Only Tone → typical CR only light → little or no CR (learning is "blocked" for light's predictive value)

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

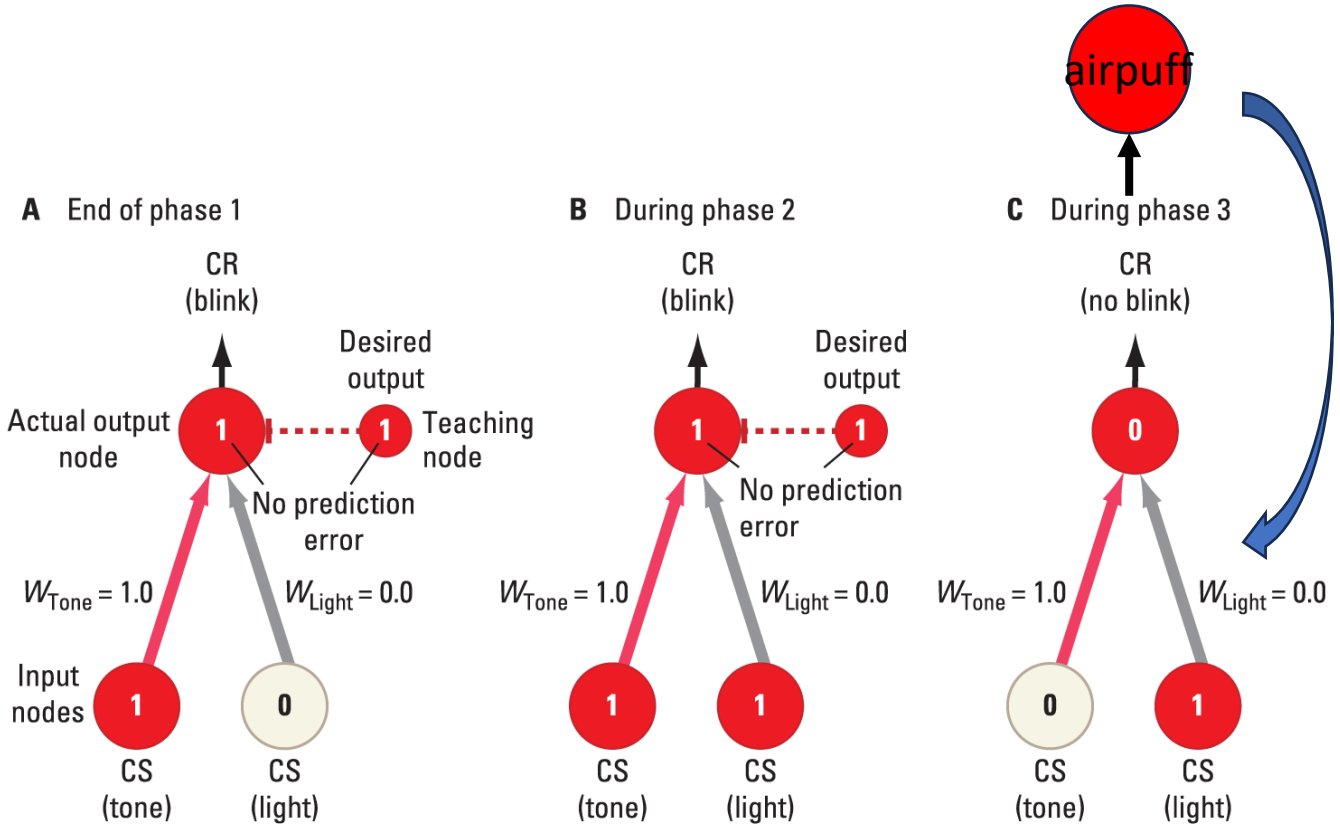
The ability of the light to predict eye-blink is lowered or lost

cues appear to compete with one another for associative strength.

The Rescorla–Wagner Model for Blocking

Group	Phase 1	Phase 2	Phase 3 (test)
Experimental "pretrained" group	Tone → eyeblink	Tone + light → eyeblink (CR)	Only Tone → typical CR only light → little or no CR (learning is "blocked" for light's predictive value)

- 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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Rescorla–Wagner model

Error correction and response

Conditioning error	R–W model response	Tennis error	Herman's response
Positive error: CS predicts nothing or too little, but US unexpectedly occurs or is unexpectedly strong	Increase association	Ball falls short	Increase strength of serve
No error: CS predicts US, and predicted US occurs	No new learning	Ball lands perfectly	Do same thing next time
Negative error: CS predicts US, but no US occurs	Decrease asso-ciation	Ball goes too far	Decrease strength of serve

Modify weight/strength of associations to reduce error

- Classical conditioning → event prediction → error prediction → ?

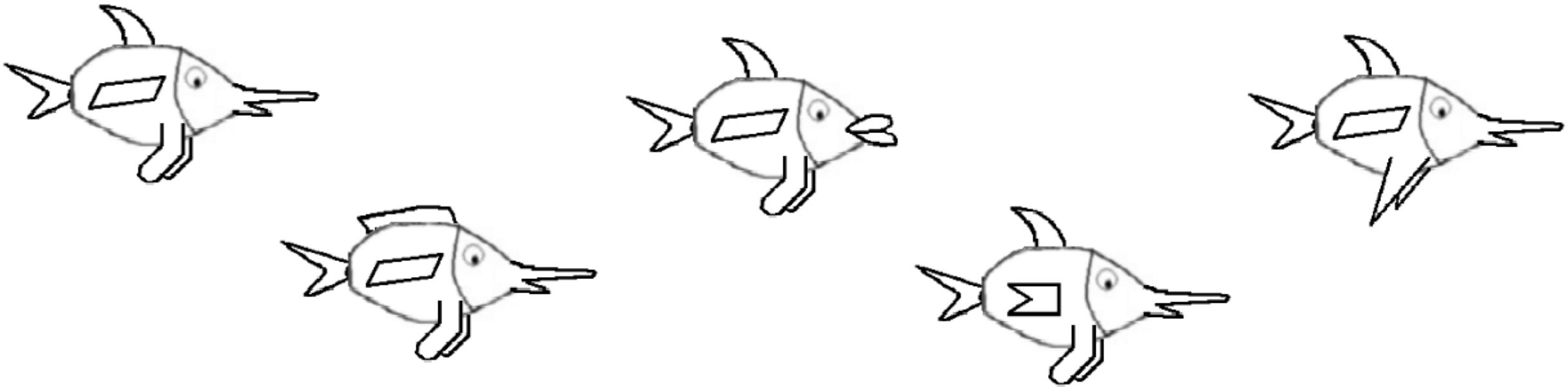
(lower order cognition)
Fewer cues to compete for CS

(multiple cues - higher order cognition)
Trial and error?

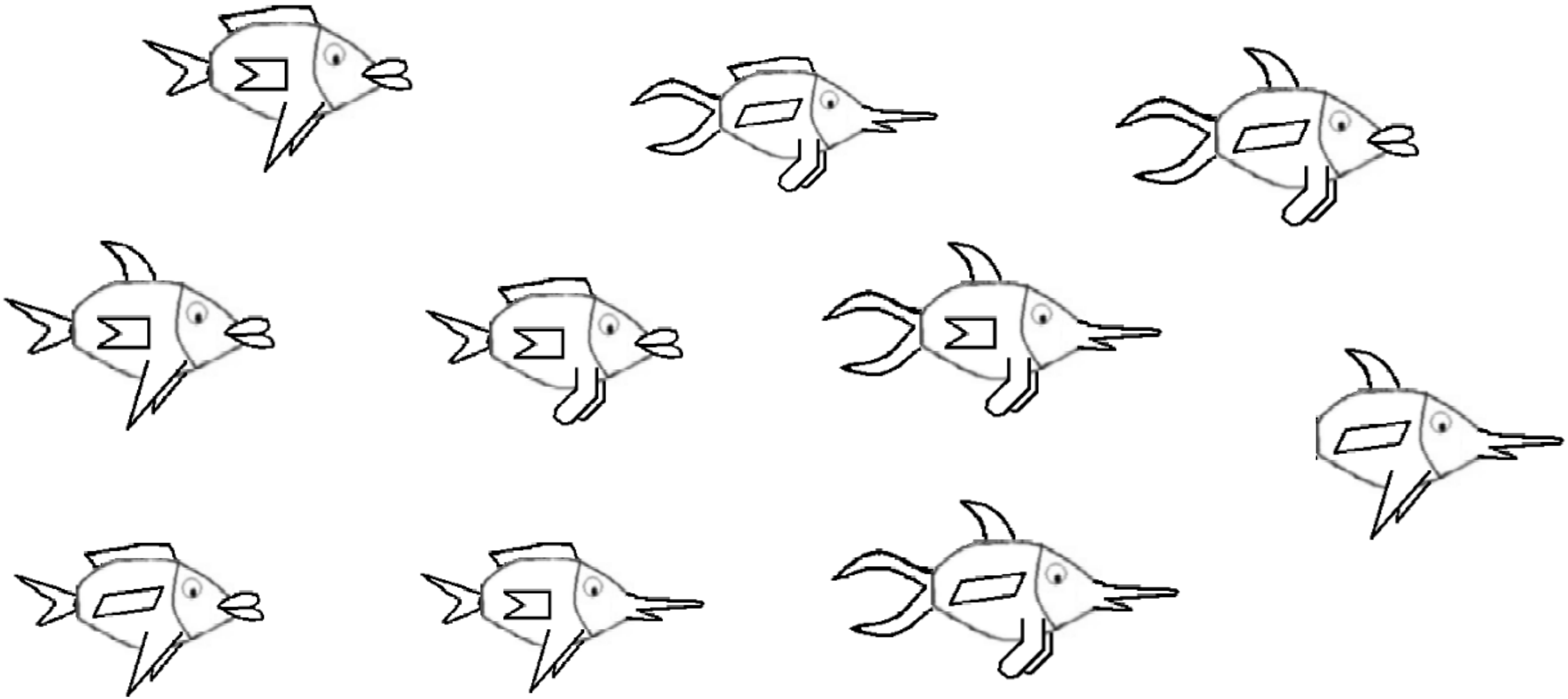
speech recognition,
category learning

Category A

Category B



Which category?



https://link.springer.com/chapter/10.1007/978-981-16-9565-0_4

A Phase 1 training

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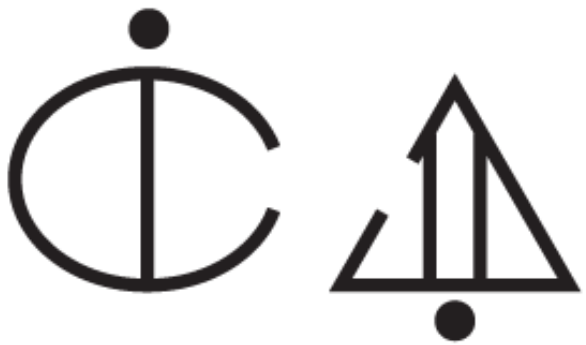
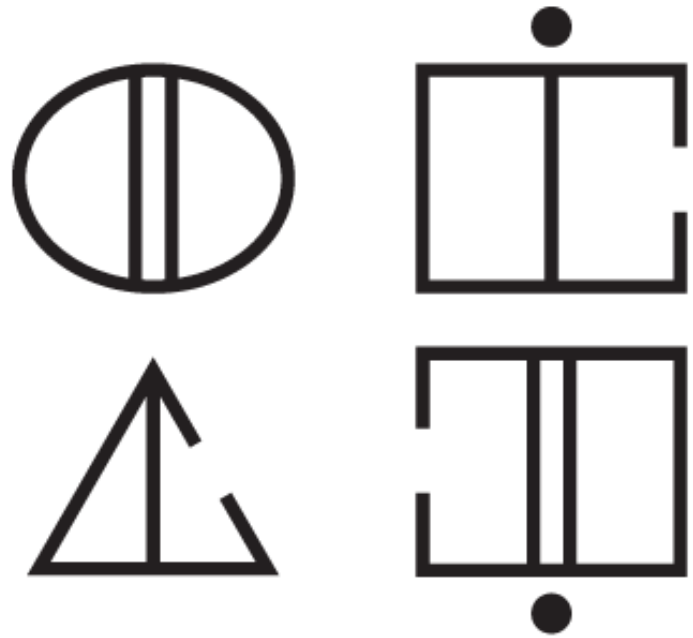
B Phase 2 training



C Testing



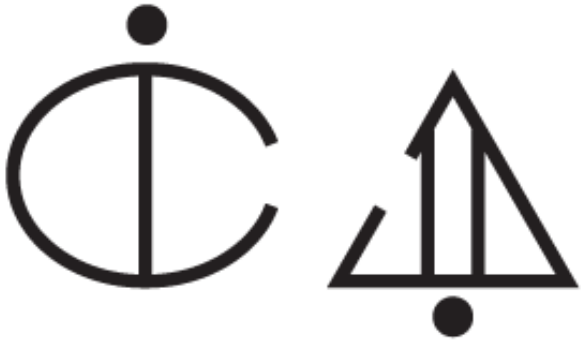
Category Learning Task – redundant cues – blocking effect?

A Phase 1 training

Category A

Category B

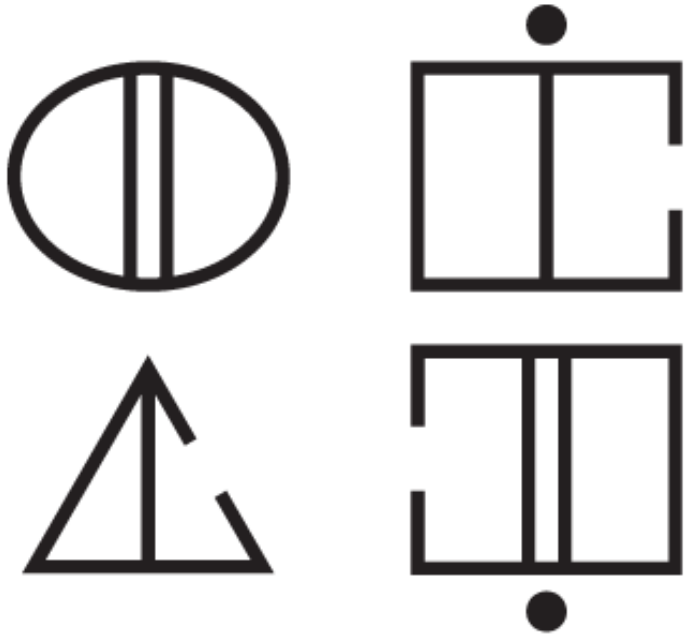
B Phase 2 training



Category A

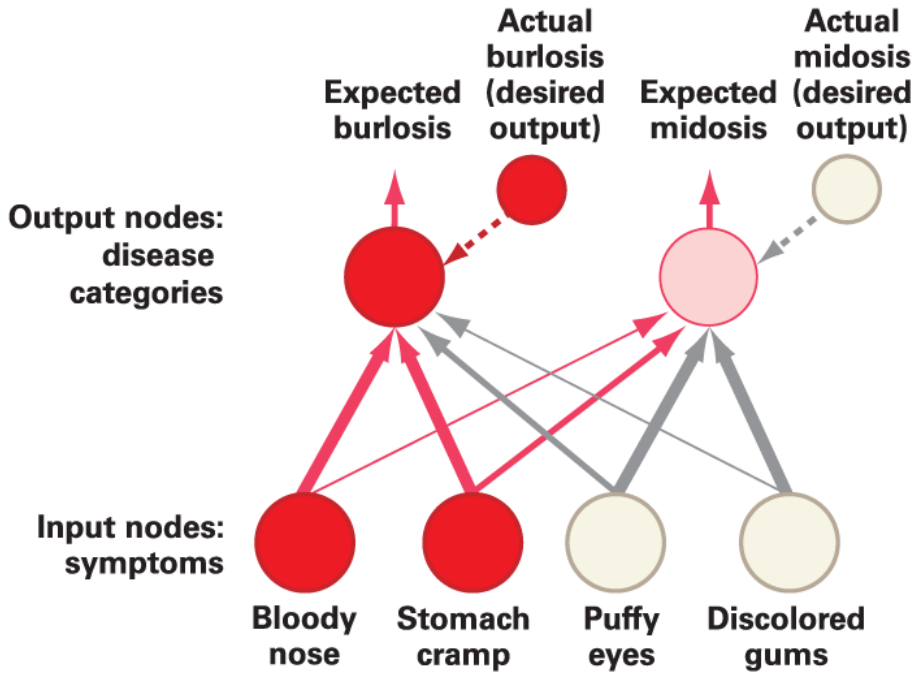
Category B

C Testing



Gluck and Bower's Probabilistic Categorization Task

Using error correction to understand predictive nature of cues



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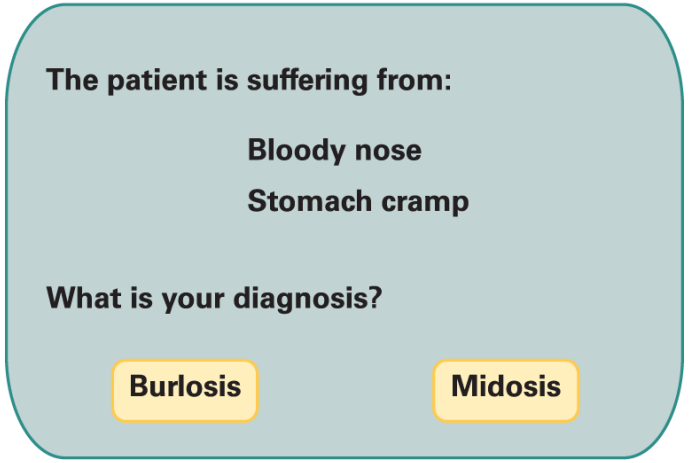

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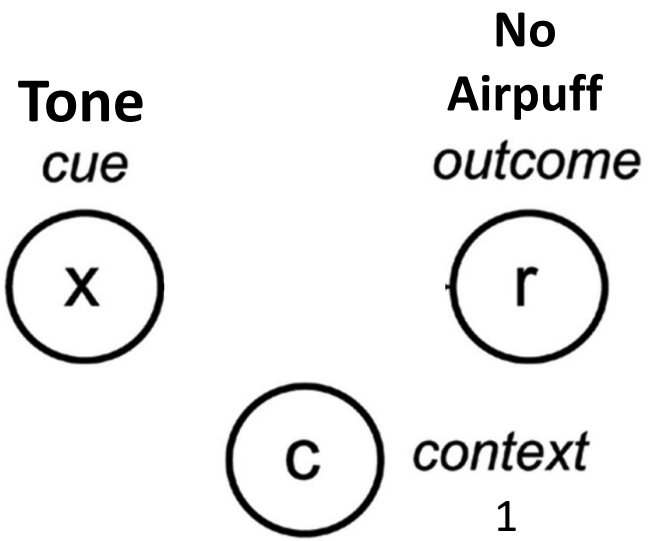
The same basic network model used by Rescorla and Wagner but the main difference is that the disease-category learning model has more possible outcome categories and more possible input cues.

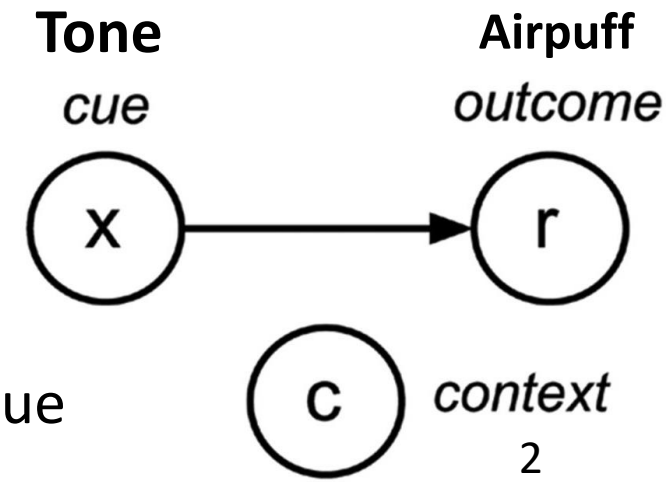
On a particular learning trial, a research participant would see a listing of symptoms (e.g., bloody nose and stomach cramps), make a diagnosis, and then be given feedback about whether the diagnosis was correct

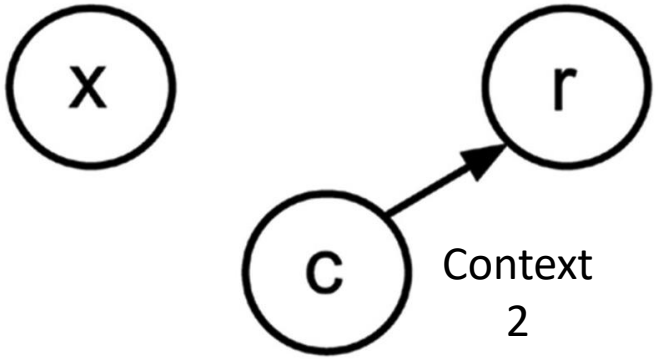
The model correctly predicted the percentage of participants who would classify each of the 14 possible symptom charts as being midosis versus burlosis; it also predicted how well the participants were later able to make judgments about the probabilities of the two diseases when they knew only one of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

Cue–Outcome Contingency - causal inference



Tone is not a reliable cue





Risk of Lung Cancer Increases
But rate of smoking is the same

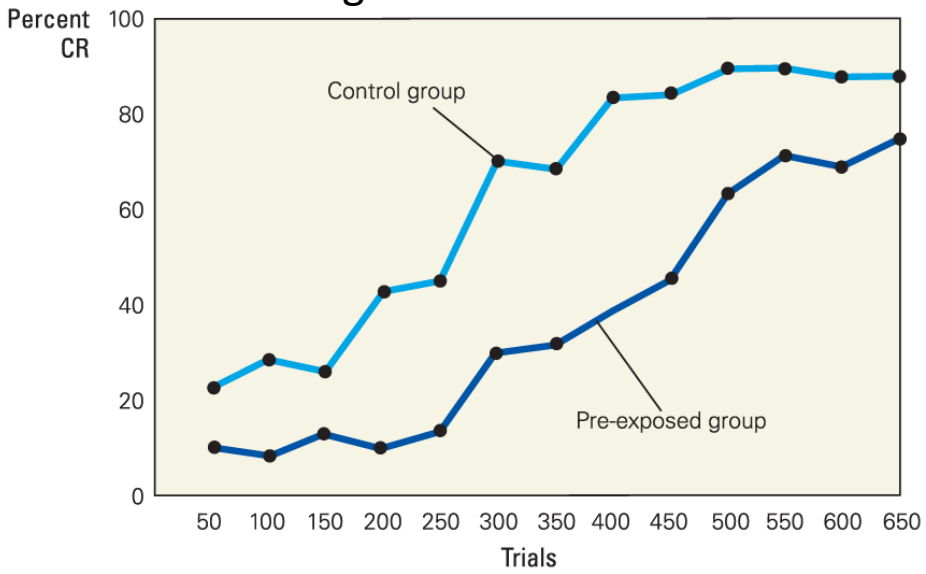
Smoking is not a reliable indicator of lung cancer.

The Latent Inhibition

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

Difference?

prior exposure to a CS retards later learning of the CS–US association



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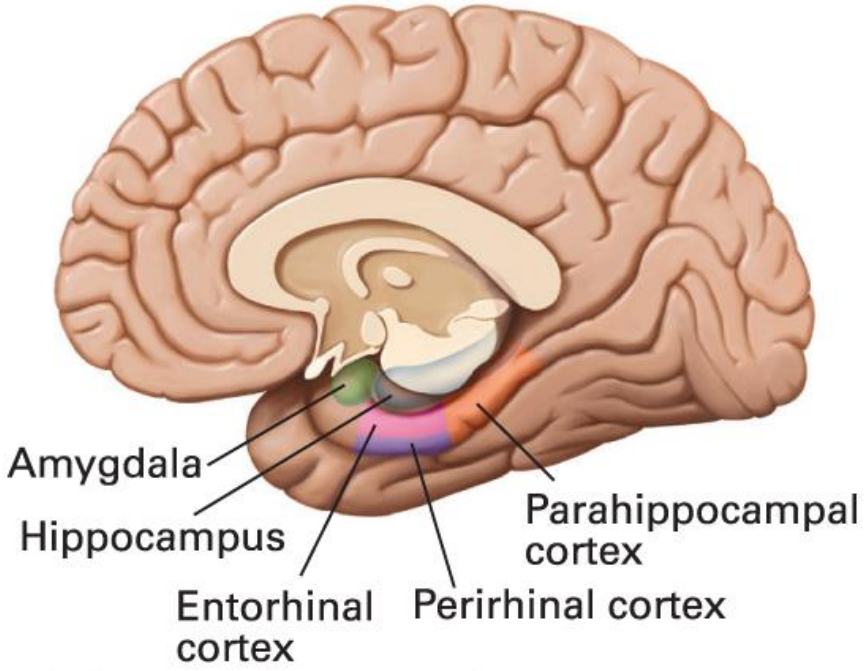
- **Error prediction (Rescorla Wagner) model failed to account for the latent inhibition**

Latent Inhibition in Rabbit Eyeblink Conditioning



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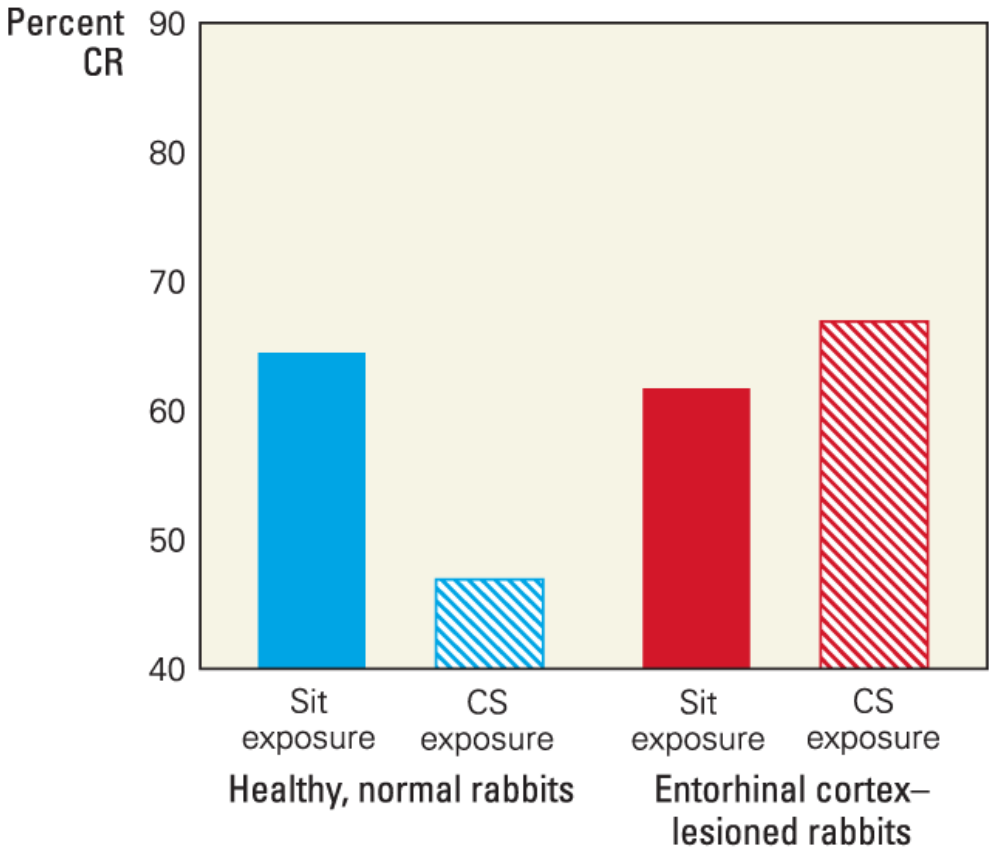

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- People without a hippocampus do not show latent inhibition

Attentional Approach to Stimulus Selection

- **US modulation theory:** unexpected arrival of US (eyeblink) after a CS (tone)

(Example: Rescorla–Wagner model) – could not explain latent inhibition

- **CS modulation theory:** CS becomes associated to US because of the attention given to it and how it 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.*

We all receive a constant stream of stimuli throughout the day — sights, sounds, smells, etc. A person with a normal level of latent inhibition is able to tune out the information that experience has shown to be irrelevant. Someone with *low* latent inhibition, however, doesn't do that as well. He or she pays attention to what can become a overwhelming amount of stimuli.

People with low latent inhibition tend to be easily distracted, which can lead to a diagnosis of ADHD. In more extreme cases, low latent inhibition manifests as psychosis (a mental disconnect from reality). In fact, during the early stages of schizophrenia, a chemical change occurs in which latent inhibition disappears.

But it turns out there's a good side to low latent inhibition, too. In people with high intelligence and good working memory (an ability to think about many things at once), it can lead to original ideas and creative achievement.

https://www.hopementalhealth.com/blog/latent-inhibition-filtering-out-the-madness

- 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?

Extinguishing a Drug Habit

- 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

- 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
  - 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