Rescorla-Wagner and other stuff, too

Sam Cheyette

Plotting in Python

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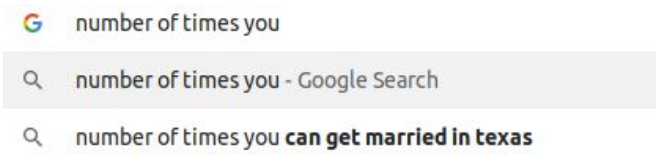

Classical conditioning

- Conditioned Stimulus (***CS***)
  - Something not intrinsically rewarding, such as a tone, light, or touch.
- Unconditioned Stimulus (***US***)
  - Something intrinsically rewarding/unpleasant, such as food, warmth, or a shock.
- Have ***CS*** precede ***US*** repeatedly.
  - Result: ***CS*** causes response (e.g. salivation, fear) even before presence of ***US.***

Operant condition

- Agent forms an association between an **Action (A)** and an **Outcome (O)**.
- This is called *reinforcement learning* because **A** is being reinforced (positively or negatively) based on the valence of **O**.
- The association between **A** and **O** can be mediated by a **Context (C)**.

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- The association between **A** and **O** can be mediated by a **Context (C)**.
- Example:
  - C: “Roll over, boy”
  - A: Rolls over (by chance)
  - O: Yummy treat

Rescorla-Wagner

- Model of how associative strength changes between CS and US given observations.
  - How well does the CS predict the US?
- Learning happens when events violate expectations.
  - “Prediction error”
- Greater prediction error $\Rightarrow$ greater learning.

Rescorla-Wagner

$$\Delta V_x = \alpha_x \cdot \beta \cdot (\lambda - V_{tot})$$

- $\Delta V_x = \alpha_x \cdot \beta \cdot (\lambda - V_{tot})$
  - V_x : associative strength to a CS *x*
  - ΔV_x : change in associative strength *x*
  - α_x : salience of *x*
  - β : learning rate
  - λ : maximum associability to US
  - V_{tot} : summed response (across all CS)

Rescorla-Wagner

What happens when there is no US after a CS?

Rescorla-Wagner

What happens when there is no US after a CS?

$\Delta V_x = \alpha_x \cdot \beta \cdot (\lambda - V_{tot})$, where $\lambda = 0$

$\Rightarrow \Delta V_x = \alpha_x \cdot \beta \cdot (0 - V_{tot})$

$\Rightarrow \Delta V_x = - \alpha_x \cdot \beta \cdot V_{tot}$

Practice problem 1

Draw/plot the curve that occurs with the Rescorla Wagner learning model when there is one CS *x* and one US *y* given: 0.1 strength of association from x to y, learning rate of .5, salience of 1, and maximum associability of 1.

- What happens when there is a maximum associability of .5?
- What happens when there is a change in salience?
- What happens when there is a change in learning rate?

Practice problem 2

Plot/draw the curve that occurs with the Rescorla Wagner learning model when there are two to-be-conditioned stimuli with associative strengths of V_1=.1 and V_2=.1, learning rate of .5, salience of α_1=1 and α_2=.5, and maximum associability of 1.

What happens?
What is this phenomenon called?

Practice problem 3

Draw/plot the curve that occurs with the Rescorla Wagner learning model when there are two to-be-conditioned stimuli with associative strengths of V_1=.1 and V_2=.1, learning rate of .5, salience of α_1=1 and α_2=.5, and maximum associability of 1.