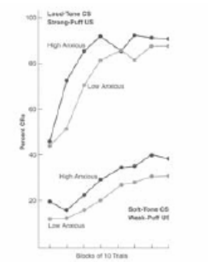
Learning II

Factors that influence CC



- Eye-blink conditioning
- CS Intentsity
  - Loud vs. Soft Tone
- US Intensity
  - Hard vs. Soft Puff
- Anxiety
  - High vs. Low

Stimulus Generalization

- Conditioned responses (CRs) occurring to stimuli other than the CS used for training
- Similarity
  - The more similar the second stimulus is to the CS the more generalization will occur
- Critical feature of learning
  - we rarely encounter the exact same stimulus twice

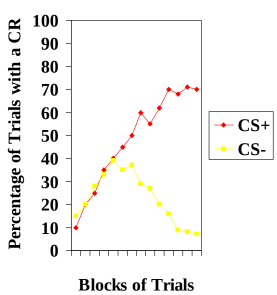
Discrimination

CS+ ---> UCS

CS- ---> ____

- The stimuli will come to control responding:
  - The CS+ will elicit a CR
  - The CS- will not elicit a CR

Discrimination

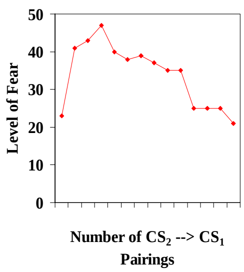


- Hypothetical example
- Initially the organism responds to both stimuli
  - shows generalization

Second-Order Conditioning

- Phase 1:
  - Pair CS_1 ---> UCS until learning occurs
- Phase 2:
  - Pair a new stimulus (CS_2) as the CS with the first one (CS_1) as the UCS
  - CS_2 ---> CS_1
- Because CS_1 reliably elicits a CR, the new stimulus, CS_2 that is paired with it, will begin to elicit the CR as well

Second-Order Conditioning



- From Rizley & Rescorla, 1972
  - CS1: flashing light
  - CS2: 1800 Hz tone
  - UCS: (shock)
- Phase 1:
  - CS_1 --> UCS (8 Trials)
- Phase 2:
  - CS_2 --> CS_1

Advertising

- Pair products with stimuli that elicit positive emotions
- Second-order conditioning

Stewart & colleagues (1987)

- Slides
  - Neutral scenes
  - Pleasant scenes
  - Various products
- Experimental group
  - Brand L toothpaste always followed by pleasant scenes
- Control group
  - Brand L toothpaste always followed by neutral scenes
- Experimental students rated Brand L significantly more positively than the Control group did

Taste Aversion

- Chemotherapy
- Give children distinctive-flavored Lifesaver candy (CS) between their evening meal and the chemo session (UCS)
  - 12/15 children ate the food at the meal again later
- Control: no lifesaver
  - 6/15 children would eat that meal again

Treating Phobias

- Peter
- Jones (1924) brought a rabbit into the same room but far away from Peter while he was eating his cookies and milk snack
  - Rabbit: CS that elicits anxiety
  - Snack: CS that elicits good feelings
- Brought the rabbit closer and closer until there was no fear to the rabbit
  - Eventually the rabbit was put into his lap!

Counter-conditioning

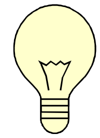
- CS presented at the same time as another event that elicits an incompatible response
- Systematic Desensitization (Joseph Wolpe, 1958)
  - Train person in deep relaxation
    - separately
  - Create hierarchy of fear eliciting stimuli
    - from least to most strong example of stimulus
    - imaginal or in vivo desensitization
  - Pair each item of hierarchy with relaxation
    - without producing fear
    - combines counter-conditioning, generalization, and extinction

What leads to conditioning?

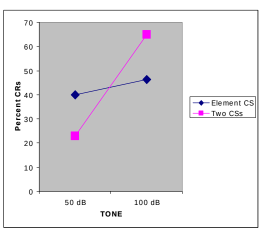
- *Contiguity*
  - Stimuli that are close to one another in time and in space become associated
- Co-occurrence
  - Proximity critical
- *Contingency*
  - When one stimulus depends on the other, they will become associated
- Information
  - Predictive value critical

Overshadowing

- When conditioning involves a *compound stimulus*, one stimulus may acquire more stimulus control than the other
- More salient stimulus interferes w/ conditioning to less salient one



Overshadowing



- Grice & Hunter, 1964
- Human eyeblink conditioning
- 3 Groups:
  - 100 trials w / CS (loud tone)
  - 100 trials w / CS (soft tone)
  - 50 trials w / CS(loud tone) & 50 trials w / CS (soft tone)

Which one?

- Contiguity
- Contingency

Blocking

- Phase 1: Pair CS1 → UCS
- Phase 2: Pair compound stimulus with UCS: CS1CS2 → UCS
- Phase 3: Test element stimuli alone to determine amount of conditioning
- Conditioning to CS1 will be strong, but conditioning to CS2 will be weak: Blocking

Kamin (1968)

- Acquisition (→Shock)

Group	Phase 1 16 Trials	Phase 2 8 Trials	Test: 4 trials Nonreinforced	Test: Results Supp. Ratio
NL	--	NL	L	.05
N-NL	N	NL	L	.45
N only	N	N	L	.44

Suppression Ratio of 0 indicates complete fear conditioning, 0.5 indicates chance behavior (no conditioning)

Contiguity or Contingency?

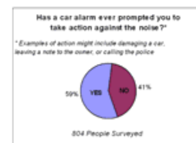
Contiguity

- Both CSs were paired with a UCS in the Blocking procedure
  - BUT one of the CSs was not learned

Contingency

- CS that was most reliably associated with UCS was learned

Predictive Value: Alarms



Contingency

p (UCS / CS) + p (UCS / No CS)

- In other words, a CS is only good as a predictor if the UCS occurs fairly often in the presence of the CS but not very often in its absence

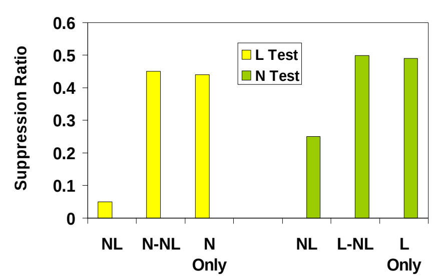
Contingency

- Kamin's study:
  - Group N-NL received 24 shocks during acquisition
    - p(shock / Noise) = 24 / 24 = 1.0 and
    - p(shock / No Noise) = 0 / 24 = 0
  - Group NL received 8 shocks during acquisition
    - p(shock / Noise) = 8 / 8 = 1.0 and
    - p(shock / No Noise) = 0 / 8 = 0
- Predictive value of noise?
  - Noise is a great predictor for both groups

Contingency

- Kamin's study:
  - Group N-NL received 24 shocks during acquisition;
    - p(shock / Light) = 8 / 24 = .33 and
    - p(shock / No Light) = 16 / 24 = .67
  - Group NL received 8 shocks during acquisition;
    - p(shock / Light) = 8 / 8 = 1.0 and
    - p(shock / No Light) = 0 / 8 = 0
- Predictive value of Light?
  - Light is a great predictor for Group NL
  - Light is a poor predictor for Group N-NL
  - Consequently, little learning for Light in N-NL group!

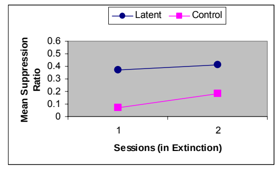
Kamin's (1968) Blocking Study



Latent Inhibition

- Phase 1:
  - Present CS alone for several trials
- Phase 2:
  - CS → UCS for a limited # of trials
- Test Phase:
  - CS → _____ to see if conditioning occurred to the CS

Latent Inhibition



Hall & Minor, 1984

- CER Procedure:
  - Phase 1: Train thirsty rats to drink from tube
  - Phase 2: Separately present Tone during 3 Sessions; Controls had no Tone while in box
  - Phase 3: All rats had Tone→ Shock pairings
  - Test Phase: Present Tone while rats were drinking from water tube

Co-occurrence vs. Contingency

Group	Probability that US follows CS	Probability that US occurs by itself
(1)	.8	.8
(2)	.8	.4
(3)	.4	.4
(4)	.4	.0

Rescorla-Wagner

Co-occurrence vs. Contingency

Group	Probability that US follows CS	Probability that US occurs by itself
(1)	.8	.8
(2)	**.8**	**.4**
(3)	.4	.4
(4)	**.4**	**.0**

Rescorla-Wagner

Rescorla-Wagner Theory (1972)

- Organisms only learn when events violate their expectations
- Expectations built up when 'significant' events follow a stimulus complex
- Expectations modified when consequent events disagree with the composite expectation

Rescorla-Wagner Model

- Change in associative strength of a stimulus depends on
  - Existing associative strength of that stimulus
  - Associative strength of all other stimuli present
- Change depends on level of existing associative strength
  - If low, potential change is high
  - If high, very little change occurs
- Speed and asymptotic level of learning determined by strength of the CS and UCS

Rescorla-Wagner Model

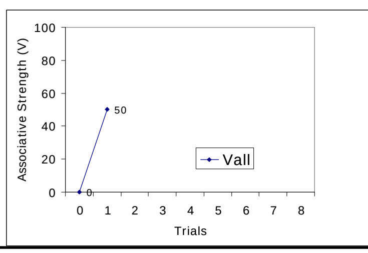
- **Rescorla and Wagner used a mathematical model to make their "cognitive" account more rigorous**
  - $\Delta V_A = \alpha_A \beta [\lambda - V_{AX}]$
    - ΔV_A - Change in associative strength to CS_A
    - V_{AX} - Current associative strength to CS_{A+X} (context)
    - α_A - Salience of CS_A
    - β - Salience of UCS used in the Experiment
    - λ - Maximum associative strength possible

Before conditioning begins:

- λ = 100 (number is arbitrary & based on the strength of the UCS)
- Vax = 0 (because no conditioning has occurred)
- c = .5 (c must be a number between 0 and 1.0 and is a result of multiplying the CS intensity by the UCS intensity)

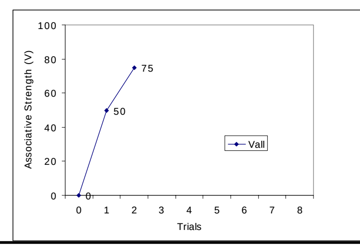
First Conditioning Trial

Trial	c	(λ	-	Vax)	=	ΔVA	1
	.5 *	(100	-	0)	=	50	



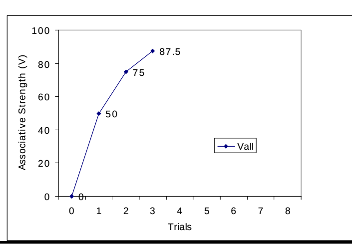
Second Conditioning Trial

Trial	c	(λ	-	Vax)	=	ΔVA	2
	.5 *	(100	-	50)	=	25	



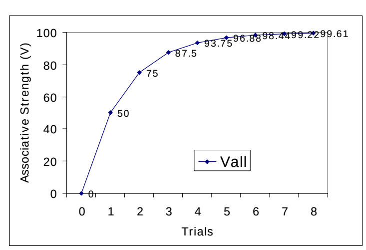
Third Conditioning Trial

Trial	c	(λ	-	Vax)	=	ΔVA	3
	.5 *	(100	-	75)	=	12.5	



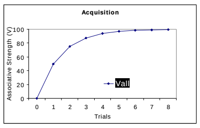
8th Conditioning Trial

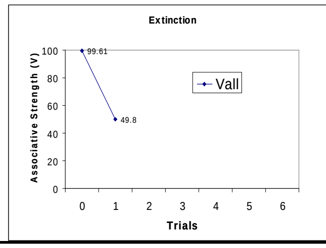
Trial	c	(λ	-	Vax)	=	ΔVcs	8	.5
	*	(100	-	99.22)	=	.39		



1st Extinction Trial

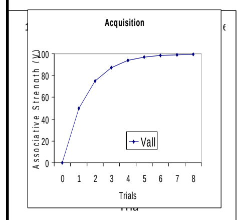
Trial c (λ - Vax) = ΔVcs 1 .5 * (0 - 99.61) = -49.8

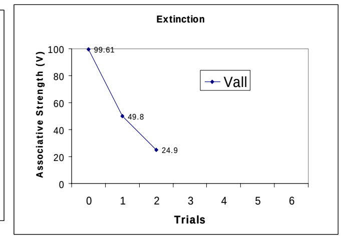




2nd Extinction Trial

Trial c (λ - Vax) = ΔVcs 2 .5 * (0 - 49.8) = -24.9





Rescorla-Wagner Model

- Describes acquisition and extinction of a conditioned response
- Many other learning phenomena, too!

Rescorla-Wagner

- Overshadowing
  - When multiple stimuli or compound stimulus:
    - $Vax = Vcs_1 + Vcs_2$
  - Trial 1:
    - ΔVnoise = .2 (100 – 0) = (.2)(100) = 20
    - ΔVlight = .3 (100 – 0) = (.3)(100) = 30
    - Total Vax = Current Vax + ΔVnoise + ΔVlight = 50
- Blocking
  - Clearly, the first 16 trials in Phase 1 will result in most of the λ accruing to the first CS, leaving very little λ available to the second CS in Phase 2

Rescorla-Wagner Model

- Theory not perfect:
  - Can't handle second-order conditioning
  - Can't handle latent inhibition
- But, it has been called the "best" theory of Classical Conditioning

Rescorla-Wagner & Delta Rule in Neural Network Learning

- **Rescorla-Wagner Rule:**
  - $\Delta V_A = \alpha_A \beta [\lambda - V_{AX}]$
- **The second is Sutton and Barto's (1981) reformulation of Widrow-Hoff**
  - $R_i(t) = [z(t) - y(t)] x_i(t)$
- **It simply says that the amount of reinforcement at time t for weight i is a function of the difference between desired and actual output, as well as the signal through the weight at that time**