ANIMAL COGNITION (I/II) – LEARNING

WHAT IS LEARNING?

Knowledge sources = innate + learned by experience + cognitive (not independent of other 2)

Learning = inferred change in organism's mental state…results from experience…influences, relatively permanently, the organism's potential for subsequent adaptive behaviour

- Need to separate from the following 3 phenomena that appear to overlap in some cases

Learning vs performance

- Learning vs. behavioural change
- Learning can be "latent"
    - Only identifiable experimentally upon observation of behavioural change
    - E.g. *before a lecture vs after a lecture*
        - Learning, but no change in behaviour so from an outsider's perspective, wouldn't be able to ID that learning has occurred

Learning vs development

- Learning vs. maturation
- Learning depends on special experience
- Unlearned sexual responses appear at maturity, regardless of experience

Learning vs motivation

- Learning vs. state-dependent reversible behavioural change
- Learning = permanent
- Hunger/arousal etc. = reversible

TYPES OF LEARNING

Non-associative

Responding to repeated/intense single stimulus

- Habituation – decreased innate responding to consequence-less stimulus
- Sensitisation - ^ responding

Associative

Association of 2+ events

- Classical conditioning
    - Associations between external events
    - Pavlov => dog and bell
- Operant conditioning
    - Associations between own behaviour and outcomes
    - Thorndike/Skinner => Skinner box

CONDITIONS FOR ASSOCIATIVE LEARNING

Contiguity

= shorter interval between CS & US

Appropriateness

= easier recognition of relevance of CSs for USs

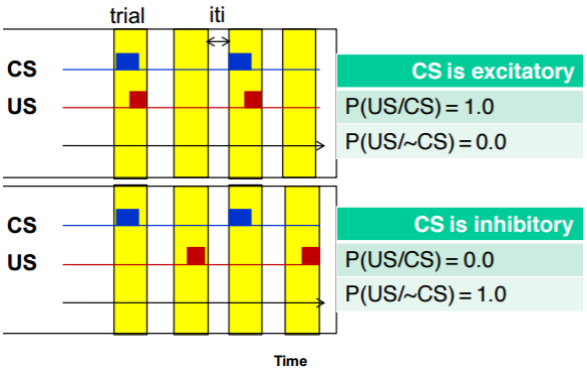
- E.g. *smell to taste easy…smell to electric shock less easy*

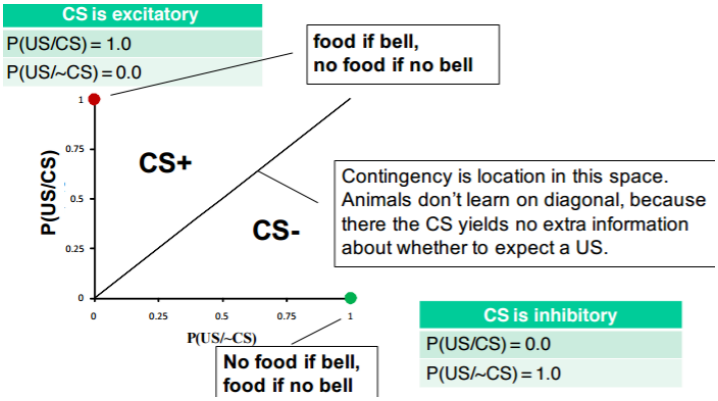
Contingency

= correlation between CS + US = most important

- i.e. how often does CS precede US

- CS can…
  - Predict US presence (excitatory)
  - Predict US absence (inhibitory)
  - Be non-predictive





E.g. *rats: tones + electric shocks*

- P = 0.4 <= shock in presence of tone
- P = 0.1, 0.2, 0.3, 0.4 <= shock in absence of tone
  - Tone followed by shock equally for 4 groups…BUT reduced response to tone shock when ^ probability of un-signalled shocks
  - Learning => decreased uncertainty

BLOCKING

No uncertainty => no learning

E.g. *rats: tones + electric shocks + light*

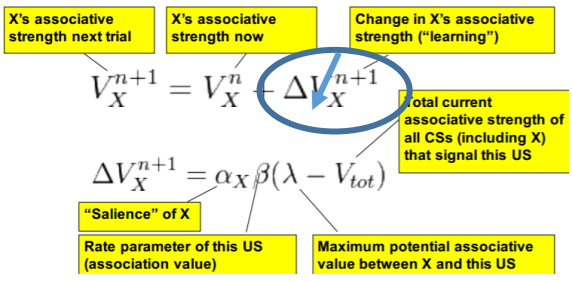
- Group 1 => noise signals shock…light has no uncertainty to remove…BLOCKING
- Group 2 => noise + light signal shock…rats learn about both

Rescorla-Wagner model

= dominant model explaining blocking

Future associative strength = Current associative strength + Change in associative strength

- What causes change in associative strength???



CLASSICAL VS. OPERANT

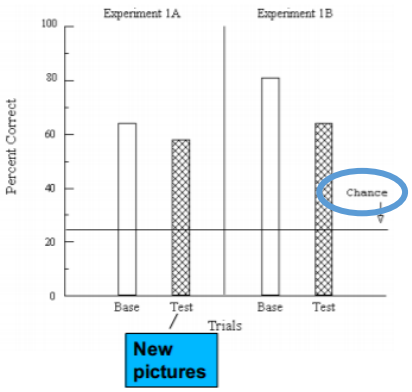
- Associations between external events vs. between own behaviour and outcomes
  - Why is own behaviour not treated as external event? HOTLY DEBATED

Autoshaping

= classical conditioning phenomenon that assists thinking about this potential divide

E.g. *pigeons*

E.g. Bhatt et al (1988): *pigeons w/ 4 categories (cats, flowers, cars, chairs)*



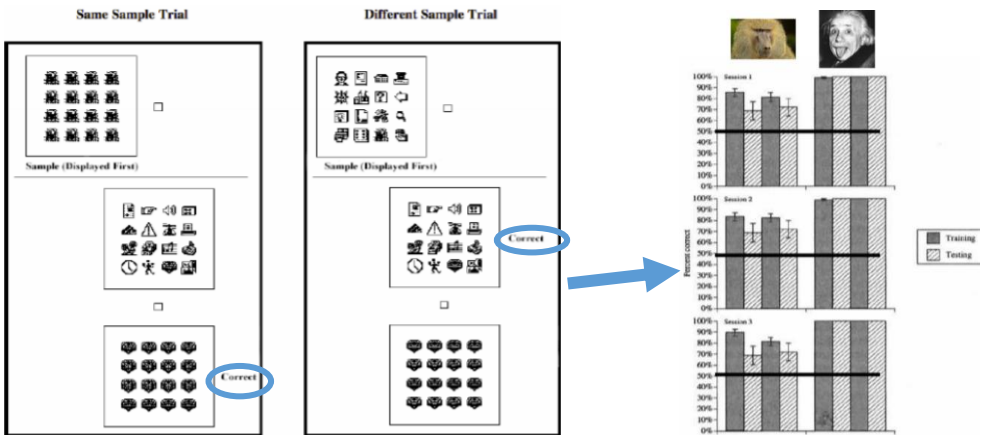
- More demanding test
- RESULT: > chance once again

Relational learning

= discriminating "equal" vs. "different"

E.g. *Fagot et al (2001): baboons vs. humans*

- Baboons => > chance
- Humans => 100% correct



E.g. *hooded crows*

- Capable of remembering and IDing rule simultaneously

Specialised learning

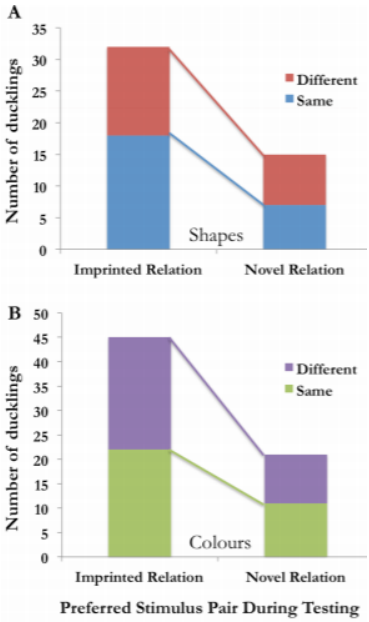
Imprinting = rapid learning @ a particular life stage…apparently independent of consequences of behaviour

- No stimulus-reward pairing
  - Seem pre-programmed w/ predisposition to learn certain imp things @ appropriate times
- Filial imprinting…
  - New-borns learn to recognise parents
  - E.g. nidifugous birds learn to follow natural or artificial stimuli soon after hatching
    - Conservation implications…can reintroduce pops

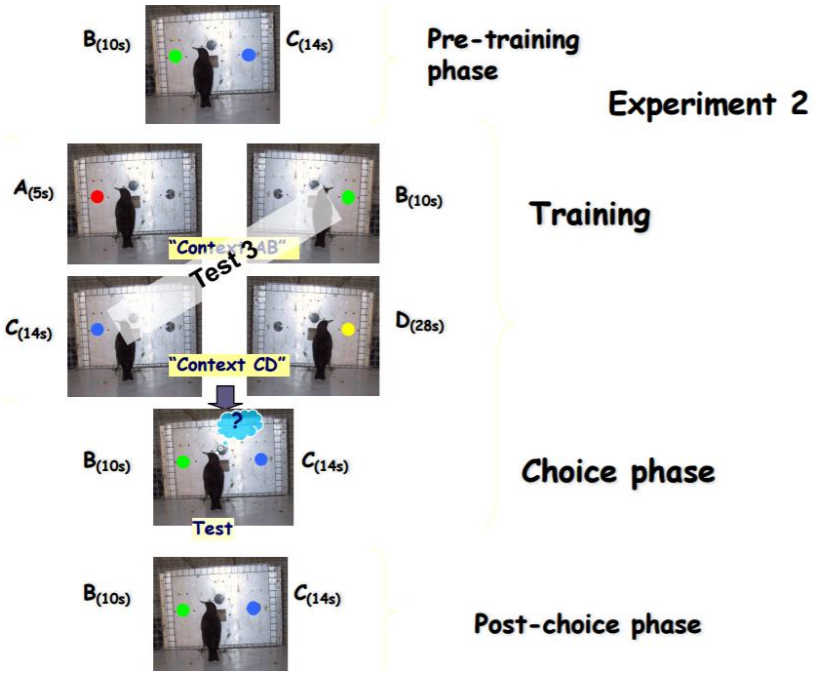
  Sexual imprinting…
  - Juveniles learn characteristics of desirable mates upon reaching sexual maturity
  - E.g. problematic in falconry
    - Imprint on keepers
  - Can be used for benefit…collect semen that accumulates in imprinted object
- Song learning…
  - Nestlings learn song from hearing their fathers

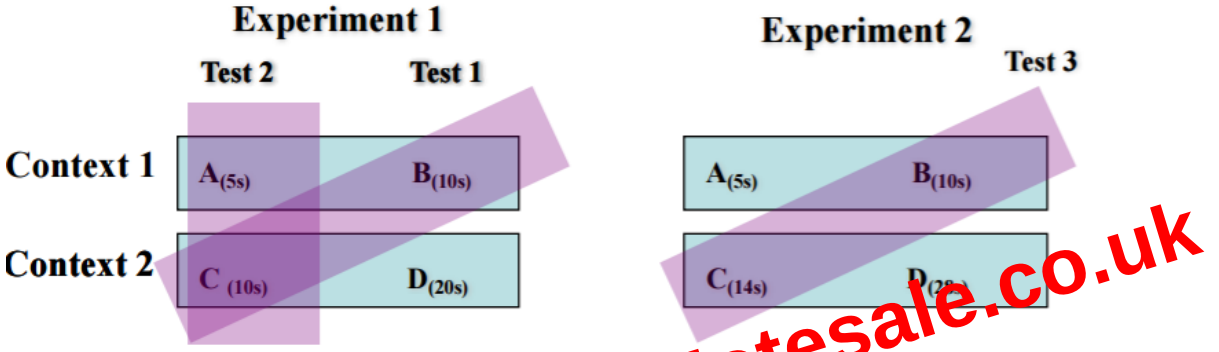
To what level of abstraction does imprinting work?

- Will ducklings choose to follow 2 "equal" or "different" items?
  - No choice initially…chooses what it knows 2nd time around



- Training…
  - 1 of 2 contexts
    - AB (more rich)
    - CD (less rich)
- Testing…
  1. B (10s) vs. C (10s)
  2. A (5s) vs. C (10s)
  3. B (10s) vs. C (14s)
- Results…



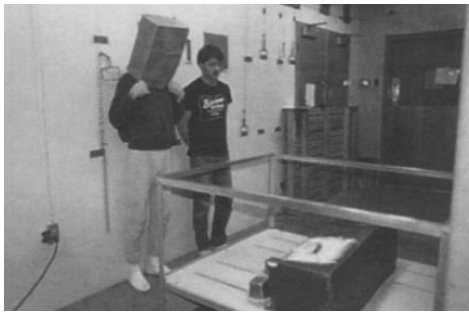


Hypothesis	Test 1 $B_{(10s)}$ vs. $C_{(10s)}$	Test 2 $A_{(5s)}$ vs. $C_{(10s)}$	Test 3 $B_{(10s)}$ vs. $C_{(14s)}$
a) Absolute memory	Indifference	A	B
b) Value by association	B	A	B
c) Remembered ranking alone	C	Indifference	C
d) Lexicographic combination: -Absolute memory priority	C	A	B
-Ranking priority	C	A	C
e) Non-lexicographic combination of absolute memory and ranking	C	A	Indifference
RESULTS	**C**	**A**	**Indifference**

Preference depends on BOTH the comparison between each option and its context and on the absolute physical properties of each option.

Are chimps capable of attributing knowledge???

- Test 1…
  - "guesser" leaves room
  - "knower" hides food
  - "knower" points to baited cup, "guesser" points to empty cup
  - subjects chose between information about hidden food location provided by 2 experimenters
- Results…
  - Chimps point to "knower" more often than "guesser"
- Test 2…
  - Same but "guesser" doesn't leave during food hiding, wears paper bag instead
- Results…
  - Similar
- Conclusion…
  - Chimps capable of modelling visual perspective of others
- BUT…
  - Performance @ chance levels for 1st 2 blocks of 50 trials
  - Associative learning can explain results
  - Chimps failed in further tests
- …BUT…
  - Are experimetnters asking too much? Understanding + unnatural actions
  - Implicit vs. explicit understanding



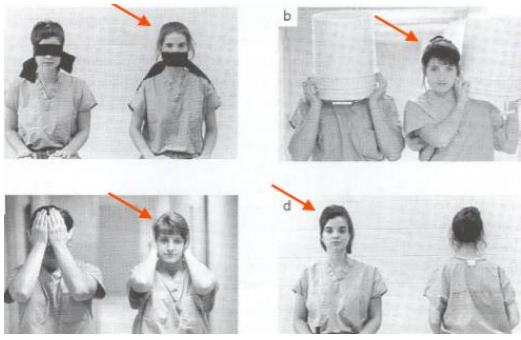
GAZE TRACKING

- Understanding that others see suggests implicit understanding
- Humans use others' gaze to work out what they're attending to
  - Can non-humans do the same?
- In chimps…
  - Able to follow gaze direction (also ravens + goats)
  - Understand that barriers block gaze

On the contrary, DOGS do preferentially beg from 'attentive' humans… feasible that this behaviour is learnt however

'SEEING'

- Is there an understanding that others see???



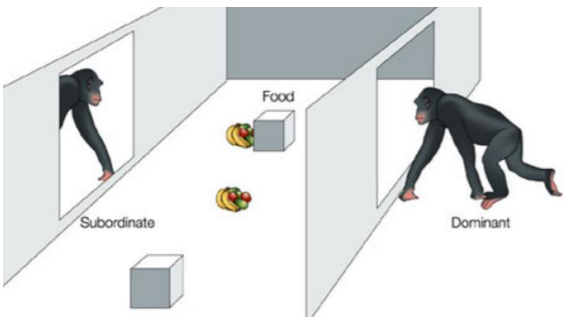
In chimps

Study 1: choose to beg for food from experimenters who can/can't see them

- Results…
  - Mostly random

Study 2: subordinate chooses between hidden or visible food

- Results…
  - Hidden food approached first in 73% of trials
- Conclusion…
  - Contradicts results from study 1 and perhaps suggest chimps do know what others see



Competitive feeding paradigm

Does 'seeing' imply knowing?

Do chimps understand what dominant sees or just react to dominant as stimulus?

- 4 conditions:

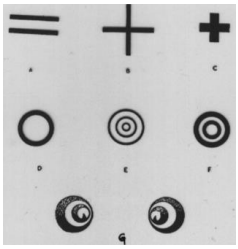
- Verts = conscious
  - Parts of human brain responsible for consciousness are phylogenetically old, thus shared w/ many spp.
- Mammals + birds = conscious
- Apes + humans = conscious
  - Parts of human brain responsible for consciousness are phylogenetically young
  - Right neocortex + prefrontal cortex = prerequisites for emotional experiences… absent from other animals

3. Humans achieve a lot w/o being conscious
   - Autonomic NS
   - Breathing/playing the piano etc. performed via conscious or unconscious routes
   - Blindsight
     - = seeing w/o being conscious of seeing
     - E.g. emotions can be influenced by stimuli that we're unaware of…
       - Brief presentation of happy/sad/angry face affect interpretation of neural ideographs, despite subjects saying they haven't seen any faces
     - E.g. patient w/ damage to visual cortex => cortically blind in left visual field
       - More accurate than chance when guessing what objects and where they'

ANIMAL COGNITION (XIII) – RECEIVER PSYCHOLOGY: EVOLUTION OF DEFENSIVE ADVERTISEMENT

ADVERTISEMENT MECHANISMS

- Flash colouration
  - Overlaps with mechanisms of concealment
  - Camo til predator is close…once spotted, no point trying to stay concealed so flash helps escape
  - DISPLAY TO CONCEAL…fool predator attention mechanisms
- Startle
  - DISPLAY TO CONFUSE…confound predator expectations
    - Frightening
    - Eye spots…may exploit subliminal reactions



Least effective - arbitrary

Intermediate - circles

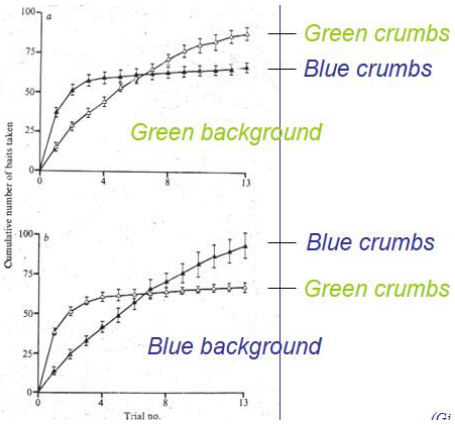
Most effective – asymmetric sub-circles

- Deflection
  - DIVERT ATTENTION from body/towards less crucial body part
    - Inhibits detection of cryptic cues
      - E.g. *insect leg flags*
        - No tests actually performed…appears to be only feasible hypothesis
- WARNING
  - Conspicuous colours => unpalatability
  - APOSEMATISM = warning signal is associated w/ unpalatability of prey
  - Gregariousness ^ learning
  - Multicomponent displays

WARNING DISPLAYS

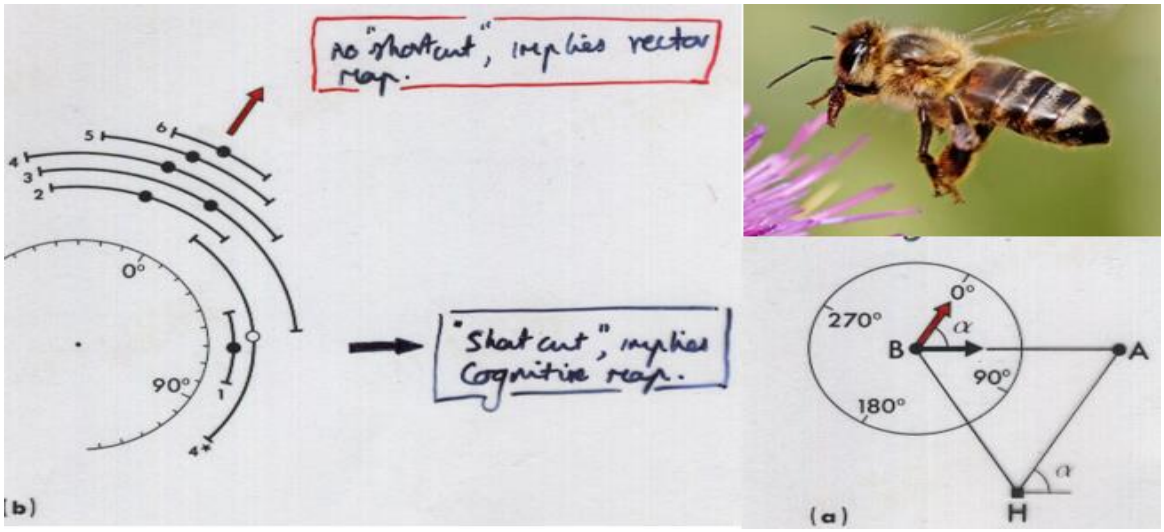
Aposematism: the role of conspicuousness

- Conspicuous => ^ chance of detection
- Might assume distinctive but as inconspicuous as possible would be ideal…avoids naïve predation
- Does it work?
  - YES – Initial rate of consumption will be greater BUT will asymptote @ lower level
- Hypotheses based on receiver psychology:
  - More memorable
  - More discriminable
  - Reduces recognition errors
- A more strategic hypothesis:
  - Conspicuousness = handicap
    - Only genuinely unpalatable prey can afford it



Gregariousness enhances learning

- Predators…
  - Learn quicker
  - Forget slower
- Enhancement is visual (not chemical)
  - Green line matches red => visual aggregation is important



E.g. *Pigeons*

- Very local shortcuts only
  - Explained by sighting of familiar landmarks on route ahead
  - Gradually ^ efficiency over each rep

E.g. *Rodents*

- Many expts have suggested they can take novel shortcuts
  - Can often be explained by simpler local rules
- Do animals learn geometry of familiar space or use simple rules?

E.g. *Ants*

- Can constantly update homeward vectors…sophisticated path integration
- Simple visual centring response to landmarks
  - In cluttered environments, tend to run along midlines of alleys formed by adjacent shrubs
  - No response to heterogeneous stationary/moving black/white gratings
  - Only respond to wall height…vertical angles subtended by the walls must be identical
- Learn simple relationships with landmarks
  - Stay certain distance away