Biology of Learning & Memory (HJC)

Helen Cassaday: Associative learning and memory

- The study of conditioning in animals - basic phenomena and theoretical accounts.
- Amnesia and other forms of memory loss - what does forgetting tell us about learning?
- Dr Jasper Robinson: 5 lectures on comparative cognition.
- Dr Charlotte Bonardi: 5 lectures on other kinds of learning, apart from conditioning.

Learning Aim: To understand basic associative processes in learning and memory.

Reading (library availability checked)

Main texts for animal learning theory:


Alternative texts for animal learning theory:


State-dependent memory:

Choose 2-3 of the following -


Retrograde amnesia:
1. Introduction to conditioning
We’ll cover basic procedures and phenomena in classical (‘Pavlovian’) conditioning. For example, the ‘conditioned emotional response’ or inhibition of responding produced by a signal for shock is a very good measure of learning in the rat. Response rates can be measured accurately and vary in a predictable way depending on just how good a predictor of shock the signal is. One of the most important factors governing what is associated with what is coincidence in time (‘temporal contiguity’).

2. Two sorts of learning
We’ll outline the differences between classical and instrumental conditioning. Classical conditioning is demonstrated when we learn about the relationship between some signal in the environment and an outcome that matters. Instrumental learning also involves learning what goes with what, but in this case the signal is provided by a self-generated response. Classical and instrumental conditioning often occur together and can be hard to separate. For example, does Pavlov’s dog salivate in an entirely automatic way given a signal for dinner or does salivation have some instrumental consequence like making the food taste better? Classical and instrumental conditioning may be dissociated (Gray, 1975) but just how different are they? How far do the same laws of learning apply to both? For example, both kinds of learning require temporal coincidence between signal or response and outcome (and if there is a gap what happens in it will influence what is learned about).

3. Selection for learning
A variety of phenomena show that learning is normally selective. We should know what these are and why selectivity matters. Learning about all the available signals in the environment would be confusing. Some signals are very weak or poorly correlated with outcomes (overshadowing), some are
Redundant (blocking), some are irrelevant (latent inhibition), and the significance of others may be qualified by other stimuli (occasion setting and conditioned inhibition). Selectivity in learning is of practical importance and is something that good theories of associative learning must account for.

4. Theories of classical conditioning
Temporal contiguity is important in learning but we need to understand how learning might come to be selective to good predictors. For this, we need a basic grasp of the following theories of classical conditioning: Rescorla-Wagner (1972), Mackintosh (1975), Pearce and Hall (1980). We should consider whether these theories have any relevance for instrumental learning.

5. Testing the theories
All theories are supported by some of the data. Objective is to understand the relevance of a few key studies.

6. Revision session: Associative learning

7. State-dependent learning & memory
State-dependency is the phenomenon that we remember things best in the same brain state in which we learned them. This is related to Tulving’s idea of ‘encoding specificity’. 

8. Retrograde amnesia
This lecture will discuss consolidation versus state-dependent accounts of the loss of (old) memories prior to trauma.

9. Anterograde amnesia
This is the loss of (new) memories after brain injury. But not all memories are affected and those preserved may give clues to how information is normally encoded.

10. Revision session: Memory and forgetting

Possible Exam Questions

Compare and contrast classical and instrumental conditioning.

In what ways is associative learning normally selective?

Compare and contrast two theories of classical conditioning. Which theory provides the best account of the available data?

Give some examples of how theories of associative learning have been put to experimental test. Which theory do you think provides the best account of the available data?

What is state-dependency? What does it tell us about learning?

What is retrograde amnesia? What does it tell us about learning?

What is anterograde amnesia? What does it tell us about learning?

These questions are related to the objectives for each lecture. These objectives should also give you an idea of other possible exam questions.