

V. Memory and Problem Solving

The Problem of Memory

- Memory is behavior
- Memory is current behavior, not past behavior
- What needs to be explained is your behavior at the moment of recall. What are the controlling variables that evoke it?
- It is not the question itself (not directly).

The Storage Metaphor

- The storage metaphor has an indexing problem. If memories are stored, how are they indexed? How do we look up the entry for yesterday's breakfast? It can't be stored under "YESTERDAY'S BREAKFAST" because the index would have to be updated every day at midnight.
- The storage metaphor faces exactly the same problem as the behavioral view, but it has introduced some terms of doubtful value.

Memory as Behavior

- Review of stimulus discrimination:
 - The red light is like a switch: it can turn key pecking on and off.
 - When the red light is presented at a later time, we expect the pigeon to peck the key. We do not need a concept of “memory.”
 - In this sense, all discriminated behavior is memory. But the term “memory” adds nothing to our account.

Memory Phenomena: A Fundamental Dichotomy

- 1) Memory as a stimulus control phenomenon
 - A stimulus was present at the time of learning and is presented again at a later time. Its presentation evokes the behavior of interest.
- 2) Memory as a problem-solving phenomenon
 - The stimulus present at the time of learning is NOT present at the time of recall. Present conditions do not evoke the behavior of interest directly.

Memory as a Stimulus Control Phenomenon

- Memory in this sense is just learning. All variables relevant to the acquisition of stimulus control will be important:
 - Reinforcement
 - Discrimination training,
 - Frequency
 - Fluency
 - Competing behavior
- How long does learning last?: Do we ever forget?
 - Long-term potentiation and long-term inhibition: Synaptic efficacy seems to decline in the absence of use.
 - But “decay” is not a systematic or orderly process.
 - Anecdote of Henry the pigeon.

Memory as Problem Solving

- Memory and problem solving are not merely two similar phenomena, with some common features.
- They are a single phenomenon. Memory is just an example of problem solving, nothing more.

Problem Defined

- A target response is in the repertoire
- It is scheduled for reinforcement
- It is not prepotent under current conditions

Multiple causation in problem solving: Marshalling supplementary stimuli

- **Look at a map**
 - **Look in a dictionary**
 - **Look on the internet**
 - **Ask a friend**
 - **Make a diagram**
 - **Reduce fractions**
-
- **Example of the square root problem again**

Recall

Where were you on Sept. 19, 2001?

Well, let's see, 9/11 was a Tuesday; plus seven is the 18th, so the 19th was a Wednesday. I was teaching behavior analysis and statistics that day. Let me consult my syllabus . . . we did a pigeon lab. Ok, that was the semester I ran one lab in the morning, one in the evening. I must have been running a lab that night. Who was in that class? According to my class list, Sonia and Helen were in that class. I remember Sonia working alone with her bird on a chaining task one night. Could that have been the 19th? No, the 19th is too close to the beginning of the semester; she wouldn't have got to chaining yet. She had excellent luck with that bird. What would she have done before the chaining experiment? Wait, that would only have been the second session of the semester. They were still working on shaping. Yes, I remember the night they worked on shaping. One group shaped their birds up in one session, but most of them didn't.

Conditioned Perception

- Perceptions are behaviors:
 - Proust and the madeleine
 - They can be evoked by discriminative stimuli
 - One can lead to another, like a waterfall, giving us a rush of related conditioned perceptions: a reminiscence
 - The conditioning of perceptions depends on experience:

The Problem of Conditioned Perceptions

- Experimentally difficult, if not impossible
 - Even interpretation is difficult:
 - What are the three terms of the three-term contingency?
Suppose I see a frog on the breakfast table in the morning. Later in the day I remember the frog; I can “see” the frog sitting on the table.
 - Stimulus: the frog
 - Behavior: Perception of the frog; that is, seeing it as a frog and not as a patch of green on the tablecloth.
 - Reinforcer: Effective action. I can try to touch the frog, or shoo it away, or sit at another table, etc. The visual interpretation of our world must be a powerful conditioned reinforcer.
- What makes a memory vivid? If powerful reinforcers or punishers are associated with it. Some days blend together with other days in a boring stream. But let us do something new and exciting, and we will remember it clearly.

- McGurk experiment: What we “hear” is conditional upon our experience
- Conclusion: Perception is behavior

Example: Those “impressionist” pictures that you must look at with eyes unfocused.

Eventually a scene emerges.

You can recall the scene, but you cannot recall the picture before it “popped into focus.”

That is, once you perceived it, once you interpreted it, it became “meaningful.”

“Meaningful” interpretation must be a conditioned reinforcer, because we can recall conditioned perceptions of meaningful stimuli but not meaningless ones.

*(Note : Notice the relevance of the preceding slide to the controversy over echoic behavior. If we don't respond to a complex stimulus, in some way, we don't remember it. It doesn't control our behavior in the future.)

- At time of recall, we can “see” the frog, but we cannot “see” the tablecloth on which the frog sat.
- That is, we form conditioned perceptions when we engage in discriminative behavior with respect to our world, but not when we simply experience stimuli. That is, we “didn’t notice” the tablecloth.
- Conditioned perception seems to depend in part on expertise (the blindfold chess player, the mathematician).
- Possibly there are some innate differences between people
- But it **must** be the case that perceptual behavior is being conditioned all the time. Why? Because we can so easily imagine scenes from our past.

Recall as a Learned Phenomenon

- Acquisition strategies: At the time of original learning. We have learned that some things are worth remembering, so we make it more likely that we will.
 - Orientation
 - Attending
 - Classify
 - Describe
 - Organize
 - Rehearsal
 - Elaboration
 - Mnemonics
 - Telling a story
 - Fading prompts
 - Test and retest
 - The tricks of the skilled mnemonist
- Acquisition strategies do not provide supplementary stimuli. Rather, they strengthen behavior with respect to stimuli that are likely to be provided by properties of a later recall task or by recall strategies.

Recall strategies

- Go through the alphabet (for a name)
- Recite one's schedule
- Go over related topics

Recall strategies and acquisition strategies work together to make the target response more likely.

Metaphor of the Flask Again

- The task of the learner:
 - To make a target response “easier to hit”
 - To work on the repertoire to increase the probability of the target response
 - We learn that certain kinds of things must later be recalled, and we engage in various acquisition strategies (mnemonics) to make them easier.
 - At the time of recall, we engage in various problem solving strategies to make the target response more probable (“float up the flask”).

- Memory as a stimulus control phenomenon (stimulus present at the time of learning and at the time of recall) does not need special treatment. It's just an example of learning.
- Memory when the stimulus is not presented again is a kind of problem solving.

Implications of the Behavioral View of Memory

- Once a strategy has been employed and a response emitted, it may be directly evoked by the question: e.g. you now know that 42 is the square root of 1764, and you no longer need to employ problem solving or recall strategies.
- Strategies are special to the individual: what works for me may not work for you.
- Strategies are acquired. We must learn to provide ourselves with supplementary stimuli to solve problems, and we must learn to remember. It isn't a basic process.
- There is no qualitative difference between a "correct" memory and an error. They are both behavior controlled by their antecedents.