

SPN 1022

LEARNING IN SCIENCE AND MATHEMATICS

BEHAVIORAL THEORY: CLASSICAL AND OPERANT CONDITIONING

Dr. Johari bin Surif

Department of Science and Mathematics

Education

Faculty of Education

UTM

BEHAVIOURISM

- Well known behaviourist psychologist: Pavlov (1849-1936), Thorndike (1874-1949), Skinner (1904-1990).
- Humans are considered passive organisms primarily controlled by stimuli from their environment
- People's behaviour can be controlled by controlling the environment and scientific methods are appropriate for studying human behaviour

BEHAVIOURISM

- Learning occurs when there are changes in behaviour that may be observed or measured based on Stimulus (S) and Response (R).
- Teaching mathematics consists of strengthening the bonds of S and R
- Example: students learn to associate $(-9) \times 4$ with -36 . Questions (S) and answer (R) are used to check the establishment of the correct bonds.

BEHAVIOURISM

- This is most common technique used from primary level to tertiary level.
- Named: 'drill and practice', 'drill and kill', 'whole class instruction', 'chalk and talk'

BEHAVIOURISM

- Example scenario:

The teacher demonstrates how to perform a rule. Example: $(-9) \times 4 = -36$

Students listen and pay close attention

Students practice with similar examples

Teacher monitors their work

Rewards those who can answer correctly and re-explains to those who made mistakes

Explain → **Practice** → **Feedback**

BEHAVIOURISM

- Stimulus-Respond Bond
- The idea of behaviourist learning is to strengthen the bond of Stimulus (question) and the correct Response (answer).
- But, how?

BEHAVIOURISM

- **Law of Exercise:** Repetitions can strengthen bonds, but distributed practice is more effective than massed practice
- **Law of effect:** any act that produces a satisfying effect in a situation tends to be repeated in that situation. Positive reinforcement is preferred
- **Law of Recency:** the most recent bond is likely to recur.

BEHAVIOURISM

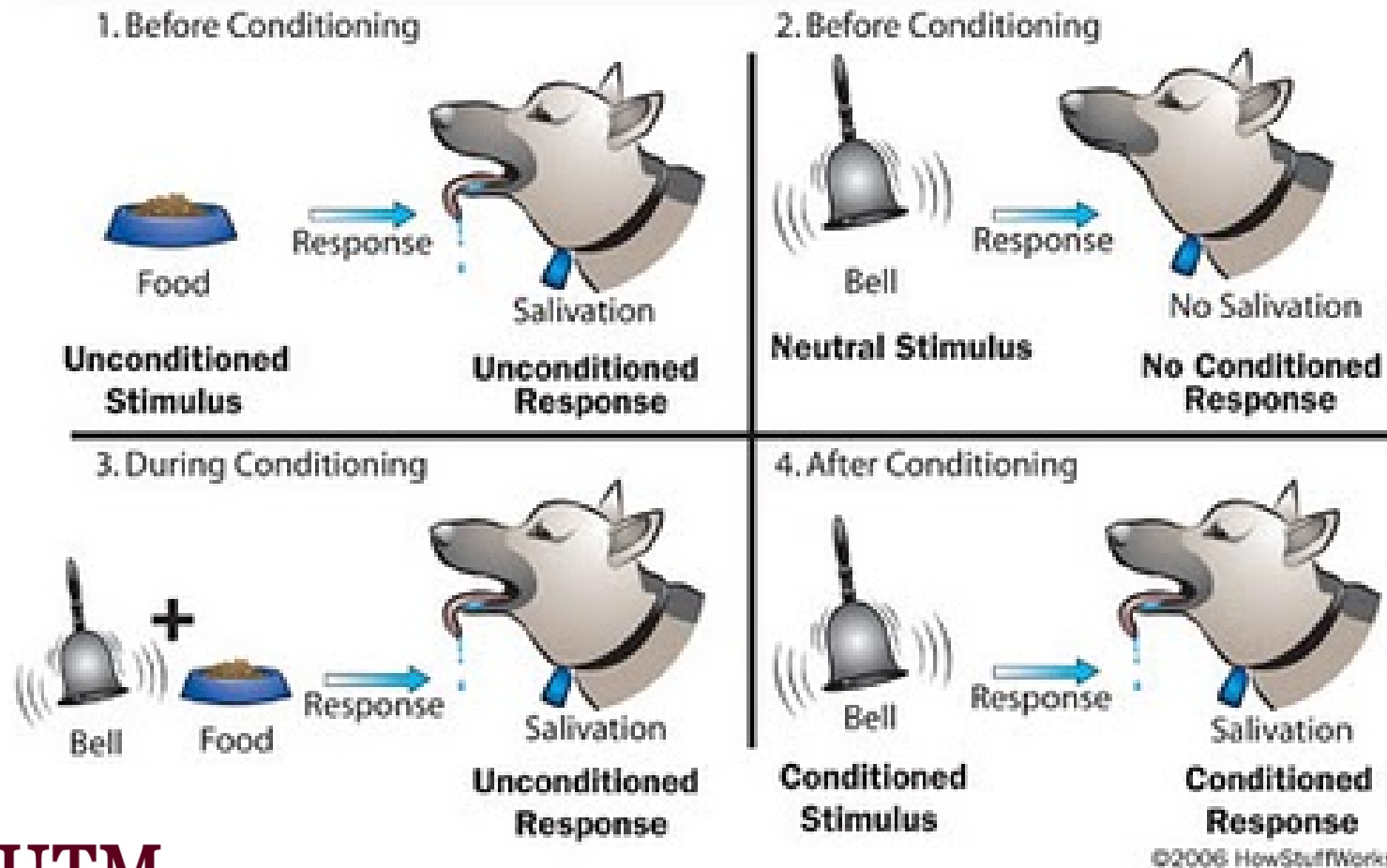
- Example
- Teach skill 1-practice skill 1-teach skill 2-practice skill 2
- Praise students who give correct answers

CLASSICAL CONDITIONING

- Skinner believes that all human behaviour falls under two categories:
- *1. Respondent behaviour*: involuntary reflex behaviours
- A bug flying towards your eye will make you blink
- A sudden bright light causes you to blink
- An embarrassing event causes you to blush

PAVLOV'S RESPONDENT LEARNING EXPERIMENT

How Dog Training Works



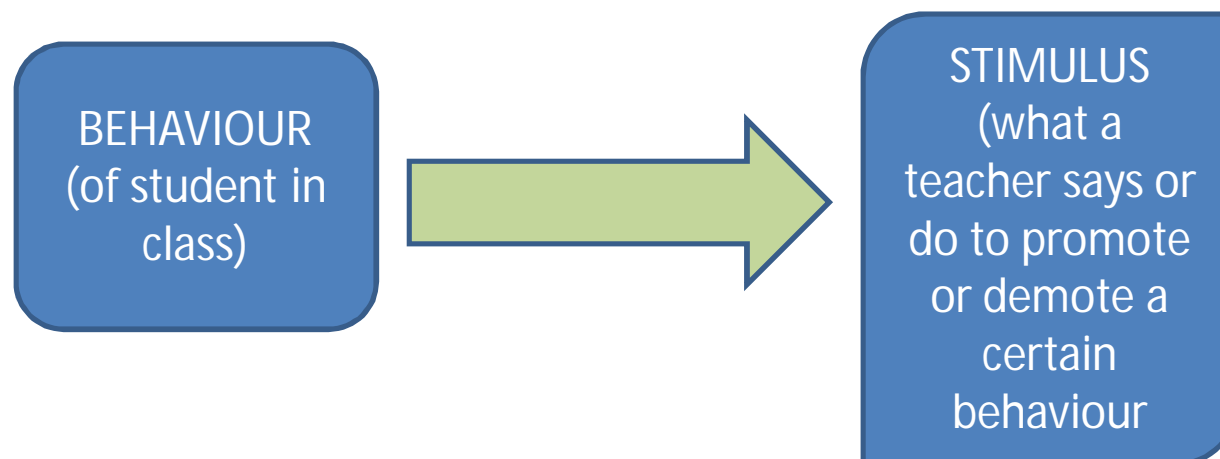
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OPERANT CONDITIONING

- 2. *Operant Behaviours*: not automatic, not predictable and we cannot easily identify the stimuli.
- A method for learning that occurs through rewards and punishments.
- Through operant conditioning, an association is made between a behaviour and the consequence of the behaviour
- Operant conditioning is when a behaviour is followed by a stimulus

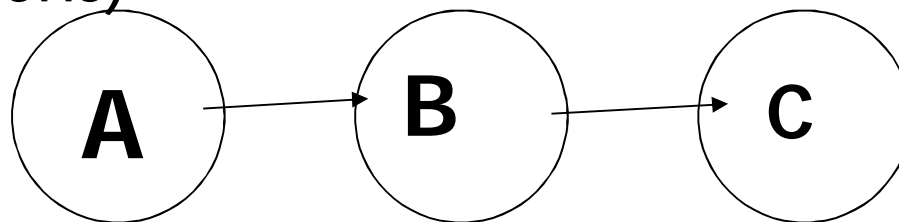
OPERANT CONDITIONING

- The stimulus offered after a response (a wanted/unwanted behaviour) is called reinforcement.
- A stimulus is designed to increase some behaviour or decrease unwanted behaviour



OPERANT CONDITIONING

- Thorndike's experiment: operant conditioning
- Edward Thorndike (1913) experimenting with cat.
- A= Antecedent
- B= Recurrent behaviour (operant-searching for knob to open the door)
- C= Outcome(consequence-accessible to food when door opens)



OPERANT CONDITIONING

- Within time, it takes less time for the cat to to use the knob
- What about among humans?

OPERANT CONDITIONING

- Reinforcement
- The stimulus given after a response (a wanted/unwanted behaviour) is called reinforcement.
- Reinforcement can assist in learning and make changes in behaviour.
- Reinforcement can be in the form of *positive reinforcement* or *negative reinforcement*.

OPERANT CONDITIONING

- Positive Reinforces
- *Positive reinforcer*: make it more likely that the behaviour is repeated (or the behavior is strengthened).
- Think of it as adding something in order to increase a response.
- The positive reinforcer may be good or bad for the student.
- Think of it as + + +

OPERANT CONDITIONING

- Some examples
- Simple example: when a child is able to answer a mathematics problem, you praise him. This will increase his likelihood to answer other mathematics problems.
- Giving out stars to good work will increase probability of the child to continue producing good work.

OPERANT CONDITIONING

- Consider this scenario
- Teacher: Jim, what does a^4 means?
- Jim: (no response)
- Teacher: well students, Jim must have forgotten how to talk. (laughter among his classmates and Jim turns red in embarrassment)

What is the consequence of the teacher's reinforcement towards Jim?

OPERANT CONDITIONING

- Jim is embarrassed and becomes even more shy in mathematics class. He will dislike mathematics classes and is less likely to respond to future mathematics questions.
- This scenario is also called positive reinforcement, set in a negative tone.
- The student does not respond to the question, and the teacher facilitates him to become even less responsive to the question.
- Think - + -

OPERANT CONDITIONING

- Tips for positive reinforcement
- ***'catch 'em being good'***: find examples of good behaviour rather than criticizing those with bad behaviour.
- **Be specific and sincere in praising**: saying 'good' is not enough. You must say 'your diagrams are very clearly drawn. Good'.
- **Model good behaviour**: arrive early in class, be organized, demonstrate your thinking when working out a mathematics question.

OPERANT CONDITIONING

- **Teach students to reinforce themselves:**
frequently ask students to write on a piece of paper as much as they can, what they have learnt today.

OPERANT CONDITIONING

- Negative Reinforcement
- *Negative reinforcers*: stimuli whose removal tends to strengthen behaviour.
- Think of it as 'take away', 'subtract', '-'
- Examples: removing distracting stimuli such as noise, disruptive student or distracting materials.

OPERANT CONDITIONING

- Punishment
- Punishment is a common technique to control behaviour.
- Punishment is a deliberate presentation of a negative reinforcer.
- Or a deliberate removal of a positive reinforcer
- **Negative punishments:** no recess for a student who has not done his homework, no pocket money if your child does not get A for mathematics

OPERANT CONDITIONING

- Punishment
- **Positive punishment:** giving extra homework for students who were noisy in class, telling students who did not do their homework to stand during class.
- Studies have shown that punishment suppress unwanted behaviour temporarily.
- These unwanted behaviour usually appear again
- Even worse some mild punishments such as extra homework or staying back after school can cause students to hate mathematics and school.

REFLECTION

- Which Classical Theory each of the following questions is related to:
 - Every time upon hearing the sound of the siren at 7.00 the hostelites will proceed to the dining hall for dinner.
 - Being talkative in Physics class Ahmad was sent out of the class by the teacher. After that he behaved himself and did not talk unnecessarily.

REFLECTION

- When the teacher gave easy Physics questions to Rama he was able to solve them. With more difficult questions given to him he put more effort and finally could solve them.
- Ah Boon cried and did not want to go to school . However when his mother gave some money he stopped crying and went to school.