Learning & Conditioning

Naveen Kashyap, PhD
Indian Institute of Technology Guwahati
Email: naveen.kashyap@iitg.ac.in

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati





Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Learning & Conditioning

- ***Learning***
  - Learning is defined as a relatively permanent change in behavior that occurs due to experience

  - Two basic kinds of learning
    - Non-associative – involves learning about a single stimulus & includes habituation and sensitisation

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

- habituation – is characterized by a decreased behavioral response to an innocuous stimulus e.g., repeated sounding of horns decreases startle response

Learning & Conditioning

- *sensitization – is a learning whereby there is an increase in a behavioral response to an intense stimulus e.g., horn startle is greatly enhanced before entering a dark alley before the horn sounds*

Associative – more complex as it involves learning about relationships among events, and includes classical conditioning and instrumental conditioning

Human Behaviour
Prof. Navdeep Kaur Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Classical Conditioning

- Classical conditioning
  - Learning process in which previously neutral stimulus becomes associated with another stimulus through repeated pairing with that stimulus
- Pavlov's experiments
  - Pavlov's research involved measuring dogs' salivation in response to food and found that the dogs began to salivate when they saw food dish

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

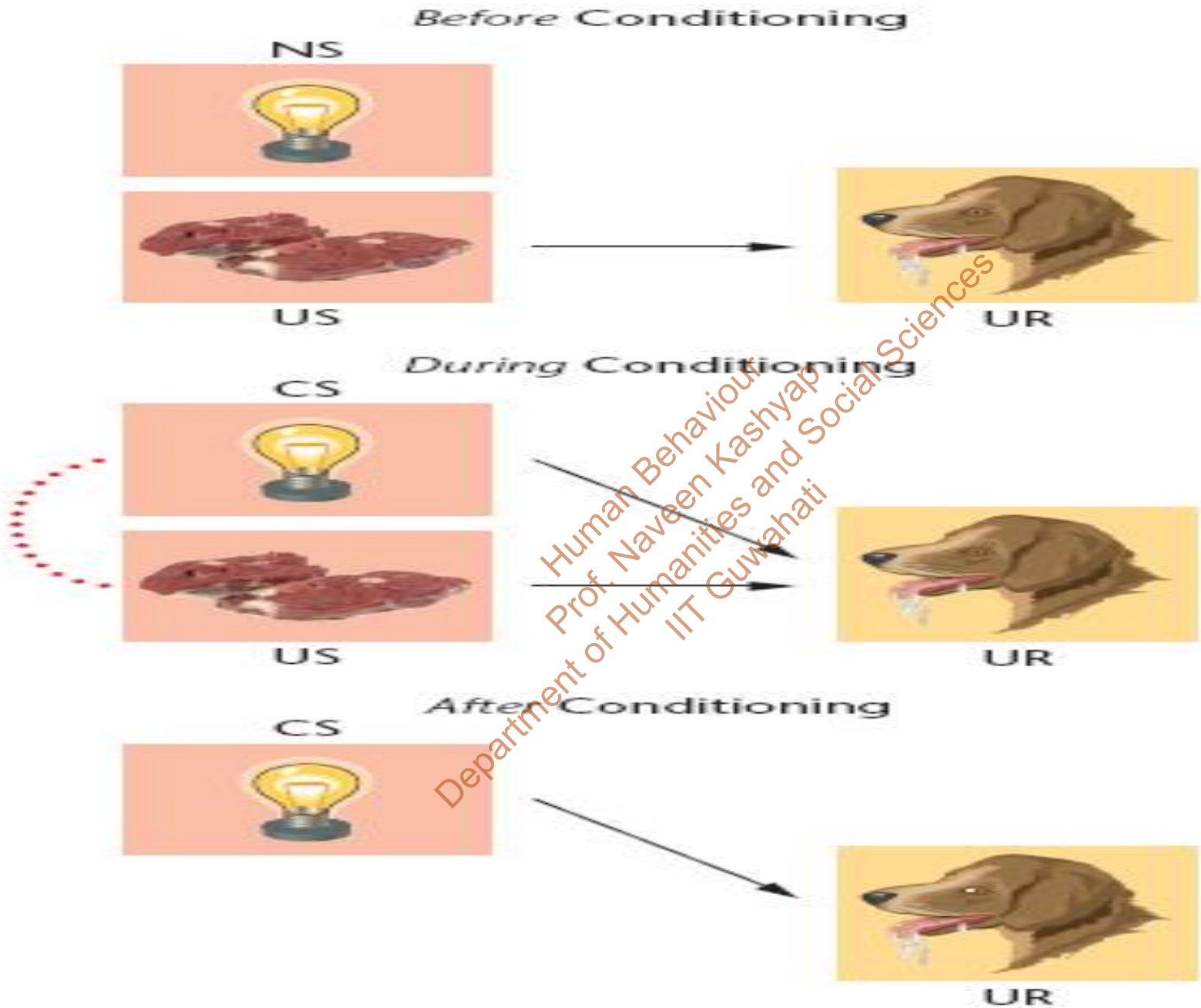
Classical Conditioning

- Unconditioned stimulus (US) – food
- Unconditioned response (UR) – salivation
- Neutral stimulus (NS) – unrelated event, e.g. light on

- During conditioning, pair presentation of food with light
- After number pairings, dog will salivate when light on

- Conditioned stimulus (CS) – light
- Conditioned response (CR) – salivation

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati



Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Classical Conditioning: Basic Principles

Acquisition: The course of Classical Conditioning

Acquisition – the process of pairing conditioned stimulus with conditioned response – proceeds quite rapidly at first, increasing as the number of pairing between CS and UCS increases. However after a while the acquisition slows down.

Beside acquisition conditioning is also affected by temporal arrangement of the CS-UCS pairings. Some possible temporal pairings are presented below

Human Behavior
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Classical Conditioning: Basic Principles

Forward Conditioning – presentation of the conditioned stimulus always precedes the presentation of the unconditioned stimulus

- Delay Conditioning – is a form of forward conditioning in which the onset of the unconditional stimulus (UCS) begins while the conditional stimulus (CS) is still present

- Trace Conditioning – form of forward conditioning in which the onset of the CS precedes the UCS and the presentation of the CS and UCS does not overlap

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Classical Conditioning: Basic Principles

Simultaneous Conditioning – form of conditioning in which the conditioned stimulus (CS) and the unconditioned stimulus (UCS) begin and end at the same time

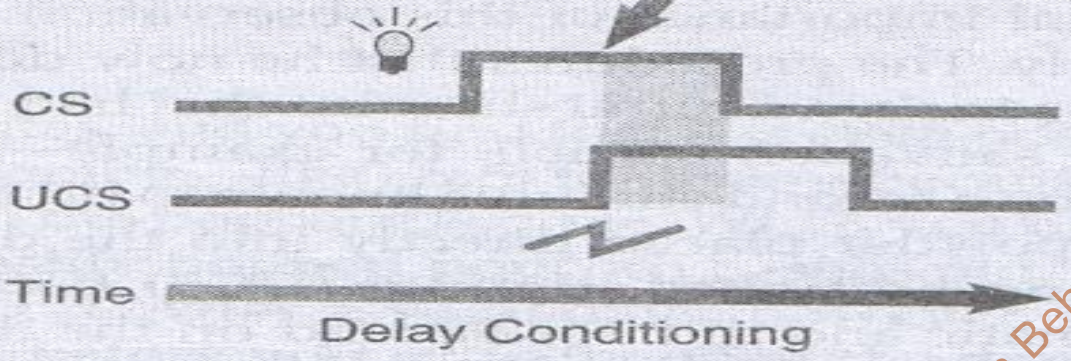
Backward Conditioning – type of conditioning in which the presentation of the unconditioned stimulus (UCS) precedes the presentation of the conditioned stimulus

Several additional factors also appear to affect conditioning.

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

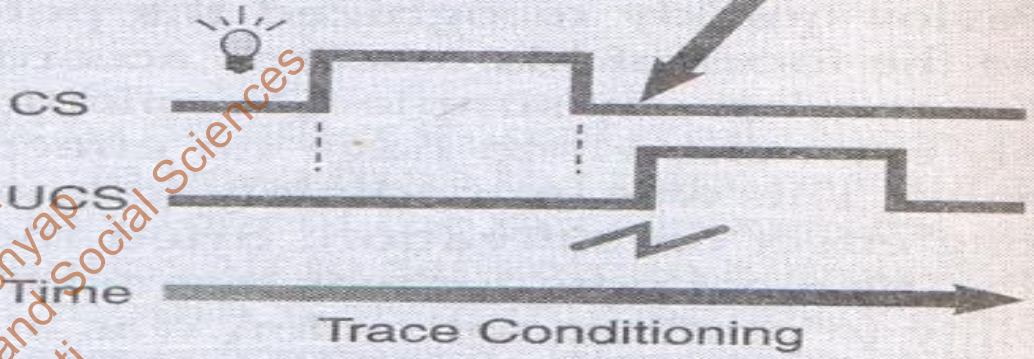
Forward Conditioning

The onset of the CS (light) precedes the onset of the UCS (shock), and the light remains on for the first part of the shock



Delay Conditioning

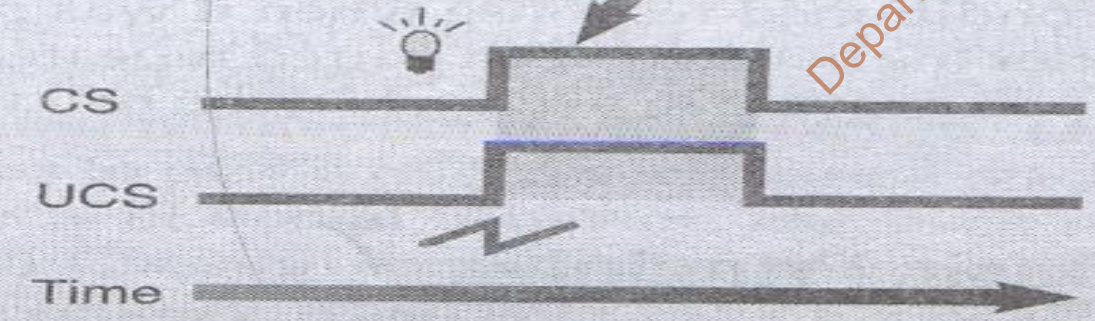
The onset of the CS (light) precedes the onset of the UCS (shock), and the light goes off before the shock begins



Trace Conditioning

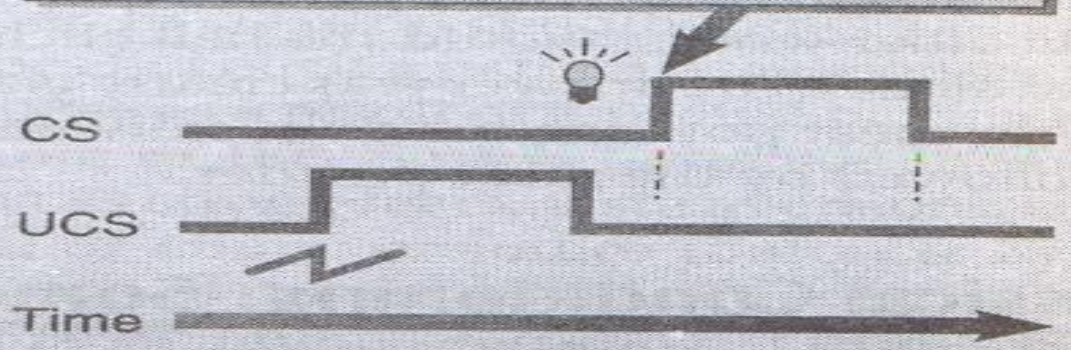
Simultaneous Conditioning

The CS (light) and the UCS (shock) come on and go off at the same time



Backward Conditioning

The onset of the UCS (shock) precedes the onset of the CS (light), and the shock goes off before the light comes on



Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Classical Conditioning: Basic Principles

*Conditioning is faster when the **intensity** of either the conditioned (CS) or unconditioned stimulus (UCS) increases*

*Conditioning also depends on the **time interval between presentations** of the two stimuli. Extremely short intervals - > 0.2 seconds – rarely produce conditioning*

***Familiarity** can greatly affect conditioning*

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Classical Conditioning: Basic Principles

Extinction: Once conditioning is acquired how to get rid of it?

The process through which a conditioned stimulus gradually loses the ability to evoke conditioned response when it is no longer followed by the unconditioned stimulus id termed ***extinction.***

Reconditioning is the rapid recovery of a conditioned response (CR) to a CS-UCS pairing following extinction.

Spontaneous Recovery is the reappearance of a weakened conditioned response to a conditioned stimulus after an interval of time following extinction

Human Behavior
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Classical Conditioning: Basic Principles

Generalization and Discrimination: Responding to similarities and differences

Stimulus Generalization *– the tendency of stimuli similar to a conditioned stimulus to evoke conditioned response*

Stimulus Discrimination *– the process by which organisms learn to respond to certain stimuli but not to others*

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Classical Conditioning: Exception to Rules

- ***Biological constraints***
  - To some extent animals are "pre-programmed" to learn particular things in particular ways
    - Learned taste aversion – bad experience with certain food puts a person off that particular food but this conditioning does not entirely comply with classical conditioning – taste aversions common after just one bad experience (no repeated pairings), & CS-US interval usually very long (number of hours rather than immediate)

Human Behaviour
Prof. Nasreen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Classical Conditioning: A Cognitive Perspective

Classical Conditioning involves more than simple associations. Regular pairing of CS with UCS provides subjects with valuable ***predictive*** information. Thus as conditioning proceeds subjects acquire ***expectation*** that a CS will be followed by UCS.

The idea that cognitive processes involving expectation play a role in classical conditioning is a thesis supported by several types of evidence

- First conditioning ***fails*** to occur when UCS and CS are paired in random order

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

- Second the cognitive thesis is supported by a phenomenon known as ***blocking*** – the fact that conditioning to one stimulus may be prevented by previous conditioning to another stimulus

- The idea that cognitive processes play a role in classical conditioning is also supported by studies of mental imagery. The main question addressed by this research is whether mental images of stimuli can substitute for their physical counterparts in the cognitive process. The thesis has been successfully tested.
  - Part of the answer to the puzzle lies in the fact that mental imagery makes people mentally scan an object, leading to eye movements which indicate movements when actually scanning a physical object.

Human Behaviour
Dr. Navneen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Instrumental Conditioning

- Instrumental conditioning
  - Involves learning the relationship between responses and their outcomes
  - Thorndike carried out experiments where animals engaged in trial-and-error learning where behavior strengthened if immediately followed by reward (law of effect)

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Instrumental Conditioning

- Skinner's experiments
  - Skinner's experiments involved putting a hungry animal in box which is bare except for a bar with food dish under. Animal's initial rate of pressing bar through exploration = baseline level
  - Acquisition & extinction – after the baseline is established, each time the bar is pressed food is released which results in frequent pressing of the bar. If food stops being released then similar extinction of response, as in classical conditioning.

Human Behaviour
Prof. Nandini Kalyanaraman
Department of Humanities and Social Sciences
IIT Guwahati





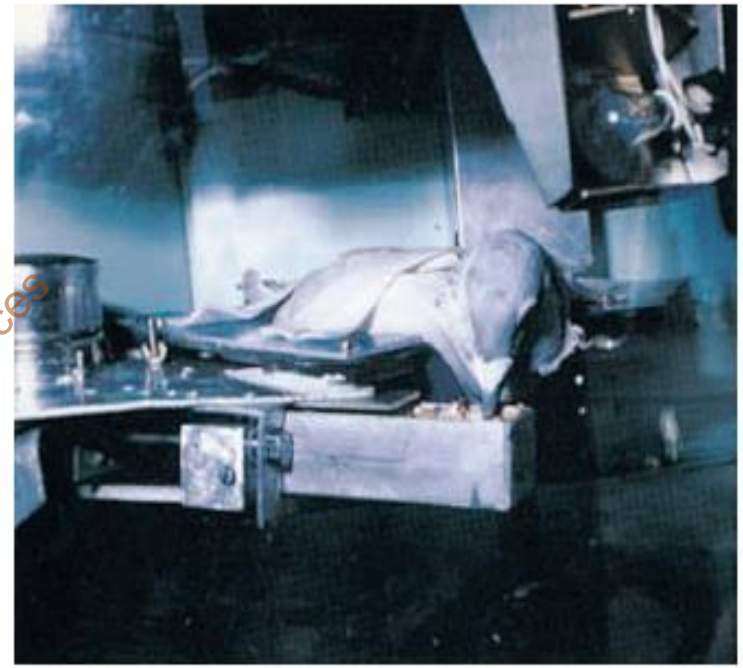
Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati



Pigeon sitting



Pigeon pecking key



Pigeon rewarded

© (ALL) COURTESY NAVAL OCEANS SYSTEMS CENTER

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Figure 7.7 Search and Rescue by Pigeons. *The Coast Guard has used pigeons to search for people lost at sea. Shaping methods are used to train the pigeons to spot the color orange, the international color for life jackets. Three pigeons are strapped into a Plexiglas chamber attached to the underside of a helicopter. The chamber is divided into thirds so that each bird faces in a different direction. When a pigeon spots an orange object, or any other object, it pecks a key that buzzes the pilot. The pilot then heads in the direction indicated by the bird that responded. Pigeons are better suited than people for the task of spotting distant objects at sea. They can stare over the water for a long time without suffering eye fatigue, they have excellent color vision, and they can focus on a 60- to 80-degree area, whereas a person can focus only on a 2- to 3-degree area. (After Simmons, 1981)*

The Nature of Operant Conditioning

In operational conditioning, the probability that a given behavior will occur changes depending on the consequences that follow it. These probabilities are determined through four basis procedures, two of which strengthen / increase (Reinforcements) and two which weaken / decrease (Punishment) the rate of behavior.

Reinforcements *– the application or removal of a stimuli to increase the strength of a specific behavior. They are of two classes*

Positive Reinforcement – involves the impact of positive reinforces - stimulus events or consequences that strengthen responses that precede them.

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Negative Reinforcement – involves the impact of negative reinforces – stimuli that strengthens responses that permit an organism to avoid or escape from their preferences.

Punishment – *refers to procedures that weaken or decrease the rate of behavior. They are of two classes*

Positive Punishment – behaviors are followed by aversive stimulus events termed punishers

Negative Punisher – the rate of behavior is weakened or decreased because the behavior is linked to the loss of potential reinforcement

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Instrumental Conditioning

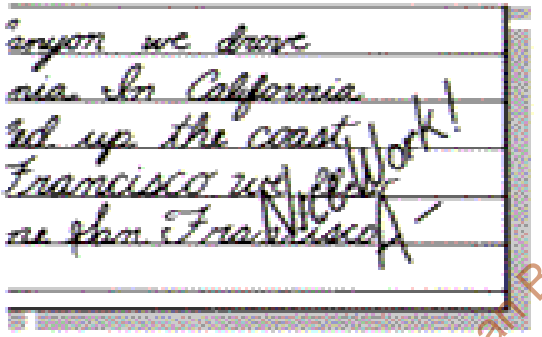
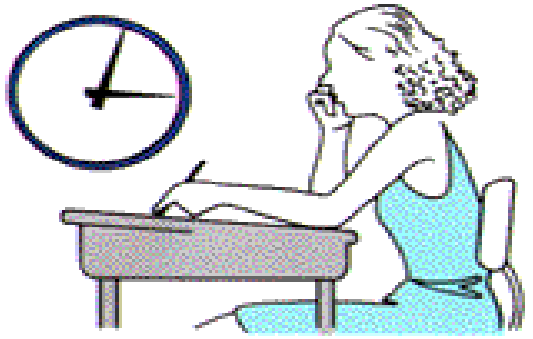
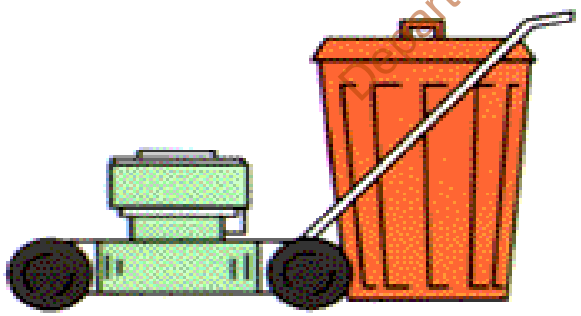
CONCEPT REVIEW TABLE



Types of reinforcement and punishment

Type	*Definition*	*Effect*	*Example*
Positive reinforcement	Delivery of a pleasant or appetitive stimulus following a behavioral response	Increases the frequency of the behavioral response	If studying is followed by a high grade on an exam, then the incidence of studying before exams will increase
Negative reinforcement	Removal of an unpleasant or aversive stimulus following a behavioral response	Increases the frequency of the behavioral response	If leaving a study area removes you from a noisy classmate, then the time you spend away from the study area will increase
Positive punishment ('Punishment')	Delivery of an unpleasant or aversive stimulus following a behavioral response	Decreases the frequency of the behavioral response	If your professor embarrasses you for asking a question in class, then the likelihood you will ask questions in class will decrease
Negative punishment ('Omission training')	Removal of a pleasant or appetitive stimulus following a behavioral response	Decreases the frequency of the behavioral response	If your girl- or boyfriend withholds affection whenever you watch TV, the time you spend in front of the TV will decrease

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

	Behavior Encouraged	Behavior Suppressed
Stimulus Presented	POSITIVE REINFORCEMENT ("Reward") Example: good grades 	PRESENTATION PUNISHMENT ("Type I" Punishment) Example: after school detention 
Stimulus Removed or Withheld	NEGATIVE REINFORCEMENT ("Escape") Example: excused from chores 	REMOVAL PUNISHMENT ("Type II" Punishment) Example: no TV for a week 

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Instrumental Conditioning: Basic Principles

In operant conditioning, organisms learn associations between particular ***behaviors*** and the consequences that follow them. In order to understand this form of learning two issues need to be addressed –

- why are certain behaviors emitted in the first place

- once emitted what factors determine the frequency with which they occur

Shaping and Channing: Getting behaviors started and then putting it all together

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Shaping – *is a technique in which closer and closer approximations to desired behavior are required for the delivery of positive reinforcement*. The organism undergoing shaping receives a reward for each small step toward a final goal – the target response – rather than only for the final response.

Chaining – *is a procedure that establishes a sequence of responses, which lead to a reward following the final response in the chain*. Training circus animals requires trainers to establish a sequence, or chain, of responses, the last of which leads to a reward

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Science
IIT Guwahati

Instrumental Conditioning: Basic Principles

- Biological constraints
  - As with classical conditioning, biology imposes constraints on what may be learned through instrumental conditioning – organisms find it easier and faster to learn response if the behavior required makes sense on an ethological level

Human Behaviour
Prof. Nasreen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

The Role of Reward Delay in Impulsiveness and Procrastination.

Operant conditioning usually proceeds faster as the ***magnitude of reward*** that follows each response ***increases***.

But the effectiveness of reward can be dramatically affected by ***reward delay***. The effects of reward delay can lead to

- Impulsiveness – the tendency to often choose smaller immediate rewards over rewards of greater value that they must wait to receive.

- Procrastination – thee tendency to put off until tomorrow what we should do today. The decision facing procrastinators is whether to perform a small less effortful task now or a larger more effortful task later on

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Instrumental Conditioning: Basic Principles

Schedules of Reinforcement: Different rules for the delivery of payoffs

Continuous Reinforcement Schedule – *a schedule of reinforcement in which every occurrence of a particular behavior is reinforced*

Fixed Interval Schedule – *a schedule of reinforcement in which a specific interval of time must elapse before a response will yield reinforcement*

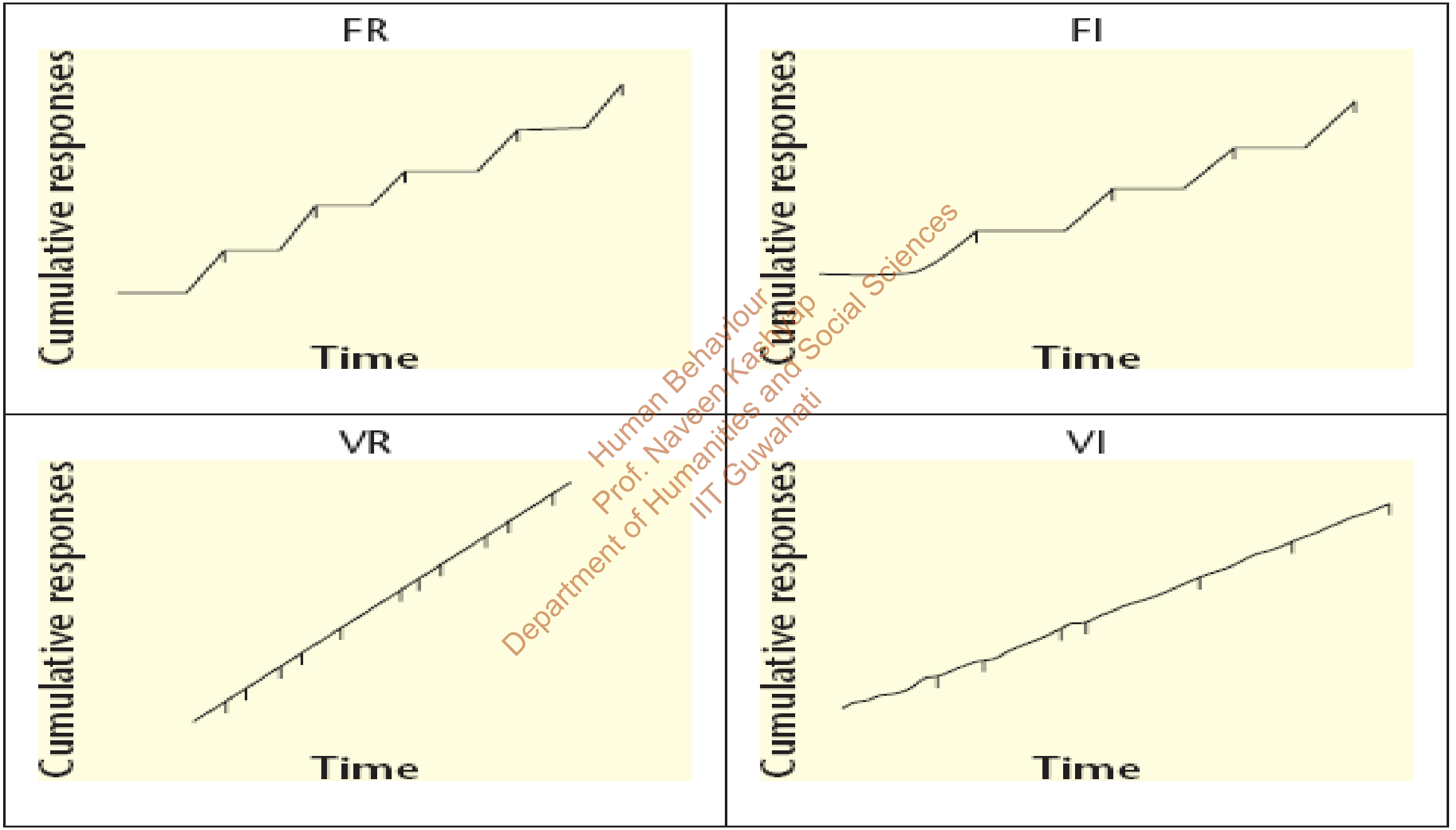
Human Behaviour
Prof. Naresen Pulshyap
Department of Humanities and Social Sciences
IIT Guwahati

Variable Interval Schedule – *a schedule of reinforcement in which a variable amount of time must elapse before a response will yield reinforcement*

Fixed Ratio Schedule – *a schedule of reinforcement in which reinforcement occurs only after a fixed number of responses have been emitted*

Variable Ration Schedule – *a schedule of reinforcement in which reinforcement is delivered after a variable number of responses have been performed*

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati



Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Instrumental Conditioning: Basic Principles

Concurrent Schedules of Reinforcement and the Matching Law

Concurrent schedule of reinforcement – *is a situation in which two or more behaviors, each having its own reinforcement schedules, are simultaneously available.* This type of schedule has been used to study choice behavior in both animals and humans.

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Matching Law – states that the rate of response will match the rate of reinforcement each alternative behavior produces. In other words A rat will distribute its behavior between alternatives in such a way as to maximize the reinforcement it receives for its efforts.

Stimulus Control of Behavior: Signals about the usefulness (or uselessness) of responses

People and other animals readily learn to pay attention to cues in the environment that reliably signal certain consequences for their actions. Overtime people learn to make responses only in the presence of these signals – ***Discriminative Stimulus*** – stimulus that signals the availability of reinforcement if a specific response is made. In short their behavior comes under ***Stimulus Control*** – consistent occurrence of a behavior in the presence of a discriminative stimulus

Human Behaviour
Prof. Nasreen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Instrumental Conditioning: Cognitive Perspective

Do Cognitive Factors influence Instrumental Conditioning?

Several Evidences seem to support the role of cognition in Instrumental conditioning –

Learned Helplessness – is the lasting effect produced by exposure to situations in which nothing an organism does work – no response yields reinforcement or provides escape from negative events.

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

- Research suggests that learned helplessness stems partly from our perceptions of control; when we began to believe that we have no control over our environment or our lives, we stop trying to improve out situation.

- In addition genetic factors like the inherited impairment in the ability to experience pleasure – ***hypohedonia –*** can also lead to learned helplessness

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Instrumental Conditioning: Cognitive Perspective

Evidence that it's all relative: The Contrast Effect

- Behavior is influenced not only by the level of rewards we receive by our evaluation of rewards relative to our experiences with previous rewards.

- Shifts in the amount of reward we receive can dramatically influence performance, a temporary behavior shift termed as ***contrast effect.*** This can be of two types –
  - Positive
  - Negative

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

- The existence of contrast effect indicates that level of reward alone cannot always explain our behavior and that experiences with a previous level of reward - and consequent expectancies – can dramatically effect our performance

Tolman's Cognitive Map

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Observational Learning

Observational Learning – is the acquisition of new forms of behavior, information or concepts through exposure to others and the consequences they experience.



Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati










Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Observational Learning: Basic Principles

What factors and conditions, determine whether and to what extent, we acquire behavior, information and concepts from others?

Bandura (1986) suggests …….

First, in order to learn through observation the ***attention*** must be directed to appropriate models (i.e., the person performing the activity)

Second, what the model does and says must be ***remembered.***

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

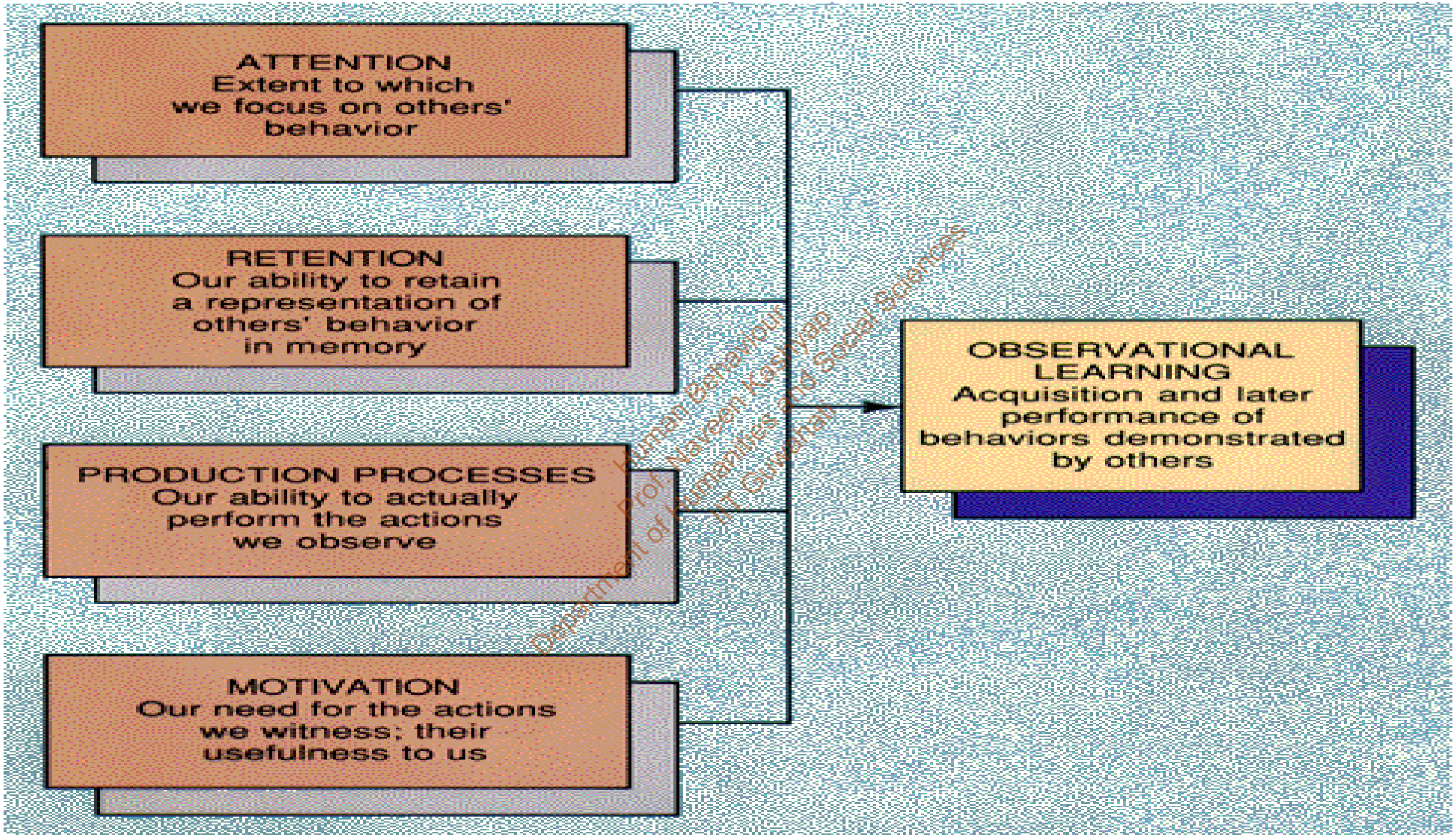
Third the memory representations formed (at 2) must be converted into actions. This aspect of observational learning is termed as ***production processes*** and depends on –

- ***Physical ability***

- Capacity to ***monitor performance & adjust*** it till it matches the original

Finally, ***motivation*** plays a decisive role in observational learning

Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati



Human Behaviour
Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Observational Learning: Basic Principles

Observational Learning and Aggression

A large body of research indicates that aggression may indeed be learned through aggression. Apparently, when children and adults are exposed to new ways of aggressing against others – techniques they have not previously seen – they may add these new behaviors to their repertoire.

Human Behaviour
Prof. Navdeep Kaur Kang
Department of Humanities and Social Sciences
IIT Guwahati

Observational Learning and Culture