Psychology of Emotion: Theory and Applications
Professor Dilwar Hussain
Department of Humanities and Social Sciences
Indian Institute of Technology, Guwahati
Module 7, Lecture 16: Emotion and Memory

I welcome you all to Lecture Number 16, titled "Emotion and Memory," which is under Module 7. Module 7 focuses on emotions and cognitions, examining how they interact with each other. This module consists of three lectures; we have already covered one, providing an introduction to the concepts of emotion and cognition. Today, we will discuss how emotion influences our memory. Before delving into that, let's briefly recap what was discussed in the last lecture.

The previous lecture primarily served as an introduction to understanding how cognitions influence emotions, with a specific focus on how emotion influences cognitions. We explored various ways in which these two factors interact, particularly delving into different perspectives to explain the impact of emotion on cognitions. In this context, three theoretical perspectives were discussed to explain the effect of emotions on cognitions. The first one was the concept of emotion congruence or mood congruence, which essentially suggests that our present mood or emotion influences various cognitive processes, such as attention, perception, memory, and information processing.

Whatever emotional mood we are experiencing in the present moment will influence a variety of cognitive processes, including perception, attention, memory, and decision-making, among others. This is broadly referred to as mood congruence or emotion congruence. We have discussed various theoretical perspectives that can explain this phenomenon. One such perspective is Bauer's associative network theory, and we have also discussed the Effect Infusion Model to explain how emotion or mood congruence can be understood.

The second perspective we have discussed regarding how emotion influences cognition is the concept of "feeling as information." This perspective suggests that emotions or feelings serve as signals or information about our surroundings or the situation we are in. They provide information that helps us make decisions. For example, if we feel afraid or fearful, it indicates that something in the environment or situation may be dangerous, prompting us to take appropriate actions. This idea of emotion as information was explored in various aspects during our discussion.

So, this can be explained as follows: there is an encoding process, followed by processing and storage, and finally retrieval. These are the three main aspects of memory. During encoding, information is taken into the memory system from our sense organs, encompassing what we see, hear, and process. This information is then stored, either temporarily or long-term. Later, when needed, we retrieve this information from our memory system. Comparing this to a computer system, encoding is akin to inputting information through a keyboard. This information is then stored in components such as hard drives and retrieved, displayed on a monitor. This process mirrors the sequential processing in human memory.

Research suggests that while computer memory stores and retrieves information exactly, human memory involves a more constructive process. When we store information, what we retrieve may not always be an exact replica due to various factors such as environment, identity, and motivation. Our memory system can involve constructive processes where information

may be altered during storage and retrieval. Human memory differs from storing exact replicas like photographs; instead, it's dynamic and subject to constructive processes influenced by various factors. These constructive processes will be discussed further when we delve into eyewitness memory. Regarding emotions and their connection with memory, they significantly impact all stages of encoding, storage, and retrieval.

So, emotion can impact all processes of the memory system: encoding, storage, and retrieval. Generally, it is observed that emotion enhances the formation and intensity of memories. When we experience certain emotions or when the content is emotionally charged, it aids in encoding the information more strongly, resulting in enhanced memory formation and intensity. This means that emotionally significant information is stored more intensely and remembered more effectively.

This effect is particularly robust and applies even to events that are not inherently emotional but occur during periods of heightened emotion. In such cases, the present emotional state can influence how information is stored. However, in extreme emotional situations, such as traumatic events, this effect may break down because the intensity of the emotion can hinder processing, leading to occasional forgetting of events that occur during moments of extreme emotion, such as panic.

While emotion generally enhances the initial formation of memory, extreme cases may lead to forgetting due to the mind's inability to process information amidst intense emotions, as in highly traumatic events. Now, let's examine why this phenomenon occurs.

Studies consistently show that emotional events and objects are more easily remembered than neutral ones. This is because emotionally charged information is encoded more strongly and intensely in the memory system. Therefore, objects with emotional significance are recalled more effectively compared to neutral ones. For instance, witnessing a bicycle accident leads to better recall of that event compared to a mundane event involving a bicycle.

For example, if we consider a normal scenario where someone is riding a bicycle, we may encounter many such incidents every day without recalling most of them. However, if we suddenly witness a bicycle accident, we are more likely to remember that event for a longer time because accidents evoke emotions. Events with emotional content tend to capture our attention more effectively and are remembered for longer durations.

Studies on word memory have conducted experimental research where individuals are given lists of words to remember. These studies have consistently shown that emotionally charged words are better remembered than neutral words and are often recalled more vividly. In experimental settings where participants are shown lists of words for a brief period and later asked to recall them, words with emotional content are more likely to be remembered compared to neutral words. For instance, words like "ugly," "evil," and "romantic" evoke emotions, whereas words like "detached," "indifferent," and "skeptical" are neutral. Participants tend to recall emotional words better and may forget neutral words more easily.

Similarly, research has demonstrated that emotionally charged pictures are also remembered better than neutral ones. Regardless of the duration or attention given to viewing these pictures, emotionally stimulating images are remembered more effectively. For example, a picture depicting a soldier bidding farewell to his daughter is more likely to be remembered due to its emotional content compared to a neutral picture of a tree.

One explanation for why emotional content is remembered better involves physiological arousal associated with emotions. Emotional stimuli trigger heightened physiological responses, which may enhance memory encoding and retention.

So, the reasons for enhanced memory for emotionally arousing pictures can also be attributed to the emotional content. It's not just about the unusualness of these pictures, but rather the emotional content that makes them more memorable. This emotional content is significant because emotions are associated with physiological arousal. When we experience emotions, our physiology becomes activated, causing our entire system to pay more attention. Physiological research suggests that emotion has a significant impact on memory formation, as heightened physiological arousal during emotional experiences can enhance memory encoding.

This physiological arousal associated with emotions leads to enhanced memory encoding. Due to this arousal, we are more likely to encode information in a stronger and more effective manner. This is one possible mechanism, supported by evidence from various studies. Researchers have manipulated the level of physiological arousal in experiments to observe its impact on memory formation.

For instance, experiments have involved increasing the release of hormones such as epinephrine (adrenaline) and cortisol, which are triggered by emotional stress. Research has shown that injecting these hormones artificially enhances memory of recently experienced events in both humans and laboratory animals. When individuals are injected with stress hormones like epinephrine and cortisol, which induce physiological arousal, their performance in memory tasks tends to improve. This indicates that heightened physiological arousal contributes to better memory formation.

Furthermore, the vagus nerve, an important nerve in the body, is stimulated by hormones like epinephrine and cortisol, which are associated with emotional experiences. This stimulation excites the amygdala, a small organ in the brain's limbic system, known for its strong association with emotional experiences, particularly fear, anxiety, and other emotions, as discussed in the lecture on the physiology of emotion. So, basically, the vagus nerve stimulates the amygdala. Memory storage is also strengthened by direct stimulation of the vagus nerve or amygdala in laboratory animals. Memory was found to be associated with better formation of memories with the stimulation of the vagus nerve, which is basically connected to the amygdala in laboratory animals. Now, even mildly stressful events that do not last long can improve memory if they trigger our stress response.

So, even when we experience some stress, in general, there can be specific aspects of memory that may not function properly under stress, which we will be looking at later. But in general, under stress, some aspects of memory that we are giving attention to can be improved even under stressful conditions simply because stress triggers the release of hormones that enhance physiological arousal, ultimately leading to better formation of memories. Now, several studies that used MRI, fMRI, which detect changes in blood flow in the brain, have shown that the amygdala is more active when individuals are presented with emotionally intense images as compared to neutral ones. And these pieces of evidence we have already looked at in the lecture where we discussed the physiological aspect of emotions. This study clearly demonstrates that

the level of amygdala activation is positively correlated with the accuracy of participants' later recollection of the images.

So, this level of activation of the amygdala was directly correlated with the accuracy of participants' recollection of images that were shown. This also clearly shows that emotions can enhance memory; generally, aspects of memory are enhanced. People who have amygdala damage can still create memories, but then it is no longer influenced by emotions because the amygdala mediates emotional experience. So, when we experience intense emotions, that ultimately influences memory formation. If the amygdala is damaged, then this whole mediation process will not be there, but they can still form memories because memory has many other aspects to it. The amygdala only mediates the emotional reaction, which enhances some memory formation that is emotionally associated.

Now, research also shows there can be differences in terms of memories of positive and negative events. When we talk about positive and negative events, we are talking in terms of emotional tone. Some studies have shown that people tend to remember negative information more easily than positive information. Generally, most research shows that we are more likely to remember negative information. Any stimulus that has some negative connotation is remembered more easily than information that evokes positive emotions.

This could be explained using various explanations. One is obviously the evolutionary perspective, which says that negative events, as we have also explained in other lectures, have survival importance. So, our attention and resources are automatically allocated to negative aspects or stimuli because of their survival value. This is how our biology has evolved. As compared to positive ones, which are more related to luxury experiences and have no direct survival importance. This is one evolutionary explanation for why negative events are remembered more, due to their survival value. These stimuli usually elicit higher physiological arousal.

Another explanation is that negative stimuli usually elicit higher physiological arousal. Whenever we encounter negative stimuli, our physiological activation is much stronger compared to positive stimuli. Again, this could also be connected to survival aspects. When we experience fear or anger, our entire body becomes activated in terms of energy, heartbeats, sweating, and so on. Therefore, the improved memory for negative events can be due to the level of arousal they generate rather than just their negativity. High-arousal information is generally better recalled than low-arousal information. This is a general finding because more attention is allocated to high-arousal stimuli. Whatever we pay more attention to, we are more likely to remember better.

Now, let's talk about mood-congruent memory. In the last lecture, we talked about mood congruence as a general phenomenon, where your current emotional state can influence various cognitive aspects. Here, we will specifically talk about how this mood congruence impacts our memory functioning. This is similar to mood congruence in general emotions.

Mood-congruent memory means that we are more likely to remember whatever current emotional state we are experiencing. We are more likely to remember congruent information from the past. For example, if you are happy now, you are more likely to remember happy incidents from the past, and vice versa. For example, if you are sad now, you are more likely to remember sad information from the past, simply because your present emotion triggers

congruent information from the past. That is called mood-congruent memory. When we try to recall events from the past few weeks of our lives, we are more likely to remember events that match the emotional tone of the current mood. If you are happy, you are more likely to remember happy events; if you are sad, you are more likely to remember sad events. This is evident in daily life experiences as well. Mood-congruent memory occurs when we tend to retrieve memories that correspond with the current mood. Whatever information you are likely to remember is generally congruent with the current emotional mood.

They are similar in line, in sync, with the current emotional state. Mood-congruent memory occurs because an individual's emotional state triggers the corresponding emotional node in memory. This term "node" comes from the associative network model that we discussed in the last class, in Bower's model, where it says that emotions and memories are connected to each other in associative networks. Whenever we are in a state of emotion, such as happy or sad, this emotional state can trigger corresponding emotions similar to those experienced in the past and all the events associated with those emotions.

So, that is what is called corresponding emotional node in memory. It will activate the present emotional state, and this activation spreads through the network, bringing to mind memories that are associated with those emotions. It is like this whole thing spreads from the present emotional state. For example, if you are happy, this happiness will trigger the happy nodes, the happy emotions that we have experienced in the past. Let's say you had a party last week. So, that will trigger that emotion and the event associated with that emotion, and whatever memory is associated with that party, whether you were eating, talking to friends, and so on.

So, all these memories will get triggered by the present emotional state. This can be explained through the associative network model, explaining why mood-congruent memory happens. Mood-congruent memory has been observed through various methods of inducing emotional states; it has been found to be valid in all contexts, whether induced using music, hypnosis, guided recall of personal events, smells, or naturally occurring states. For example, let's discuss one study conducted in 1995 by Halberstaedt and Kulik. Here, participants were put into different emotional states.

Artificial emotional states were induced in participants using music, as music can induce happy or sad emotional states depending on the type of music. They used homophones, which are pairs of words that sound similar but have different meanings. For example, the word "morning" (m o u r n i n g) is associated with sadness, while "morning" (m o r n i n g) is a neutral word referring to the time of day. Similar homophones were presented to participants after inducing different emotional states. The meanings of these words were read to them, and they were asked to write down the word, with the spelling revealing which meaning the participant had retrieved from memory. This was the experimental condition.

Results showed that participants' current emotional state influenced the meaning of the word they recalled. Those induced into a sad emotional state were more likely to remember the word "mourning," while those induced into a happy emotional state were more likely to remember the word "morning." Thus, their artificially induced present emotional state influenced which word they remembered in their memory. This is an example of mood-congruent memory through this experiment. Similar studies were performed later and showed similar findings.

In this experiment, different pairs of homophones were used, such as "bridal" and "bridle," "deer" and "dear," "heel" and "heal," and so on. Research shows that individuals are more likely to recall words corresponding to the emotional state they are experiencing. Sometimes, due to this mood congruence, people can remember false information that is not actually there.

So, this phenomenon is called mood-congruent false memory. It means that an individual's emotional state influences their memory retrieval, causing them to recall events that never happened but are consistent with their emotional state. Sometimes, individuals recall things that were not actually there, solely because of their present emotional state. This is termed false memory, but specifically, it's mood-congruent false memory, where the mood induces the retrieval of non-existent information. People are more likely to falsely remember information congruent with their emotional state that was never experienced in real life.

For example, let's consider someone named John who is currently feeling depressed. In this state, if he recalls attending a party, he might remember it as less enjoyable than it actually was. He could recall his friends as distant and disinterested, even though they were engaging and supportive during the event. This happens because our present emotional state filters information, sometimes leading us to add false details that align with our current mood.

This phenomenon occurs due to mood-congruent false memory, where individuals add information to align with their present emotional mood, even if the reality differs. We filter information based on our emotional state. Mood-congruent memory can lead to the addition of information that aligns with our present emotional mood, despite the reality being different. We tend to remember information that corresponds with our current emotional state.

This can be seen more clearly in the in-utero, where it impacts how information is processed. Another related phenomenon is mood state-dependent memory. The difference lies in how the information retrieval is dependent on the mood state during encoding.

Mood state-dependent memory refers to the phenomenon where information is better retrieved if the emotional state during recall matches the emotional state during encoding. It focuses on the emotional state during learning, triggering the recall of similar material when experiencing similar emotions later. The content of the information doesn't have to be emotionally charged. You can learn anything, but if you were in a certain emotional state during learning, you're more likely to remember it when experiencing similar emotions later. For instance, if someone studies for a test in a positive mood, they are more likely to remember the material when they are also in a positive mood during the exam. This is called mood state-dependent memory. In mood congruent memory, you recall material congruent with your present emotion. In mood state-dependent memory, you're more likely to remember things learned in a specific emotional state when experiencing similar emotions later. The emotional state during learning becomes encoded in memory along with the information.

So, later on, similar emotions trigger those learnings again. When the same emotional state is experienced later, the mood state can act as a cue to retrieve these memories. The mood state can activate the same emotional node in memory and whatever was learned during that emotional state. This associative network model easily explains this. As I explained earlier, the emotional node in memory becomes activated when a particular mood is experienced. Similar moods from the past are also activated, along with whatever was learned in that emotional state.

Therefore, memories encoded in a specific emotional state become more accessible during the same emotional state compared to different ones. This mood state-dependent memory is likely to occur in a free recall task compared to a recognition task.

In a free recall task, participants are asked to recall items without any cues provided. They are shown a list of items, then given a distraction task, and asked to recall the items. In a recognition task, participants are shown items and asked to recognize them among other distractor items. In free recall, the mood state becomes a cue for remembering those things. In recognition, since cues are provided in the words themselves, mood may not influence much. Recognition tasks already provide cues for retrieval, so people use their mood state as retrieval cues very little. In contrast, in free recall tasks, participants are asked to generate previously learned items without any other cues provided. Mood becomes a cue and helps recall those items.

If we compare mood congruent memory and mood state-dependent memory, we see differences. In mood congruent memory, we tend to retrieve memories corresponding to the current mood. The current mood is important in mood congruent memory; whatever mood you are in; you are likely to remember things from the past that match that mood. In mood state-dependent memory, information is better retrieved if the emotional state during recall matches the emotional state during encoding. The emotional state during learning is more important here. The content of information is generally emotionally charged in mood congruent memory, whereas it need not be emotional in mood state-dependent memory. For example, if you are currently feeling sad, you are more likely to recall sad memories. In mood state-dependent memory, if someone is in a positive mood while studying for a test, they are more likely to remember the material when they are also in the same mood later. The focus is different; mood congruent memory emphasizes the impact of the current emotional state on memory, while mood state-dependent memory focuses on the emotional state at the time of encoding as the primary influencer. In both cases, emotions play a significant role in memory processes. We tend to remember emotional information better than neutral information, as evidenced by general findings. Emotions such as sadness are more likely to trigger the recall of other sad memories. Mood congruent memories mean that similar emotional content will be remembered when experiencing a particular emotion. Emotional state also acts as a mental framework for memory, meaning that memories formed during a particular emotional state can be more easily retrieved during a similar emotional state. The retrieval of emotion could also depend on the emotional state in which it was encoded. Encoded emotion and retrieval emotion correspond with each other in these processes. These are some of the important points summarized from our discussion.

Now, let's discuss eyewitness memory, where emotion can also play a very important role. Eyewitness memory can be explained using the concept of the reconstructive nature of memory proposed by Bartlett in 1932. Bartlett suggested that memory is not a passive recording device but an active constructive process. When individuals remember an event, they do not retrieve a perfect replica of the event; instead, they reconstruct it based on their current knowledge, experiences, and cultural norms. This reconstructive process can lead to memory distortion, where people inadvertently alter their recollection of events over time. If memory can be changed through the reconstructive nature of memory, then emotion can also play a role, especially in the context of eyewitness memory. Eyewitness memory refers to an individual's

recall of an observed criminal incident or other significant and dramatic event they have witnessed. Eyewitness memories typically deal with situations where people become witnesses to criminal events or dramatic events and later have to recall them, whether in court or another context.

Psychologists, particularly Loftus, a prominent researcher in eyewitness memory, have found that eyewitness memory can often be erroneous. People frequently report details that are not correct, leading to inaccuracies in their recollection of events. Confidence in recalling something does not necessarily mean that it is accurate; confidence could stem from a belief that the memory is correct, even if it is not. For instance, the Devlin report in 1976 was a UK government committee set up to investigate instances of wrongful convictions in the UK.

A committee was formed to investigate this issue, and they concluded that convicting an individual solely based on eyewitness testimony can lead to wrongful convictions, unless there are exceptional circumstances or supporting evidence from other sources. Therefore, it may not be correct to rely solely on eyewitness testimony most of the time, unless there are exceptional circumstances or additional evidence. Eyewitness memory can be influenced by the misinformation effect, wherein providing misleading information can alter a person's recall of an event. Lawyers often exploit this effect by asking leading questions that can change a witness's recollection of events.

Cognitive psychologist Elizabeth Loftus conducted extensive research on memory, particularly in the context of eyewitness memory and false memories related to childhood sexual abuse. Loftus is known for developing the misinformation effect paradigm in the eyewitness context, which explores how exposure to incorrect information can lead individuals to misremember details of the original event. In one of Loftus's classic experiments conducted in 1974 with 45 US college students, participants were shown films depicting car accidents and then asked questions about the events using varied forms of questioning. The choice of words in the questions significantly influenced participants' estimates of the car's speed, demonstrating the impact of the misinformation effect on memory recall.

For instance, participants who were asked about the speed of the car when it "smashed" into each other tended to provide higher speed estimates compared to those asked when the cars "collided" or "bumped" into each other. This experiment illustrated how the wording of questions could influence participants' memory recall, leading to the misinformation effect. Furthermore, a follow-up experiment conducted a week later found that participants exposed to the "smashed" condition were more likely to falsely remember seeing broken glass, even though none was depicted in the accident picture. This demonstrated that leading questions not only influenced participants' memory of the car's speed but also led them to falsely recall details that were not present in the original event.

Numerous studies have supported the idea that even young adults are susceptible to the misinformation effect, and children and older adults may be even more vulnerable. It's important to note that the misinformation effect can occur unintentionally, as memory is reconstructive and influenced by personal beliefs and cultural norms. Eyewitness memory is particularly susceptible to such distortions, as individuals are often in strong emotional states when witnessing significant events, which can influence their recall. Additionally, stress and anxiety during eyewitness situations can further impact memory by narrowing attention and potentially leading to decreased encoding of certain information. While emotional events may

be remembered more vividly, stress can also result in forgetting other details. Therefore, eyewitness testimony should be approached with caution, considering its susceptibility to various factors that can influence memory recall.

So, this is how we can explain. Let us briefly discuss these two aspects. Firstly, there is a decrease in the encoding of information in general when we are under stress. When individuals who are eyewitnesses undergo significant stress, their memory capabilities generally diminish because their attention turns toward safeguarding their own safety. In the context of eyewitnesses, it is not just a general emotional situation; the person's own life is at risk. Therefore, when one's life is at stake, they may not process all the information due to the focus on survival. Studies have shown that witnesses of violent events tend to experience greater levels of memory disruptions. In a meta-analysis conducted by Deffenbacher, Bornstein, Penrod, and McGorty in 2004, it was found that increased stress adversely affects the accuracy of eyewitness identification. Witnessing a high-stress event can drastically decrease memory functioning and accuracy due to the intense stress experienced by individuals.

Secondly, there is a narrowing of attention under stress. When individuals act as eyewitnesses or witness acts of violence, it triggers an increase in arousal, causing their focus to narrow down to a limited amount of information, typically the source of stress. This narrowed attention results in a decrease in the quantity of information that can be stored and reported.

The reduction in stored information occurs because attention becomes fixed on only a few dramatic aspects of the situation, while less cognitive processing is allocated to other details. One aspect of narrowing attention is called the weapon focus effect. This effect represents a distinct case of narrowed attention, where the weapon itself serves as the focal point due to its significance in threatening lives. Therefore, individuals tend to allocate all their attention to the weapon, diverting focus away from other environmental details. Consequently, peripheral details may not be accurately encoded or remembered at all.

As a result, emotional recall often comes at the expense of impaired recall of other non-emotional aspects. In eyewitness situations, attention typically focuses on central information, while peripheral details are neglected or processed poorly, leading to errors in reporting. Central information, such as significant actions taken by individuals involved in the event, is more likely to be remembered compared to peripheral details. Research has indicated that we have better memory for information related to the gist or general theme of events compared to unrelated peripheral details. Therefore, errors often occur in eyewitness testimony due to the focus on central information and the neglect of peripheral details.

In conclusion, these findings demonstrate how emotion can influence our memory in various ways, impacting our ability to recall events accurately. In the next lecture, we will discuss how emotion impacts judgment and decision-making. Thank you.