Psychology of Emotion: Theory and Applications
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Lecture 3: Communication and Measurement of Emotions

I welcome you to the third lecture of the course titled Psychology of Emotion: Theory and Applications. So, this is the third lecture of module 1 and overall also it is the third lecture. So, today's lecture is titled 'Communication and measurement of emotion.' So, we will talk about how emotion serves a communicative purpose, what are emotions, how emotions are communicated in that context and also, we will talk about the measurement of emotions, and how emotion can be measured particularly in the field of psychology and other associated disciplines. So, before we talk about today's lecture, let me give you a brief recap of lecture 2 which is the last lecture.

So, in the last lecture, we talked about the historical background and some basic theories of emotions. In that context, we discussed some of the prominent figures in the research of emotions and some of the theories that evolved out of their research. So, we discussed Charles Darwin's concept of emotion, how Darwin talked about emotions and we discussed in detail some of the major ideas of Darwin. Primarily we have seen how Darwin talked about emotions, and how emotional expression evolved either directly from adopted behavior or in association with adaptive behavior.

So, it is an evolutionary purpose, an adaptive purpose - all the emotional expressions because it helps us survive. Darwin also gave a lot of ideas which we have discussed and one of the main things that he also talked about is the concept of basic universal emotions and the methodology that he used by showing photographs and taking observations you know labelling of emotions is still used, it is one of the major methods. So, he has contributed a lot in terms of theories as well as methodology of emotional research. Then we talked about the contribution of William James who gave a particular theory along with another person called Lange which is called James Lange theory that talks about the physiological arousal that precedes emotional experience. So, whenever an event happens, first the physiological arousal happens and then emotional experiences happens, by kind of labelling it, labelling those as emotional physiological arousals which is kind of counterintuitive.

They gave some evidence, but obviously, this theory had a lot of limitations particularly a lot of limitations indicated by Cannon. Walter Cannon is an American physiologist. He also gave a theory along with another person so that theory is called as Cannon-Bard theory. Cannon-Bard theory talks about whenever an event happens in the environment. So, three

things happen simultaneously and independently. So, physiological arousal, the experience of the emotion and also whatever is the cognition part of it.

Cognitive labelling, whatever happens, cognitions, feelings as well as you know physiological arousal all these three things happen simultaneously and independently. Not one is causing the other. Then we talked about Schachter-Singer's theory which is also one of the first cognitive theories where you know interpretation, cognitive interpretation was given a lot of importance. This theory states that emotional experience depends on cognitive processing and labeling of physiological arousal by looking at the surroundings. So, there is an interaction between physiological arousal and cognitive processing and labeling.

So, whenever an event happens there is cognitive labeling, physiological arousal, and which emotion will be experienced depends on the interpretation of the situation you are in. So, the same physiological arousal can lead to a happy experience if the situation triggers happiness or it may lead to unhappiness or sadness or whatever it is depending on the situation. Similarly, appraisal theories also evolved which are pure cognitive theories that give a primary focus on cognitive appraisal or interpretation is the first thing that happens and then it triggers physiological arousal and the emotional experience. So, the primacy of cognitive processing is given a lot of importance in the appraisal theories, primary theories you know included like you know Richard Lazarus and so on. Zajonc-LeDoux's theory also we talked about where we discussed that they said that some emotional experience could bypass cognitive interpretation.

For example, you know whenever a loud sound happens unexpectedly we experience immediate emotions, and there is no cognitive intervention. You do not think ‘Should I be fearful or not?’ So, in some emotional cases, such bypass can happen so that was their idea. So, some of these theories we talked about and we also kind of looked at the pros and cons and limitations of each of these theories in the last class. So, today we will talk about communication of emotion in that in this we will talk about particularly the nonverbal communication of emotion which is very interesting and significant that we communicate emotion in so many ways other than language like you know facial expressions, bodily expression, you know expression of emotion through the body and so on. So, we will look into all these aspects today.

Then also we will talk about the measurement of emotion, how emotions are measured in the research, particularly through self-report measures, physiological measures, and behavioral measures. So, these will be some of the key points through which we will navigate in today's lecture. So, communication of emotion is one of the central aspects of human social life. We experience emotions, diverse emotions throughout the day in every

day on a daily basis and these emotions when we experience it most of the time it is not just your own thing, it kind of happens in the context of the relationship with other people in the environment and there is a sense of communicative purpose to it. So, it communicates a lot of things about us, what is our intention, what is our state of mind, and so on.

So, emotion has a very strong communication purpose, it communicates a lot of things about us and we express emotion which is communicating to other persons, other people know how we are feeling because communication is expressed through so many channels including face, voice, body movements, postures and so on. So, when we talk about communication of emotion, there can be two ways to look at it. So, communication of emotion can be done by majorly two channels, one is verbal communication and one is non-verbal communication. So, in verbal communication, basically using language and non-verbal communication includes all kinds of paralinguistic channels. So, emotion can be communicated majorly through verbal communication or non-verbal communication.

So, in verbal communication, it is very simple, we express emotion by saying something by saying the words for example, 'I am feeling angry or I am feeling sad, I am feeling happy'. So, this is directly communicating through language, expressing using words of a particular language whatever language one is speaking. So, it is a straightforward thing. So, verbal communication of emotion can happen when we express it using our language or some phrases whatever is available in that particular language. The interesting part is non-verbal communication.

So, words are not just you know the major way that we express emotions. So, many other channels of non-verbal communication of emotion happen which is very interesting in that sense and is not linguistic but just based on you. So, it may include facial expressions. So, without saying through face one can understand what kind of emotion one is experiencing through body movements. So, all these things can you know kind of you know gestures body movements and so on, voice also how you speak the same language, same sentences can mean so many things depending on how you say it.

So, voice also communicates your intention, how and what you want to communicate is also communication. So, a large chunk of communication of emotion is actually dependent on non-verbal chambers and paralinguistic channels. So, we will talk mostly about the non-verbal part of it because a lot of research has gone into it. Linguistic verbal communication anyway we know it is all through language. So, non-verbal communication of emotion is something that we will focus on here.

So, each emotional expression can connote diverse meanings and refers to many classes of non-verbal behavior. So, non-verbal understanding of emotion is very important because

a lot of complexities and nuances of communication can happen through non-verbal communication of emotion. For example, a smile may mean many things- you know if a person is smiling it may mean a lot of things depending on the non-verbal communication channels that are there in the context. So, a smile may mean politeness or a smile can also hide feelings of disapproval you know. So, when you have a feeling of disapproval you can just smile just to hide that or to expect romantic attraction or it can signal certain weaknesses. Also, sometimes smiling can also signal a sense of weakness to pretend that we are following what another person is saying and so on.

So, the non-verbal aspects of behavior can mean a lot of things depending on the context. So, one expression may mean many things depending on the non-verbal aspects of it you know depending on how it is expressed the different non-verbal channels associated with it may mean a lot of things. So, that is why it is important to understand the non-verbal aspects of emotions. Now, before we talk about specific non-verbal communication of emotion let us see the different categories of non-verbal behavior. So, Paul Ekman as we have already discussed his theories in detail, he is one of the pioneers in the field of emotional research, and along with Wallace Friesen they organize non-verbal behavior into 5 categories.

So, all non-verbal behaviors can be categorized under 5 categories. One is called as emblems. So, in every non-verbal communication, there can be emblems. What are emblems? Basically, it means gestures that directly translate to words. So, this is these are the gestures that we use while talking and communicating, but these gestures can be translated into specific meaningful words. So, they are intentional gestures that we do these are not unintentional, we intentionally indicate something through the gestures which can be easily translated into words. So, sometimes, a lot of such emblems we use for example, we use thumbs up which basically means ok or something you are saying it is fine, go ahead.

So, even if you do not say anything just showing a thumbs up will communicate to the person it means ‘ok’. So, it can be easily translated into a meaningful word or you just indicate *(gestures)* ‘come here’. Even if you do not say anything you just show this a person will understand he is saying ‘come here’. So, these are called emblems. So, they are intentional gestures that we use that can be easily translated into words they need not be associated with some sentences or words or something sometimes just an indication that can be decoded into specific meaningful words. The only thing is that a lot of these emblems can mean different things in different cultures.

So, maybe in one culture thumbs up is a good thing or indicates ok or something but, in another culture, people may not take it in a positive light or something like that. So, from

culture to culture, these emblems may change meaning. So, they may not have a fixed meaning across all cultures. So, these are called emblems. So, these are a nonverbal part of certain communication which you know also communicates a lot of things.

Another one is called illustrators. Illustrators are a little bit different from emblems in a sense that you know these are also gestures just like emblems, but they are accompanied with speech. So, emblems are not necessarily accompanied with speech, but illustrators are always associated with speech. So, you say something and with your sentences, you show certain gestures. So, they are accompanied with the speech to make it clear, visual, and emphatic to emphasize something you are saying something as well as you are indicating something just to add emphasis to it.

So, those are called illustrators. So, they are just gestures used to illustrate certain verbal messages to enhance the understanding of the receiver or whoever is listening. So, whenever we give direction to someone generally we say you go straight and then turn right. So, this is an illustrator. So, you are speaking as well as indicating with gestures without speaking probably this will not mean much, and many people may not understand.

So, you are saying go straight and then turn right. So, you are saying as well as indicating something just to add emphasis to it or to make the meaning clear. So, these are called illustrators.

Then comes regulators. Regulators are nonverbal again certain behaviors that we do or use to coordinate or regulate conversation. So, conversations to regulate conversation or to kind of according to our situation. So, it includes behavior such as nodding heads, eyebrow flashes. So, when we make conversation with people along with whatever we speak we also nod our head to show we say yes or no something like that to regulate it just to make it you know smoother or something like that. We also use eyebrows flashing you know, which also communicate something, or sometimes using lips - also the movement of lips and so on. So, these are all called regulators which are kind of you know subtle ways kind of nonverbal behaviors that regulate or you know, communicate information.

The fourth one is called self-adapters. Self-adapters are basically mostly the nervous activities that appear with which have no apparent goal other than to release nervous energy. So, many times in conversation, in communication people release their nervous energy by scratching their chins or you know scratching their head or something like this biting their lips something like this. So, a lot of these are actually channels through which some nervous energy is you know released they also communicate something. So, these are also part of nonverbal communication. So, most of the time they unconsciously happen, you may not be very consciously doing them. So, these are called self-adapters.

The fifth one is a display of emotion in terms of nonverbal aspects. So, this is where we will talk in the remaining part of our lecture. So, in the display of emotion when we specifically display your emotion it includes facial expression, it includes your voice, it includes the body movement et cetera.

So, these are some of the things through which we communicate emotions, and information through all these channels nonverbal channels apart from linguistic aspects. So, the facial expression is the most important thing. Our emotions are most vividly shown in our face, face is the mirror of our inner expressions. So, one of the most crucial parts of human communication is facial expression. Face is in charge of conveying not only thoughts or ideas, but emotions. We all know whenever we talk to somebody we look at their face only.

So, everything is communicated through the face. So, the expression of face says everything. So, this plays a central part in terms of communication of information and communication of emotions particularly and other things. The faces are the most essential and eye-catching objects that people see and are the first thing babies also perceive after birth. Now, you know whenever we communicate with someone we look at their face only.

So, this is the first thing even a child does. After the birth of the child, a baby only looks at the face and all the communication happens through the face of the mother and the other people. Until a newborn develops language the caregiver's nonverbal behavior becomes the channel of communication because a child cannot understand the language initially. So, all communication happens through nonverbal communication and most importantly through facial expression. Face and facial expressions continue to be important even after we learn to communicate. So, once a baby learns to communicate with language, the importance of the face never fades away it still remains very important.

Face attracts our attention more than the other visual stimuli so we quickly notice it. So, this is the first thing we notice. So, it is adaptive for humans to pay attention to faces it was adaptive because it is necessary to survive to understand other people by immediately focusing on their faces. So, it is adaptive in that sense since others around us facial expressions reveal information about their emotion as well as their attitude towards us and the objects in our surroundings. So, we understand the person's intention persons whether the person is willing to talk to me or associated with me, all these things we get cues from their facial expression.

This knowledge then influences our own behavior. So, according to their expression, we then regulate our own behavior. So, for example, nowadays if you see in the era of social networking or social media and so on, there is a growing usage of emojis in whatever

textual message in WhatsApp or messages everywhere emojis are very popular nowadays. So, why emojis are used even though you can write about whatever you are feeling people sometimes just use emojis to express something. So, an emoji is nothing it is just a face with certain emotional expressions - sad face, happy face, angry face, and so on.

So, you know even just one emoji can express more than writing many sentences because it is just a face that expresses everything. So, that is why these emojis are very popular they express your emotion much better in a way and also it helps to give more meaningful clarity to your sentences. So, you add emojis to your textual messages. So, it makes your communication much better especially communicating your emotion to the other person. The mechanics of facial expression you know how facial expression happens and a lot of things.

So, we do not get too much into it, but a little bit of just understanding how complex mechanisms are there in the facial expression. Now, it happens very automatically to us, but actually, so many mechanics are involved in it. So, facial expressions are created by the coordinated contraction of muscle groups there are so many muscle groups in our face and coordinated contraction happens depending on different expressions that we do which results in folds and wrinkles on the face and on the skin of the face. Other skeletal muscles in the body on the other hand are connected to bone and can move your skeleton. So, facial muscles are a little bit different from other muscles.

It is estimated that about 43 muscle groups are involved in facial expressions. So, 43 separate muscle groups are there which can coordinate move, and express so many emotions. These muscle groups also control the sensory organs of the face such as closing and opening of the eyes. So, they are not just for emotions they also do a lot of sensory functions like opening and closing of eyes, mouth and so on.

By changing those muscles we can express a lot of emotions. So, the way our brain receives feedback from the facial muscles. So, brain whenever there is a movement in the facial muscles a signal goes to the brain and the brain accordingly helps us experience certain emotions. So, your facial muscles about their current state are also distinct because it relies on something called ‘mechanoreceptors’ in the skin. So, this is called mechanoreceptors in the facial muscles which are mostly sensitive to changes in the position. So, whenever there is a change in the position of the muscles in the face change.

So, the face has mechanoreceptors that send signals to the brain and the brain interprets them according to whatever situation is present. So, the facial muscles have mechanoreceptors as compared to that of other muscles which have proprioreceptors. Proprioceptors in other muscles which basically provide constant information about the

stretching and contraction. For example, legs may be stretching, you understand this and thus, the signal goes to the brain and so on. So, in terms of mechanics, there is a difference in terms of receptors - facial muscles have mechanoreceptors and other muscles have proprioceptors.

So, in that sense little bit of different their different facial muscles are different in terms of feedback particularly they depend on if there is a change in the position of the facial muscles the brain interprets it in certain ways. So, what is fascinating about emotional communication is that it appears as if some of these expressions of emotions like fear, anger, disgust, happiness, sadness, and surprise are biologically wired across cultures. We have seen some of these theories of basic emotions. Some of these basic emotions have been found across cultures and everybody kind of understands even if faces with this emotional expression are shown to different people. Obviously, you know there are differences in which emotion should be the basic emotion there are differences in that, but some of these emotions are very basic most of the research shows they are almost like biologically hardwired in our system and they expressed in the same way.

For example, fear, anger, and sadness are expressed in a very similar way across all cultures. So, it is kind of shared across all of humanity. So, this debate between universal and culture-specific facial expressions we will look into much more detail based on the research later on in the upcoming lectures, but some of this seems to be valid across cultures. Now, these faces actually are, this photograph is taken from Paul Ekman's groups I have already shown it while discussing Ekman's theory. So, it just shows the mechanics of the face when we experience certain emotions and what kind of changes in the muscle happens.

So, you can see I will just show one or two emotions just to give you some idea. So, you can see when the person has an angry face some changes happen in the facial muscles like here eyebrows are pulled down and together. So, here you know these eyebrows are pulled down and together. So, this becomes much closer and pulled down, eyes become wide open.

So, this becomes wide open, lips are pressed tightly and together. So, generally, this is one of the typical expressions of anger where you know how certain muscles in the faces change their positions and this leads to the experience of anger or whenever we are angry we pose such kind of facial expression. When we face fear similarly you can see how muscles change in the face here, eyebrows are raised and pulled together. So, these eyebrows are raised here and pulled together, the upper eyelid is also raised, the lower eyelid is tensed, the jaw is dropped open and lips stretched horizontally backward. So, this is a typical expression of fear and this is how muscles change when we experience fear.

Face of happiness when we experience joy or happiness see how muscles change in our face.

So, the eyes are narrowed and there is some wrinkling around the eyes. So, these are taken from Paul Ekman's research, and from his website these photos are taken. So, these eyes are generally narrowed and there is some wrinkling here you can see some wrinkles, cheeks are raised you know this part is raised and there is a wrinkle also, lips are pulled up here pulled back and teeth are and teeth are exposed. So, this is a typical expression of happiness. So, these are some of the examples Paul Ekman. All kinds of detailed expressions of how it is for all these 7 basic emotions.

One can find it on his website also. So, you can if you are interested you can look at his website and find out the other expressions. So, what do facial expressions convey? So, there are certain different viewpoints about what it expresses, and what facial expression actually conveys. So, there are 2 viewpoints we will talk about here one is called read-outs and another is called behavioral ecology. So, let us see what are these 2 aspects.

So, facial expression when innate or learned whether innate or learned. So, we can learn some expressions are very innate basic emotions like some facial expressions we learn through socialization probably. Certain have a communicative function in addition to the physiological purpose. So, one is obviously, physiologically it helps you to know automatically when you take certain facial expressions. So, apart from that, there is a communicative purpose to it. So, there is a debate about whether facial expression reveals a person's real internal feelings or reflects the person's intention to influence others.

So, whether facial expression reveals a person's real internal feeling whatever you are actually feeling is it like it comes to your face or you just manipulate it to influence other people or to just show one show whatever you want to show to the other person. So, based on these are the 2 viewpoints we will talk about it. So, we will discuss using the readout view and behavioral ecology. So, readout view means what? According to this view, there is a close relationship between emotion close relationship between emotion and expression and this relationship is due to the operation of an inbuilt effect program. So, according to this point whatever you experience or feel inside is expressed through facial expression.

So, there is a close relationship between whatever emotion you experience and how you express it. So, whatever you will express whatever you will experience it will be expressed and this happens because there is an inbuilt biological program within us, an emotional program. So, whatever you will feel, it will be expressed. So, emotions are external representations of internal feelings.

So, according to this B point. So, according to this view, facial expressions mirror the expressor's inner emotional states. So, it is very straightforward forward - whatever you feel is expressed because of certain biological programming itself. So, in other words, when one experiences an emotion such as fear facial expression will correctly and honestly reflect that one is terrified. So, whenever you feel fear it will be expressed in your face that fear this facial muscle externalizes those internal feelings. So, the function of these facial muscles that we have discussed their function is to externalize whatever you feel internally those are externalized through these muscles.

So, these facial muscles have these functions. You may have to learn to conceal or mask some unwanted emotions people also learn they may be feeling something and trying to hide it. So, that is possible one can do that through socialization, but according to this view your genuine feeling may leak out your genuine feelings may leak out in the form of subtle facial muscle movement. So, even though you may try to hide it, in subtle ways those emotions will leak out in your face which may be very evident or may not be visible, and so on. So, the idea is because of this inbuilt effect program it will try to come out through your face even if you try to hide it. On the other hand, the behavioral ecology point of view says facial expressions evolved to indicate or express our social motive in a specific social environment.

So, whatever facial expressions we show, these are actually evolved to help us navigate the social world, and social motives in a specific social environment. So, social environment, to suit the social environment to navigate in the social environment these facial expressions evolved. So, they have a kind of social function that is served through this face you know facial expression. These expressions indicate what the person intends to do and what he wants others to do. So, whenever you are communicating you are you have a hidden intention through these emotions and also you want to kind of manipulate others around you.

So, this expression can kind of take account of that also it is not just your inner expression that is just getting out. You are also manipulating your social environment what others want, and what you want others to do. So, that part is also there in the expression. A smile, for example, indicates one's wish to connect. So, when you smile, one of the indications is generally that you have a positive attitude and you want to connect to that person.

Sad expression in general indicates a request for aid and comfort. So, it kind of indicates this person is not in a good mood he wants some comfort or some kind of help from another person. So, it indicates something in a social context, it is not just your own personal thing. So, there is a social environment where you are expressing emotion with the view of your expression as well as you are manipulating what others want you to do you want others to

do. So, through sadness, you are also communicating to others that you want certain comfort. So, according to the behavioral ecology point of view facial expressions are frequently expressed in interacting circumstances.

So, if you see we do not make too much of facial expressions when you are alone, but facial expressions become much more dominant and prominent when we are interacting with other people. So, it indicates that it is more of a social function. So, many studies also indicate that displays of facial expressions are more frequent in social contexts as compared to when you are alone. So, this behavioral ecology viewpoint also underlies that emotional expression accounts for a small percentage of the total number of facial movements produced by humans daily. So, facial expression can also have many other functions apart from just emotions people can use facial muscles movement for a lot of other things like you know to highlight something to re-enact something, and so on.

We all know that you know facial expressions are not just for communicative purposes. So, facial expression seems to serve many communicative purposes including communicating information about expressing our feelings and expressing our social motives also and behavioral intentions. So, the idea is both viewpoints have their own ideas in certain emotions obviously, what you know both this viewpoint of behavioral ecology and read-out. So, emotions can have both the purpose in terms of revealing your internal state as well as also using this emotion to kind of express something in the social situation and also to kind of communicate what we want other people to do with us, it is a kind of sending signals. So, another hypothesis or theory that talks about facial expression very specifically is called the facial feedback hypothesis.

So, a lot of time people in general you know layman ideas in the context also people may tell you this is a very common advice in most cultures that put on a happy face, you know *face kho kush rakho* you know, *smile karo*. Why people say the idea is a kind of idea is that when you put your face in a particular expression your emotion also changes. So, when you are sad if you put on your smile it helps you to kind of shift your mood from sadness to some positive emotions. So, to help you overcome adversities generally people say you know put on a happy face then you may have understood. So, this is a commonsensical version of this theory this theory basically says you know. So, it was proposed by this French physician his name is Israel Waynbaum in quite early 1907.

He claimed that certain facial expressions affect the flow of blood to specific parts of the brain. We have already seen how facial muscles are connected to the brain obviously, the movement of the facial muscles influences the brain. So, this theory basically says that facial expression whenever we change the muscles in the face affects the flow of blood to the specific parts of the brain and this produces specific emotional experiences. So, these

changes in the flow of blood change our experiences of it.

So, the brain gets a signal that this is a part of the face that means, that emotion. So, it will change the emotional experiences by sending it signal to the brain. Smiling, for example, may increase blood flow to certain regions of the brain which increases our positive mood. So, those areas of the brain that are responsible for positive mode blood will flow more when we put on smile smiling face or something like that. So, that was the idea of this theory and in many contexts, this can be true also that you know sometimes changing your facial expression can change your mood to some extent. So, that is one of the theories that very specifically talk about how facial expressions are related to emotions.

A lot of contemporary theories also kind of accept some of these ideas including Izard, Tomkins, Zajonc, Murphy and Inglehart. They claim that making facial expressions and getting sensory data from the face modify the intensity or create emotional experiences. So, it is a kind of modern lot of theories that also kind of validates some of the claims of the facial feedback theories. So, to put it simply, according to the facial feedback hypothesis facial expression contributes to our emotional states by feedback from the face to the brain. From the face, feedback goes to the brain, and the brain then changes or creates certain emotional experiences.

Now, the facial feedback hypothesis also I mean it receives some support, but it is not like everybody has not been given equal support. Not all researchers found equal support for this theory. So, there is a positive relation between specific facial expressions to specific emotional expressions obviously, certain facial expressions have connections to the positive, you know, corresponding emotional experiences. A lot of research actually found the effect of facial expression on the emotional experience is not very strong. It has an influence, but the strength or the impact is not that high. According to several studies emotional experience is more dependent on the signals from the autonomic nervous system.

The autonomic nervous system which we discussed in yesterday's or the last class lecture 2 is responsible for physiological arousal. So, your heartbeat increases, your breathing becomes rapid and those physiological increase or arousal actually determines emotions much more strongly than facial expressions. Facial expressions play an important role, but the impact is not that high it is not the only thing, but the feedback from the autonomic nervous system or organs is also very important. It is much more important than facial feedback, of the muscles feedback from the facial muscles. As it is, data from facial expressions is only one of the several components that contribute.

So, it is one of the components that is not the exclusive factor. So, this is kind of some important things that we have discussed about facial expression and we have understood

how the face can express emotions and is very significant. Now, another part of the communication of emotion is through bodily expression of emotions. Our body movement, body postures everything also express emotions. So, there is a systematic and discernible link between emotional stage and specific body gestures, just like facial expressions.

So, there are specific facial expressions related to certain emotions. Similarly, it is possible that certain body movements or postures are associated with certain emotions. So, feedback from the body, like feedback from the face, can influence the intensity of emotional experiences. For example, the brain gets feedback from the face and accordingly, certain emotions are experienced. Similarly, feedback from the overall body can also send signals to the brain and lead to certain experiences of emotions. So, if there are distinct patterns of body movement related to emotions. Are there any distinct patterns possible that we can identify and say when you are in this state of emotion, you will have certain body postures?

So, let us see some of the evidence available. So, in one study, a researcher recorded actors in a darkened room exhibiting certain emotions like disgust, fear, rage, happiness, and sadness with their body movements. So, this was a study where certain actors were in a dark room. So, where their face is probably not very visible, through their body, they were expressing certain emotions, most of these basic emotions like fear, anger, and so on. While they were wearing full-body costumes with reflective matters at a few key spots in the wrists and heads et cetera.

So, Atkinson and colleagues in 2004 they did this research. So, it is a dark room. So, the face is not visible. So, can just body movement communicate certain emotions because face we know from the face we can easily understand certain emotions, but without looking at the face, just the movement of the body can certain emotions be displayed? So, the darkened room and all these actors who are displaying emotion wore certain costumes which had certain lights as in certain key parts of their body in that particular dress. So, that these lights will be visible and only body movement you can see without looking at the face. So, wearing a full body costume with some reflective material, some light where light can be visible, you know, at a few key spots like wrist and head and so on.

They then asked participants. So, they were wearing these costumes in the dark room with certain lights associated with certain parts of the body. So, that they can just visually see the body movement without looking at the face. And the audience were there looking at that and they were asked to assess the emotions exhibited in the video clips while the performers and entire bodies were visible when only the reflective points on the suits were visible. So, there were two conditions one is where the entire body was visible. So, there was a videography was shown to the participants, and in another case only this dark room with certain reflectors in certain parts of the body where the face is not at all visible is

shown to the participants and asked which emotions they were displaying.

So, the result shows even with the point light displays versions where the face is not at all visible, even the whole body is not visible certain key parts of the bodies were visible through those light points. Participants showed very good accuracy in identifying the moves according to the emotion. So, a lot of participants actually showed very good accuracy in identifying which emotions were displaced by these actors implying that very little information is required to detect an emotion in the body. So, at least, this research shows that people can detect emotions through body movements without even looking at their faces.

So, this was taken from their experiment. So, it was like this - in one case, the face was masked and the body was visible there. So, actors were doing movements according to certain emotions. In the second case, the body was even not visible, but at certain key points in the body, certain actors were there and they were, you know, showing those emotions and even participants in the reflector case also could identify some of these typical emotions. So, in their experiment of Atkinson and their colleagues, you know how the actor expresses those emotions. So, in case of anger these actors made erratic gestures towards the camera, erratic fast movements they were doing, shaking their fists, stomping their feet.

So, erratic movements. So, this was kind of how the body movement was there in that experiment. Fear was indicated by shrinking, constricting motion away from the camera. So, they were moving away from the camera shrinking their body as we do in fear we do not kind of expand we kind of constrict in the fear. Motions away from the camera frequently with hand raised in protection, something like this, you know.

So, we will see some of these photographs also. So, the fear was indicated like this. Happiness was expressed with broad gestures such as skipping, bouncing up and down, and pumping the arms. So, all these movements they were doing to express happiness in that experiment. Sadness was accompanied by sagging posture, and self-soothing behavior such as placing hands on the face or across the body, certain this kind of movement was done. Disgusting emotion was expressed by covering their mouths and noses, turning away from the camera, and swiping their hands in front of their faces as if waving away a terrible odor. So, this is the kind of movement they did in the experiment and interestingly, most of the participants could even identify without looking at faces and whole bodies, just reflectors.

So, these are some other experiments where some of these photographs were shown. If you see, even faces are kind of masked how body movements some of the body movement. So, this is obviously a static picture where some of the body posture can express some

emotions you know. So, anger could be like this, disgust could be shown like this, fear could be shown some of this movement. Many of us can identify just by looking at this face because emotions are named here, but even if these emotions are not there, a lot of this expression of the body posture we can understand. You know, just looking at that face, we can kind of guess what emotion this person is experiencing because the face is not visible here.

So, this is how happiness is expressed, sadness is expressed like this, surprised and this is these are neutral kind of thing. So, this is a female person, this is a male person, anger, disgust, fear, happiness, sadness, surprise like this. I think we can kind of make sense of it that at least a lot of these body movements clearly express some of these emotions. So, emotions in the voice now body movements we have discussed now let us see how emotions are expressed in the voice.

So, when we speak, when we say something, both the words and the tone of our voice convey emotions. How do you say something? What is the tone of your voice? So, this is called linguistically called 'prosody', which refers to non-linguistic elements of your voice. What you say is not focused, but how you say it. What is the rate, pitch, and loudness of your utterances? So, that is called prosody and it can convey a lot of emotions. How do you say something? By merely changing the prosodic aspect of speech, one can utilize the same words to portray multiple emotions.

The same words, when I say it differently, can mean so many things, different things depending on the prosodic quality of it. So, if I say something like, you know, 'What are you doing?'. Very simple neutral way if I say, 'What are you doing'. So, that is a clear kind of I am just interested to know what somebody is doing. If I say the same thing with high pitch, 'what are you doing?'. So, for example, if I say it like this that means, one of the aspects could be, you know, I dislike what you are doing. So, I am just with anger I am saying, 'What are you doing?'. You understand? So, the meaning will be completely different depending on how I am saying it.

So, by changing prosodic features, the whole meaning and emotions of the sentence could change. So, that is how we express emotion through voice. So, the same sentence can become serious, it can become sarcastic, it can become very exciting, it can become low excited, whatever it is, depending on what is the pitch in which you are saying. So, vocal expression communicates our feelings to those around us and hence exists to influence others, but they are also frequently automatic and uncontrolled. Sometimes as certain emotion happens automatically our voice changes and it communicates those emotions.

So, for example, one may be unable to make their voice stop quivering with nervousness

during an important presentation. So, sometimes if you are very nervous when you speak, automatically quivering and shaking happens. It is not that you wanted that, automatically, it happens because of those energies, and that conveys certain things about certain emotional experiences that you are having you know you are nervous or something like that, it communicates that. So, much research on verbal expression like that of facial expression has been attempted to uncover discrete patterns. So, lot of research try to understand is there any discrete pattern that we can identify for specific emotions in the voice just like as we did for body movements and the facial expressions? The investigation of sounds made by people experiencing various emotions let some researchers to believe that voice reflects only a few characteristics of emotions.

So, research shows it may not be possible to understand every aspect of emotions or determine every emotion from the voice, but some aspects of emotions are reflected in the voice, but may not be very specific emotions. So, specifically physiological arousal whenever happens it impacts your voice whenever you are very aroused your voice will change in terms of maybe the intensity will become very high or it can quiver whatever it is you know certain changes will happen in the voice. So, the physiological arousal aspect of the emotion is influenced, it is directly influenced by the sound of your voice, and some claim that it is the only element that can be detected. So, this is according to them, not a specific emotion we can determine, but that physiological arousal part can be detected in the voice. Other aspects such as valence positive or negative may be more difficult to understand from the voice itself anger and joy for example, one is positive one is negative both are associated with high pitch sound pitch and loudness.

So, when you are you are feeling anger or you are feeling joy voice qualities could be very similar in some contexts. For example, both are associated with similar increases in speech and loudness presumably because they are both high arousal emotions. So, pitch and loudness may be very similar in this case, but obviously, hence when the researcher includes the full range of acoustic properties. So, when the researchers try to include many other properties of the voice including irregularities in the speech patterns whether when somebody speaking is there any break in speech? So, one is obviously, the high and low pitch then there are other aspects of voice like regularities irregularities in the speech patterns changes in the phonation how those sounds are changed when you speak as you speak they found that a combination of features could distinguish emotions in a sentence spoken. So, when we look at all of these things, a combination of features, then obvious we can be more confident in understanding which emotion the person is experiencing.

For example, anger may sound more abrupt. So, obviously, joy and anger both have high speech, but there may be certain other differences also when we are angry our sounds are more abrupt, you suddenly shout at somebody abruptly and then you stop. So, it can be

more irregular with slight pitch disturbances when you are very angry. There may be speech disturbances in your speech and speaking and it could be very abrupt and irregular. So, as compared to joy, when we express joy it may be more regular, but both have high pitch sounds. Maybe they are associated with both these emotions, but there may be other differences in the qualities that can distinguish whether you are angry, the voice is coming from anger or it is coming from joy. So, it is possible in some of these contexts. Another method to assess if the voice can compare discrete emotions, is to have participants identify the emotion presented through vocalization and observe how much agreement there is.

So, a lot of this emotion research actually does try to find out participant's agreement. In the case of facial expressions, they will show photographs of expressions, in the case of body movement they are shown different body movements and I ask them to identify which emotion they are comparing. Similarly, in the voice also similar experiments were done where you know certain voice clips were given and participants were asked to identify which emotion was behind those voices. So, a meta-analysis of 60 experiments found that, means lots of, so many experiments were done in the voice understanding voice and emotion and overall analysis of all these experiments is called meta-analysis. They found that independent of the rater's culture of origin or whether the vocalizations were spontaneous or poised raters' consensus was quite high in certain emotions, it was very clear that people could identify which emotion the person was going through from the voice itself. Particularly in the case of anger, fear, happiness, sadness and tenderness.

So, these are some of the emotions where the voice could very clearly indicate something. So, a lot of this research indicates you know which emotion one is experiencing. Again, Paul Ekman also because he is one of the prominent researchers. In his research, he also showed in certain emotions how the voice would be typical. So, in the case of anger, it is vocalized in two ways, if it is controlled anger one can even generate a roar and yell if not controlled.

So, if it is an uncontrolled anger. So, the person will shout and roar and yell all around. So, one can understand that sometimes anger can be controlled it may not have that roar and yell, but it may have a sharp edge and high pitch and those kinds of things. So, in case of fear, people's voices may often become higher pitch and more strained. So, you kind of speak very loudly, but very strained voice, it is not a very open kind of voice. One may scream with fear - many times we scream also. In the case of sadness depending on what type of intensity, a sad voice can either become lower in pitch, talking very slowly, or we talk with low sound and low intensity in a softer volume.

Sometimes higher pitch can also be there and louder in volume depending on the intensity of the sadness and situation. So, these are some of the examples I took from Paul Ekman's

website. So, voice qualities can also have an impact on social relationships. So, how you speak can have an impact, particularly in the cases of depression patients in a lot of, in some of the studies of undergraduates you know indicate that undergraduates judge depressed or non-depressed classmates based on how they speak. So, generally, the participants who were depressed were more likely to be rejected in part because they spoke in soft flat tones and with long pauses. When a person becomes sad and depressed they generally speak in certain voices very soft flat tones with long pauses which may lead to social rejection in many cases, particularly in schools and colleges.

So, this can be a problematic part in the case of depression because they themselves are going through certain mental states that are negative, and further, their voice quality could kind of alienate other people. So, this alienation can further enhance depression. So, it can become a vicious circle in that sense. So, because of the emotional changes in depression, sadness becomes very strong, and it impacts your voice quality also and communication with other people.

So, in the last part of this lecture, we will talk about the measurement of emotions. Now, how so this is what we talked about communication of emotions. So, all these channels, nonverbal channels can display and communicate emotions in diverse ways through facial expressions, body movement, and voice quality. So, these are all very significant aspects of it.

So, in emotional communication, all these channels can play a very important role. Now, let us come to the measurement of emotions. So, emotions in the research, how do people measure emotions? Now all this research we have discussed they are saying you know How these emotions are measured in the research? So, these are some of the ways in which emotions are kind of measured are self-report measures, physiological measures and behavioral measures. So, let us briefly see what are these measures. So, self-report measures basically are very simple you just ask people to describe their emotions or report their emotions in certain scales.

So, self-reports are descriptions of the participants. So, because you no one else can know what is going on in a person's mind. So, you just ask them to rate their emotions, certain emotions on a scale, a 10-point scale or 5-point scale or a 7-point scale because there is no other way to know. Another person cannot know what kind of emotion the person is going through or what intensity of emotion one is going through. So, you ask the person. So, that is called a self-report description of the participant's emotional feelings reported by the participant themselves. So, participants may also self-report their cognitive behaviors associated with the emotion depending on the research purpose.

So, generally, they are asked to report their emotions on a rating scale from 1 to 10, or 1 to 7, or 1 to 5 et cetera depending on the different research. For example, PANAS is one of the most popular self-report measures which measures both positive and negative emotional states that people go through recently in their life which has 20 items, 10 positive and 10 negative items. So, this scale looks something like this. So, they will ask in the last week how, what kind of, to what extent you have experienced all these emotions you know from very slightly or not at all to a little moderately quite a bit to extremely. So, this is how one can have a profile of emotions, the recent emotional experiences one has gone through.

So, all of these important emotions - 10 are positive and 10 are negative. So, one can rate them and accordingly, we can have a score of emotions. However, the self-report measures have certain limitations just like any other thing there is no perfect kind of measure. So, they are not precise, as the standard of rating differs from person to person. So, when you ask a person to rate it from a 1 to 10 scale, what is 5? What does 5 mean? Even though if you specifically say what 10 means, it may differ from person to person. For one person, 10 may mean something, and for another person, 10 may mean something else. So, obviously, there is a range to it, but the idea is that it may differ from person to person in terms of understanding what 1 to 3 means. So, one may not report one's true feelings which is also another issue. You cannot be 100 percent sure that person is reporting with true authentic feelings, but as the researcher, you have to believe or at least trust your participants or take a large sample.

So, these things may be difficult to use with subjects who cannot speak or report, you cannot use self-report for everybody. If you want to take data from infants or brain damage patients or non-human subjects or people who cannot speak or something like that. So, because they cannot report using self-report measures, in different linguistic and cultural contexts may be difficult as it may not be easy to translate. So, if a questionnaire is in English and I want to use it in Hindi language, it may not be easy to accurately translate those into another language although people do it by using a lot of careful measures, but linguistic equivalence becomes a problem because many time languages are so different that exact translation may become very difficult. Despite all these limitations self-report measures are very useful and easy to collect and provide significant information despite all these limitations you have to use with certain caution there is no other way in many cases you cannot use anything else, but self-report measures. So, if a person has scored 5 today in a measure of emotion and 2 after a week we can say something that the person's emotional experience is changing if he gives a score of 5 today and after 1 week he gives us 2 in the same item I can say this emotion is changing in that person, at least it is giving me some information.

Furthermore, in many contexts, self-report is the only way to measure - there is no other

way. For example, the feeling aspect of emotion can only be measured by self-report. What kind of feelings are going through, how can you know other than asking that person? Physiological measures are another important measure that is taken by a lot of people because every emotion is associated with a physiological aspect that we have discussed in detail - every theory talks about physiological arousal. So, people try to measure emotion using physiological parameters.

So, most of these emotional states are associated with physiological changes in the body such as heart beating, flustered, sweating in the palm et cetera. Physiological measures attempt to assess some of these changes that happen as a result of emotions. Details of physiological changes associated with emotions and what changes happen in detail we will discuss later in some other upcoming lectures. Researchers also study brain activity as a measure of emotion. So, physiological measures also include brain activity changes that happen when we experience certain emotions.

So, some of the things that are used like one is called electroencephalography EEG to measure you know physiological parameters. EEG is one approach in which electrodes are attached to the participant's scalp. So, brain monitors in the head so many electrodes are kind of attached to assess momentary changes in the emotional activity in the brain. So, whenever there is an emotional experience electric currents change and those are detected by those electrodes that are put in the head and scalp. EEG measures the activity of cells in the brain area closest to each electrode millisecond by millisecond.

So, it records all these changes and you can say when a person experiences those emotions what kind of changes happen electrically. EEG is extremely beneficial when researchers need to know the exact timing of an experience the electric response of the brain to pleasant or unpleasant stimuli can be measured in a fraction of a second. So, with quite accuracy, one can see the electrical changes in the brain using this methodology. Another method that is very important is functional magnetic resonance imaging fMRI which is also very you know popularly used to measure you know physiological parameters, particularly brain activity.

It analyzes brain activity based on changes in the oxygen uptake in the brain. Oxygen use differences are detected by fMRI. When a brain area becomes very active because different functions are by different parts of the brain when one part of the brain becomes very active it requires more oxygen. So, more activity means it will require more oxygen to do those activities and the hemoglobin molecule in the adjacent blood vessel releases this oxygen. So, adjacent areas release more oxygen from the hemoglobin. fMRI actually scanner enclosing the head identifies these differences in the hemoglobin molecule with oxygen respond differently to the magnetic field than hemoglobin molecules without oxygen.

So, these differences are detected by fMRI machine and this is how different parts of the brain activities are noted. An fMRI image detects changes in the brain activity within about a second of them occurring within a second whatever changes happen it can detect not of the millisecond or like EEG, but sufficient for understanding most of the major emotions. It also pinpoints the location of these changes to within 2 to 3 mm k as it can give an accuracy of the location where these changes are happening even deep within the brain providing significantly higher spatial accuracy than EEG. So, it can give spatial accuracy which area is responsible for certain activity fMRI is much better in terms of giving location. So, there are certain advantages of physiological measures that is it is much more precise as compared to self-report measures. In self-report, you are just reporting we may not know exactly how it is, but in the case of physiological measures, it is much more precise. For example, we are not sure what it means to claim nervousness fell from 5 to 2 in a self-report measure except that we know it has lowered, but in physiological measures, if you know heart rate jumped from 75 to 110 beats per minute we know specifically measurably we know how much heart rate has increased.

Furthermore, the definition of heart rate is unambiguous no one can say what heart rate means changes know self-report may it can change. What is happiness may differ from person to person one can have different arguments, but what is heart rate does not change from person to person. Whereas, we never know whether someone else's definition of nervousness is the same as ours. So, in self-reports subjective differences can happen. However, just like other measures physiological measures also have some limitations. Physiological markers of emotion can also vary from person to person even though they are very accurate in most of the context. Some of these varieties are due to the fact that people who are engaged in various activities, but even within the same activity people's bodies differ, and everybody's brain activity will be different.

So, in the beginning, people may differ in certain activities. So, that can also create problems. For this reason, researchers typically examine the impact of emotion by taking first a baseline measure and then they will take after a certain intervention response or certain emotional experience how it changes. So, then they compare with the baseline and after effect. Measures like EEG and fMRI have significant practical problems one thing is these are very costly, and it is not possible for every researcher to use them. In the case of fMRI, one has to go lie inside a machine which can be very difficult and problematic for a lot of people and the machine will surround your head and can be very noisy. Many people particularly children and those suffering from other diseases or mental issues like claustrophobia may be unable to go through these kinds of machines.

So, practical issues are that it is expensive, and everybody cannot go through all these

things - we cannot collect data from a large number of people. Furthermore, fMRI technology is very expensive and few researchers outside hospitals or major research institutions have access to it. The process limits the kind of experience that can be tested by the investigator majority of our ordinary experiences occur. So, because it becomes very limited in a particular setting in a machine inside a machine you are measuring something. So, it becomes very limited in real life - how emotion is experienced, and it is difficult to actually use those machines in more real-life situations. So, the brain scan study results must be interpreted. Then the interpretation of results becomes very difficult as one has to be very technically knowledgeable to understand, otherwise, you know the interpretation can also create problems. One can make an erroneous interpretation of what is the finding of these machines and so on, a lot of technical knowledge is required.

The last one is behavioral observation. We also can report or kind of measure emotion by observing the behavior - how people behave in the real world. Now observational data can give us information about the emotional state of an individual. For example, we assume that individuals are afraid when they jump, or scream at the sight of a snake or something like that we infer anger when someone makes a fist and shouts. So, these are observations we make apparently of their behavior and then say certain emotions they are going through. So, our parents also taught us the terms of emotion by inferring our emotions from our actions and then telling us 'You are fearful'.

So, this is how we learn. People observe our behavior and then say 'Are you experiencing fear?'. So, like this observational data are very prominent in our day-to-day life. As people frequently cannot or do not choose to accurately report their own emotions, researchers generally separate self-reports and observations. So, generally people use observational data also along with self-reports. So, that enhances the validity of the findings. So, I may not just completely rely on what a person is saying, but I am also observing how this person is behaving in a certain context of the research.

So, that will validate my findings. More specifically, analysis of facial expressions can provide information about emotional states. Observation of facial expressions - when people feel angry for example, they frequently lower their eyebrows, crunch them together et cetera. So, all these facial expressions also can give additional information. Particularly, Paul Ekman has developed something called the 'facial action coding system'. FACS, we call it FACS. It is a behavioral coding system used by researchers to record facial muscle contractions. So, is a very detailed way that we can analyze the muscle contractions in the face and analyze which emotion one is going through.

So, this kind of software also can be used for detailed behavioral observation. Certain muscular contraction patterns are more likely to occur when people experience certain

emotions or are in certain circumstances likely to provoke a specific emotion. Now, this kind of coded facial expression can also have limitations. People can try with varying degrees of success. Sometimes people can fake expressions also - it can become a problem. Coding facial expressions takes a very long time, again it is a very technical thing one has to know how to code and how to analyze, everybody cannot do that.

Muscle movement can be very subtle and it takes a lot of practice and time to correctly understand what is happening. While most scholars agree on the meaning of some expressions, many might differ or be unsure about it. So, nonetheless given enough time and effort researchers can classify a wide range of facial expressions with enough high rates of agreement. So, certain issues are there in terms of technical understanding and theoretical knowledge. So, what is the best measure of emotions? All these are kind of important and should be used. Depending on the context, whatever is feasible may be used. It is better to use multiple sources of data from multiple measures that enhance the validity as much as possible. Thank you with this we will end today's lecture. Thank you.