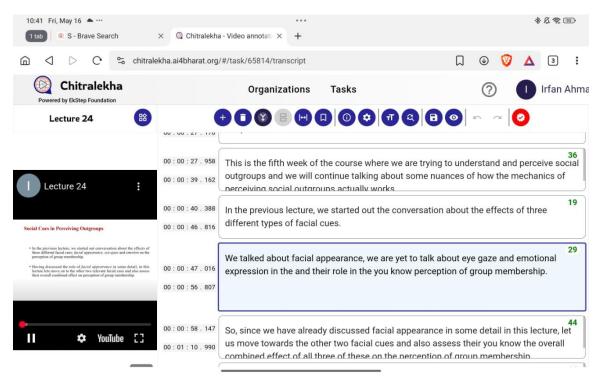**Social Behavior and the Brain: An Introduction to Social Neuroscience**
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Week - 05
Lecture – 24

Hello and welcome to the course social behavior and the brain and introduction to social neuroscience. I am Dr. Arik Verma, an associate professor in the department of cognitive science, IIT Kanpur. This is the fifth week of the course where we are trying to understand and perceive social outgroups and we will continue talking about some nuances of how the mechanics of perceiving social outgroups actually works. In the previous lecture, we started out the conversation about the effects of three different types of facial cues. We talked about facial appearance, we are yet to talk about eye gaze and emotional expression in the and their role in the you know perception of group membership.

So, since we have already discussed facial appearance in some detail in this lecture, let us move towards the other two facial cues and also assess their you know the overall combined effect of all three of these on the perception of group membership. Now eye

gaze, eyes are generally believed to be one of the most powerful channels of human social communication and everybody sort of you know while I am telling you this as part of research I am sure it everybody must have experienced that even if you are talking to somebody and if you are constantly avoiding eye contact it seems very disruptive because So, communication happens when you are actually looking into you know people's eyes when they are when you are looking at them they are looking at you that is the best form of communication. So, it seems that yes the eye gaze you know the eye contact for that matter must have something to do with how you know efficiently people are communicating, what are the different types of information that they are exchanging. The perception of eye gaze is offered or is also often argued to play a very critical role in the development of mentalizing or theory of mind.

Remember what is theory of mind? Theory of mind is when you are trying to make a sense of others inner mental lives, their emotional states, their feelings, their choices, their emotional expressions, their intentions and goals, all of this comes under theory of mind. When you are trying to form a theory of somebody else's mind, and you are not even having an eye contact with them that does not work very well so in order to really make a good judgment make a very good estimate about you know other individuals it is very important that we are having let's say an eye contact with these individuals and so on Now eye contact also has been found to be is related to yielding higher galvanic skin response, EEG arousal, increased heart rate and also increased amygdala responsivity in different observers. So it seems even if you are sort of you know looking at somebody you are looking at their face unless there is an eye contact. Seems, and these results seem to suggest that a contact has not really happened. The exchange of information sort of has not really started.

The channels of communication have not really opened. Only after you are looking at somebody's eyes and they are looking into your eyes that is where the actual connection between two people is happening. and this is not really you know reserved to only let us say friendly or romantic communications but it is also very important you know feature a very important aspect of all sides of communication even if you are fighting with somebody even if you are sizing them up for or evaluating them for a given role unless you are having an eye contact it becomes very difficult and this is how the system is wired it becomes very difficult to make a sense of what the person is all about and all the other you know associated information will become available to you only when eye contact is really there all right or at least that the immediate evaluations that happen eye contact or eye gaze is a very very important component. Now, amygdala damage has been implicated in undermining the ability to orient to the eyes of another other people during social communication and consequently to follow another's direction of attention. So, which area of the brain might be responsible for moderating these eye contact or eye gaze, it seems that the amygdala is really important.

And if amygdala is damaged it undermines the individuals ability to make an eye contact with another individual during social communication also ah to follow their line of attention typically for example if me and you are talking and i say oh i i have ah you know this pen here on on the table I do not really need to use my hands to point I can just look there and say oh I have a pen on my table and you will be able to follow the line of my attention and basically you know decipher what is it that I am actually talking about. So eye contact in that sense is rather informational as well it tells you about where others are paying attention at. Also I am sure you would know that for example, in autism spectrum disorders one of the critical features is that the individuals, the children are not able to make constant eye contact with people when they are interacting with them and that also has been linked back to the amygdala function. Now, a number of recent studies have demonstrated differential cortical and amygdala activity to threat displays as a function of gaze direction. For example, even if you are trying to, you know, size up the amount of threat that is involved in a given display in a given scenario, let us say in the eyes of a given individual, if the gaze is direct versus if the gaze is averted, it is looking somewhere else.

It basically you know leads to different calculations from the same scenario with the same person suggesting that eye gaze actually combines with specific facial expressions to modulate threat responses. So, a threat response if you even if you are For example, showing your anger, if you are showing that you are unhappy or you are showing that oh I am you know going to be aggressive or violent towards somebody else, eye gaze is actually very important. You might have seen a lot of you know mothers follow this that or even fathers and teachers that when they have to scold or when you have to you know really give a slightly stricter message to their children, the eye contact is really very important. They will actually you know resort with modulating their eye gaze you know. and that basically conveys the message a bit more strongly ok.

Let us look at some of these recent studies. So, recent studies by Adams and colleagues serve to illustrate the you know and clarify the important role that eye gaze can actually play in emotion processing from faces. Let us look at that. So for example, Adams and Kleck demonstrated that angry faces when they are coupled with direct gaze and fearful faces when they are coupled with averted gaze are perceived as more intense and are recognized more quickly and accurately than angry faces when they are coupled with averted gaze or fearful faces when they are covered with direct gaze. So, it seems that specific combinations of facial expression and gaze actually work to inform the other individuals about what the emotion the individual is carrying and the proper communication will only happen when the right kind of facial expression is combined with the right kind of eye gaze in the same direction.

A relatively recent study by Fox and colleagues reported that emotional expressions can also influence gaze processing even the level of attentional allocation. For example, they

found that for participants who are high in trite anxiety, fear coupled with averted gaze yielded greater reflexive attentional shifts in observers compared to that found for either anger or neutral expressions. whereas anger coupled with direct gaze yielded greater attentional capture effects than either fear or neutral expressions. Now again just you know look at this in a bit more detail when you are afraid when you are fearful then you are not directly making eye contact then you basically the most natural emotion is that you are looking all around and you are super afraid and that is basically how you know you may inspire the other person to sort of shift the attention to where the source of fear is. Similarly, if you are angry and you are trying to convey aggression, the direct gaze actually motivates or moderates attention capture much more than say for example, if you are you know fearful with the direct gaze or you know just having a neutral expression with the direct gaze.

So, as I said the correct combination of the eye gaze response and the emotional expression on the face actually works to communicate the facial expressions effectively to other individuals. Finally, there is another study we can talk about. So, Richardson and colleagues specifically examined the influence of direct versus averted eye gaze in the context of intergroup perception. So, they articulated a similar rationale for predicting the influence of gaze in amygdala responsivity during race perception as that described above for the role of eye gaze in emotion perception. So, they basically you know they said that it probably happens is what happens is that amygdala sensitivity or amygdala responsivity to race perception actually gets moderated with respect to if you know people are in direct gaze contact with the members of the other race or they are in an averted gaze response ok.

So, because direct gaze signals approach as does the hostile intent that is typically stereotypically associated with black males, the authors argue that the combination of this. So, the eye gaze and the rays should be expected to have a combinatorial effect to communicate a heightened threat response in this kind of thing. So, for example, if you are looking at a And again, this is from the perspective of white participants who, you know, performed in this study and because there is much more experience and baggage related to, you know, Afro-Americans or African-Americans in that culture. So, if you are combining a hostile intent with the direct eye gaze, then it basically, you know, leads to heightened threat response. If you are combining, let us say, an averted gaze with, you know, basically, you know, the stereotypically style contained in the African American faces, then it will not give or it will not incite that kind of a heightened threat response.

Now, their results, if you look at them, actually confirmed this idea. So, they actually found that there was greater amygdala activity in white participants when they were viewing black faces relative to white faces, but only when the black faces were combined with direct eye gaze. So, it seems that there are various nuances in how you are perceiving these other groups or how you are perceiving these out groups. And those

nuances are also very layered at the level of visual information that is coming in. Yes, when you see the face first you are calculating all of the structural and variant information on the face, so structure and expressions and so on, but the eye gaze is also a very important component here.

You probably need all three things, the emotional expression of the face, the facial identity information or the structural information of the face as well as the eye gaze and together these three will tell you more things about the face than either two of them. Now in another similar study authors found that direct gaze coupled with black versus white faces selectively captured attention to a greater degree. Now again remember this is all in the context of these white participants. So when these white participants because they have a lot of historical baggage with respect to you know hostility and violence and so on and so forth. When they look at or when they are looking at black faces having direct eye contact, direct gaze.

Then ah these things capture their attention to a greater extent than if it comes with the averted gaze or if you are seeing a white face with either direct or averted gaze. Why is this happening? It is happening because of the fact that ah direct gaze combined with the black face let us say to ah which conveys a degree of hostility or negative emotions ah presents threat, requires vigilance and therefore moderates ah you know amygdala activity to that certain degree. Finally, eye gaze was also recently found to significantly impact the otherwise ubiquitous cross-race memory effect in the sense that the effect was only apparent for direct gaze faces. So, we are talking about the fact that oh ah you know ah people do not ah in in some cases we talked about out group face homogeneity effect, but there is also cross race memory effect. For example, if ah you are describing a scene of crime and you saw an African American there and you are a white American ah and if that person stands out from there.
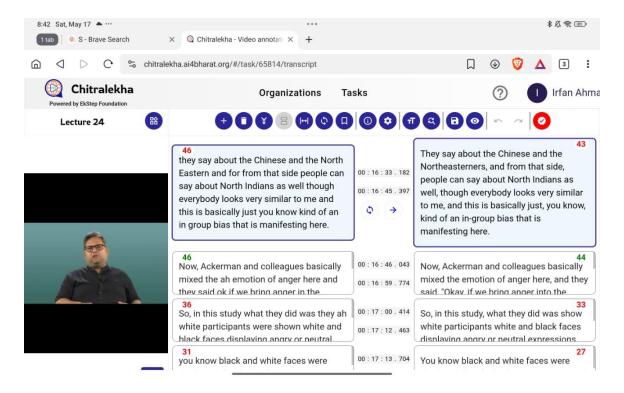
So, you will probably remember that face better, but this also happens when there has been some eye contact and there has been some communication that has happened. Altogether, these findings actually highlight the importance of compound social cues during intergroup perception. Remember, we were talking about three things, facial appearance, structural information about the face, eye gaze, which is what we just covered, and now we will talk about emotional expression, and then we will talk about the overall view of all of this. So, let us talk about emotional expressions. Another very important facial cue and that which has intrigued several researchers in social and effective neuroscience is the idea of emotional expressions or emotional facial expressions that people are constantly interacting with.

Several studies have investigated neural activation in response to emotional displays and they have yielded rather interesting findings. What are the findings? Look at them. For

example, social psychologists have paid attention to the fact that the effects of emotional displays on the perception of in-group and out-group members. It happens differentially.

Let us take an example. Eugenberg and Bodenhausen investigated whether target race would moderate the recognition for happy faces. So, typically in facial emotional literature you will find that there are you know basically there are these six emotions, but the fastest reaction times or the most accurate people are when they are detecting happy faces as opposed to neutral faces or angry or sad or disgust faces and so on. so they basically said okay maybe if we just mix the race angle here as well whether the aspect of race will moderate these reaction times or not what did they find they they made the white participants take part in an emotion recognition task which used computer generated black and white faces which displayed anger joy and sadness as stimuli probably happiness as well the authors found that their white participants were faster and more accurate at evaluating happiness in white targets as compared to black target faces but were interestingly faster at categorizing the angry and sad expressions of the black target faces so you can see here the bias and again it is not explicit bias in this case it is that implicit bias that is in some sense and this is because of a several years of you know cultural and traditional baggage semantic knowledge that people have gained it basically sets apart the angry and sad expressions of the black faces and the happiness recognition happens fastest for only white faces same race faces so to speak. So, you can see here that it is indeed the understanding or recognition of facial expressions is you know anyways getting moderated by the race or by the race membership scenario. Now, the findings of this study seems to suggest that the race of the target individual displaying the emotion and the type of emotion that this individual is displaying actually will both have an effect on emotion recognition.

In another study Ackerman and colleagues for example, they investigate the role of emotion particularly anger in eliminating out group homogeneity effects. Now, remember what we said we said people actually do not individuate out group faces they treat all as one. Say for example, people typically say oh I cannot differentiate it between African American faces they all look alike to us. they say about the Chinese and the North Eastern and for from that side people can say about North Indians as well though everybody looks very similar to me and this is basically just you know kind of an in group bias that is manifesting here. Now, Ackerman and colleagues basically mixed the ah emotion of anger here and they said ok if we bring anger in the picture do people individuate the out group faces do they remember more information about them or you know let us see what really happened.
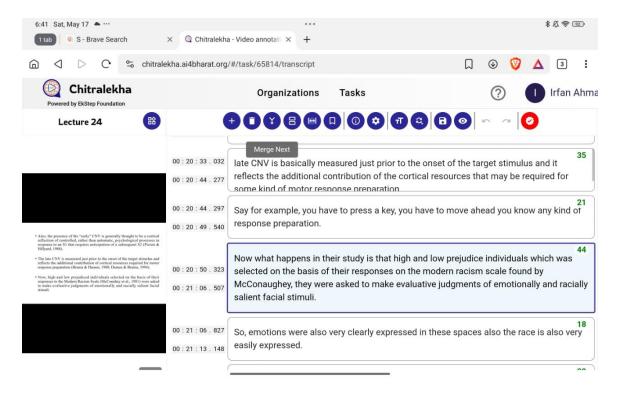
So, in this study what they did was they ah white participants were shown white and black faces displaying angry or neutral expressions and then they later completed a memory task for the previously presented faces. you know black and white faces were displayed, they had either angry impressions or neutral angry or neutral expressions and then later participants actually finished the memory task for these faces. What did the results show? The results showed that the out-group homogeneity effect was apparent for neutral faces, but was not there for angry black faces, alright. Because anger represents a degree of threat, requires vigilance, requires you know some kind of proactive response, people are apparently coding these things much better and they are being able to individuate the angry black faces. So, when the participants were placed and even when the participants were placed under cognitive constraints, angry black faces were more accurately recognized than angry white faces suggesting that there is a possibility of outgroup for heterogeneity on the basis of let us say computation of threat at least in this case.

So, these findings suggest that the race can actually play a very important role in emotion recognition as well. Now, very few studies have actually looked at how emotional displays affect the perception of outgroups at the level of the brain, at the neural level. So, in one study, let us look at some of those studies as well. So, in one study, Shiu, Delden and Ambadi examined the responses of high and low prejudiced individuals to combinations of group membership as well as emotion. The index of neural processing was the you know ERP wave called the contingent negative variation which is an ERP component.

It is a slow negative you know potential elicited typically by a warning stimulus that requires the anticipation of a target stimulus. So, CNV basically will come through when you are looking at a stimulus that is actually you know signaling the coming of another target stimulus. So, it basically is a component that indexes anticipation. So, this component also is classifiable into quantifiable into two kinds of sub components an early CNV and a late CNV whereas, the early CNV is thought to index initial attention to the information carried by the warning stimulus the and the expected degree of cognitive effort that goes in and the degree of motivation you know to respond to the target stimulus. When do you pay attention to a messenger? Let us look at the CNV component as a messenger.

Now if the messenger has brought a very benign sort of a message, it does not carry real you know actionable information as people today say, then you will not really pay a lot of attention to the messenger. So the peaks of the you know the amplitude of the CNV will be relatively lower. But, if you know the information that has been brought by this warning stimulus is dense, is complicated, requires a large degree of expenditure of cognitive effort of the target stimulus and you are motivated, you are looking forward to proactively deal with the target stimulus, then you will see that there will be more activity in the CNV. So, the presence of early CNV is generally supposed to be a cortical reflection of controlled rather than automatic psychological processes in response to stimulus 1 that basically requires an anticipation of a subsequent stimulus 2. late CNV is basically measured just prior to the onset of the target stimulus and it reflects the additional contribution of the cortical resources that may be required for some kind of motor response preparation.

Say for example, you have to press a key, you have to move ahead you know any kind of response preparation. Now what happens in their study is that high and low prejudice individuals which was selected on the basis of their responses on the modern racism scale found by McConaughey, they were asked to make evaluative judgments of emotionally and racially salient facial stimuli. So, emotions were also very clearly expressed in these spaces also the race is also very easily expressed. So, these are high prejudice and low prejudice individual and what we are looking for is we are looking for CNV variations. so the participants were basically asked to make a socially relevant judgment for example ah do i want to work with this person i show you a picture and i will say oh do you want to work with this person things like that regarding in group and out group members ok What are the results? What do we find? Low prejudice participants demonstrated the greatest CNV in ah anticipation of making evaluative responses to angry black faces than to any other category of faces ok.

Consistent with work showing that individuals do monitor ah automatic ah reactions to negative stereotypes elicited by out group stimuli because these angry black faces were ah prominent and they actually ah convey survival related information you see the greatest CNV that is happening, but it note that it is happening in low prejudice participants. What is happening in the high prejudice participants then? The high prejudice individuals showed the most decreased CNV in the anticipation of angry black targets compared to all other targets. Why is this happening? It suggests that the individuals which are who are high in explicit prejudice may be characterized by a relatively decreased tendency or motivation even to monitor automatic prejudice

responses to negative stereotypes. why is this happening see remember we talked about the fact that there is ah anticipation the information is loaded the information is very complex so where will cnv come up cnv will come up that oh a lot of you know prejudice etc is getting ah you know is is coming up and it needs to be regulated so cognitive effort the cnv is is hinting cognitive effort So, when you are a low prejudice individual you are putting in all the effort to suppress your prejudice for that you need to monitor the stimulus for that you need to anticipate the stimulus well and that is why you see you know that the low prejudice participants are showing a greater CNV in anticipation of the angry black faces. On the other hand, these high prejudice individuals actually are not concerned with, see they are probably more explicitly accepting of their prejudice.

So, they do not really care, they do not really show a very marked tendency or even motivation to monitor automatic prejudice responses to negative pseudotype. So, they will not even care, alright. And that is why you can see that there is this very pertinent CNV variation that is available in these two types of participants. So, put together this work suggests that multiple factors do combine to influence the neural responses in theoretically meaningful ways including for example, target race, the emotion that is being expressed by the target and the individual differences among the participants. now we have seen facial appearance we have seen emotional ah we have seen eye gaze and we have seen emotional expression now what do we have to see let us try and see the combined ah you know effect of these social cues and also look at in some detail at the shared signal hypothesis how do these things convergently provide some information to us So we have considered so far as I said the effects of distinct facial cues such as physiognomic invariant facial information and emotional cues.

However, not a lot is known about how would such cues contribute to give rise to the unified perceptions that guide our impression and interaction with others. it seems reasonable however that various forms of social information will meaningfully interact and even when they emanate from distinct sources such as facial expressions and facial appearance skills see as we have been saying ah you know ah time and again in this course the social stimuli are complex stimuli social interacting with the social world is a complicated job it is very information heavy it has a lot of variables it has multiple sources of information that are operating at the same time eventually these sources of information need to be factored in together need to provide you a convergent view of the world as to how will you interact with this specific social world that you are living in and in that sense even if the information is coming from different sources may be some is something is coming from eye gaze, something is coming from facial expression, something is coming from emotional expression, may be something else is coming from your contextual knowledge, may be something else is coming from your semantic knowledge, all of that information will need to be factored together in order to make a sense of you know what is really happening, alright. A lot of studies have not really done

that. Very few studies have examined the effects of these multiple or compound cues on neural processing. For instance, in Chu's study, work demonstrates or Chu's work demonstrates that interaction in the neural responsivity occurred not only for individual differences in the levels of prejudice, but also as a function of the combined influence of race and the presence of stereotypically congruent emotional expressions.

So, if there is a black and angry face, it is bringing two kinds of information. It is let us say a double negative of sorts because it is not your race and the expression is not a palatable expression. So, the combined effect of these two information actually you know works through and it demonstrates the very complex interplay of social messages conveyed by the human face in a manner that is theoretically sort of tractable. We will look at the effects as we go further. Now if you just look at some of this literature or if you just look at the possibilities that this literature offers very basic look you know and very basic look at even the work of Adams and colleagues actually leads us to what is called the shared signal hypothesis.

It is a hypothesis that is put forward by Adams and colleagues and it derives from the understanding that social cues even if they are coming from distinct sources actually share basic low level signal value. So, it is basically you know let us say if it is a stream of 0 1 0 1 0 1 it is bringing together to you certain values which you can use combinatorially to make sense of the social world to decide how will you interact in the social world. For example, whether you have to be warm towards this group of people or aggressive or happy or sad in a given social context. So, this hypothesis predicts that these cues can actually combine in either congruent or incongruent ways which may basically will lead to different kinds of consequences in both our perception and actions.

Let us look at this in some more detail. Now, several studies have supported this idea that demonstrating social cues such as eye gaze direction and the gender of an expressor can actually influence the efficiency with which a given emotional display is processed and how it is interpreted with the combination represents say for example, whether the combination was congruent or incongruent. whether two things are giving the same idea or they are giving different ideas. For example, it might be a point of cognitive dissonance if you meet and if you are a highly prejudiced person and there is a lot of this baggage that you are having. Let us say if you meet, if you see a black face with a very happy expression or if you see you know a black face with a very kind expression instead of the stereotypically associated violence and aggression that is linked with the black faces. Now those will be, so for example if it is a black face it is a happy expression, this is an incongruent you know combination of two informations.

This tells you you have to be alert, this tells you oh this is nothing to really panic, nothing really to work about. and these findings from Chew and colleagues Chew and colleagues are consistent with what is called the shared signal hypothesis in the in that the

aggression associated with anger is also stereotypically ascribed to black. So, when it combines in congruent way. So, when you see an angry black face as I said it is a double negative it the black face basically already hints you to be vigilant and so on and the anger on that face on the expression of anger on that face actually ask you to double down on being very careful and you know avoiding the interaction with this face also. Now, other recent work also demonstrates interactivity based on race and emotion cues as well as race and eye gaze cues again in a manner that is consistent with the shared signal hypothesis.

So, the idea here is basically or the idea of this hypothesis is basically that there are various channels of social information. There these can be thought of as different signals and these signals can either be giving you the same kind of information or they might be giving you different kinds of information and it is a probably a summed valence of this information that makes you decide how will you or how are you going to interact with these individuals. in combination these powerful social cues can be expected to be mutually influencing perception cognition and behavior interestingly we don't really know a lot about the cognitive and neural effects of perceiving such compound cues how are these things sort of factored in what are the mechanisms in the brain that are adding or subtracting these kind of effects also the possibility of a functional correspondence among otherwise distinct social cues also offers very exciting possibilities for future research that can actually help illuminate our understanding of intergroup perception. So, we see that you know there is a lot of you know there is a lot of social information, stereotypical information all of what gets activated when you are looking at people looking at you know different individuals. How are you doing that? What is the mechanics of this perception? You are looking at facial appearance, you are looking at eye gaze, you are looking at emotional expressions.

Now, all of all of these three yes they provide pertinent information, but they also provide convergent information in cases or you know divergent information when they are not falling together and it basically is a very important aspect of social cognition that we will use a combined perspective from these multiple social cues in order to decide our future course of action. and this is something that really needs to be understood, we need to understand what is the neural mechanics of combining the signal from these different sources and deciding upon our you know action in any given social situation. Now, an important consideration related to these issues is about what is it that we are actually looking for, what is the specific nature of information that derives you know social perception. For instance, whether exerting an up whether this is exerting an upstream you know impact on categorical thinking. So, for example, are we picking up these bottom up queues and then performing categorization or you are performing categorization first and then you know that categorization is basically you know moderating the way you know we are categorizing individuals.

So, is it a top down process or is it a bottom up process. Also the question is that to what extent and under which conditions do facial cues give rise to category and stereotype activation and similarly do category and stereotype activation influence how we are processing facial cues. For example, it is very interesting that Sometimes, if you are, you know, blinded by prejudice, you will not be able to appreciate or sense the beauty in out-group faces. You will basically say, oh, I do not like that face. Even if the members or everybody else is saying, oh, that is such a beautiful face, you will say, oh, I do not like because let us say that face is African-American or Northeastern or Chinese or anything like that. So, do these things really influence the way we are performing very basic lower level perceptual operations basically like you know computation of aesthetic beauty which comes from symmetry and so many other things.

Also, it seems that in this way the what we were discussing you know minutes ago, the influence of combined social cues on category and serotype activation seems to be driven at least in part by the number of shared signals, ok. What are the different channels? So, eye gaze, facial appearance and you know emotional expression are three channels. Are there only three channels or there are more channels and how are they combined? Also, if a person or when a person is categorized as an ingroup or an outgroup member, you know this seems to have a very powerful top down influence on whether these faces will be individuated, whether you will process them in detail or they will be sort of put aside in a broad category where you will not care about processing those things in detail. So, this is basically bunch of things that we have talked about how outgroups are perceived in these two lectures. In the next lecture, I will slightly move in a different direction and talk about regulation.