

Social Behavior and the Brain: An Introduction to Social Neuroscience

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Week - 07

Lecture – 33

Welcome to the course social behavior in the brain and introduction to social neuroscience. I am Dr. Ark Verma an associate professor at the department of cognitive science IIT Kanpur. This is week 7 and we are going to talk about assessing frontal caudal activity in anger. Remember in the last class we were talking about asymmetrical frontal cortical activity with respect to anger and we were trying to work out whether this is related to approach motivation or whether this is related to the valence of the emotion. Let us take this discussion forward.

Now previous research from a variety of empirical approaches suggests that anger is associated with approach motivational tendencies. The authors proposed that by assessing the relationship of anger and asymmetrical frontal activity they would be better placed to be able to determine whether this asymmetrical frontal cortical activity is related to either motivational direction or affective valence. So this is remember this is the question we were talking about in much more detail in the previous lecture. Now if asymmetrical frontal cortical activity relates to motivational direction then anger should relate to greater left than right frontal activity.

Remember we established approach motivation basically happens from greater left frontal activity and withdrawal motivation is linked with greater right frontal activity. Similarly positive valence is linked to greater left frontal activity and negative valence is linked to greater right frontal activity. Now, since we are pitching anger as an approach motivational tendency, then from this logic anger should actually induce more or higher left frontal cortical activity that is the point. Now on the contrary if this is not true if anger is treated mainly as a negative valent emotion if then it is possible that asymmetrical frontal cortical activities relates to affective valence or if frontal cortical activity relates more to affective valence then anger should relate to greater right than left frontal cortical activity because as we know anger is associated typically with negative valence. now let's look at this in more detail now in one of the studies designed to test these competing predictions harman jones and allen 1998 they tried to assess trait anger using the bussen perry and 1992 questionnaire and they assess asymmetrical frontal cortical activity by examining the baseline resting regional aeg activity in the band of alpha power for a four minute period In the study of adolescence trait anger related to increased left frontal cortical activity and decreased right frontal cortical activity so

people who are who had high trait anger showed higher left frontal cortical activity remember we are not talking about whole hemisphere at the moment we are talking about only the frontal cortex and we are talking about asymmetry in the frontal cortical you know frontal cortex in terms of either higher activity in left frontal cortex or higher activity in right frontal cortex.

Now a subset of this sample, this is a study being done on adolescents, a subset of this sample was comprised of adolescents in a psychiatric inpatient unit that is who are there for impulsive aggression. So these are actually people who have very high trait anger. Now, even among these individuals trait anger related positively with greater left than right frontal activity. So, this what does this tell us? It tells us that probably anger should be treated more as a approach motivational tendency rather than it should be treated on account of its negative valence. Also asymmetrical activity in other regions did not were not found to be correlated very well with anger.

The specificity of anger to these frontal asymmetries that we are observing and not any other regional asymmetries has also been reported in a several in several studies. So, we are basically seeing how or what kind of you know asymmetrical activity in the brain is found contingent to anger. Now because of these findings the authors decided to focus the review on asymmetrical frontal activity, but not the asymmetry in the entire brain. Also research has addressed an alternative explanation for the observation that relatively high left frontal cortical activity is related to anger. Let us look at that.

The alternative explanation that they come up with is that persons with high levels of trait anger might experience anger as a positive emotion and this positive feeling or attitude towards anger could be responsible for anger being associated with relatively higher left frontal cortical activity. Now see while one explanation that we are sort of peddling so far is that because anger creates approach motivation which is what we were establishing in the last whole lecture that is why anger is linked with higher left frontal cortical activity. Now this alternative explanation is a little bit counterintuitive but it is basically suggesting that people who have high trait anger. They tend to treat anger as a positive emotion, they tend to treat anger as a positive emotion. attribute of their psyche because I am angry because I am competitive because I am you know let's say a bit harsh and a bit competitive it is a good quality and they cherish that quality and they use that quality for good purposes that is basically what is involving the left frontal cortex more rather than the fact that it is higher approach motivation so these alternative theories and these alternative explanations are always there we will go further and we will try to look in more detail as to How is anger actually being treated as either a negative valent emotion or approach motivational emotion? okay now after developing a valid and reliable assessment of attitude towards anger a study was conducted to assess whether resting baseline asymmetrical activity related to trait anger and attitude towards anger so people said okay let us measure what kind of attitude people have towards anger let us give them

a questionnaire and try and understand what is their baseline attitudes towards the anger do they think of it as a positive or a negative attribute was that was established then baseline asymmetrical activity was measured basically to determine whether these people typically show higher you know asymmetry in the cortical activity with respect to angle.

What did they find results indicated that anger actually related to relative higher left frontal activity and not really it was linked to attitude towards anger. So, the attitude may be good or bad or positive or negative, but left anger typically was linked by left higher left frontal cortical activity. So, it seems that this region of the frontal cortex is intricately linked with the expression and experience of anger. Also further analysis revealed that the relationship between trait anger and left frontal activity did not really result from anger being associated with a positive attitude towards anger. So this explanation that we were just giving in the last slide that it is possible that people who have high trait anger treat anger as a positive emotion and that is why a higher activity in left frontal cortex is found that explanation does not stand anymore because irrespective of their attitude towards anger, anger engages the left frontal cortex in these individuals.

Now, this was about trait anger, anger which is you know trait anger which was a more stable aspect of their personality. Let us now talk about state anger, people who get anger in particular temporal you know states and in transition just like a mood, I am angry now, I am typically a calm and a silent person, but something that you have done now has made me extremely angry that kind of anger. Now to get around the limitations inherent in correlational studies experiments have been conducted in which anger is manipulated and its effects on regional brain activity are examined. So you can also induce anger in experimental situations when you are inducing anger in experimental situations you can basically measure contingent activity of the brain and try and link anger to the areas of the brain that are getting activated or involved when people are being made angry all right. So, in Harmon Jones and Siegelman 2001 study participants were randomly assigned to a condition in which another person insulted them.

Or to a condition in which another person treated them in neutral manner. So, you can see the experimental condition is when other people are insulting these participants and this is supposed to make them angry and when they will become angry their brain activity will be measured contingently. Now immediately following the treatment EEG was collected and as predicted individuals who are insulted evidenced greater relative left frontal activity than individuals who are not insulted. So here we can see there is a very clear relationship between higher left frontal cortical activity and people experiencing anger. Also, additional analysis revealed that within the insult condition reported anger and aggression were positively correlated with relative left frontal cortical activity.

So, here we are also seeing that both anger and aggression remember we were in the last lecture defining aggression. as a positive approach tendency you know when you are

angry and you are you know deciding to attack you are deciding to engage in offensive aggression that is basically what should be including or involving higher left frontal cortical activity. So, this is what can be found in this study as well. Interestingly, neither of these correlations were found significant in the no insult condition. So, when the participants were not insulted nothing of these and none of these correlations were actually found significant to any level.

Together these results suggest that relatively high left frontal cortical activation was associated with more anger and aggression in the condition in which anger was invoked, invoked by the insults that were met to these participants. Also, more recent experimental evidence has replicated these results and also reveals that state anger you know anger transitorily evokes both increased left and decreased right frontal activity. Remember in one of the you know points mentioned in the last lecture we were saying that probably the right frontal cortex exercises some kind of control over the left frontal cortex in the expression of anger. So, when people were showing this high state anger increased left frontal cortical activity was experienced that is perfectly fine, but also at the same time decreased right frontal cortical activity is also observed which means that the inhibition sort of goes away a little bit ok. So, in addition when participants were first induced to feel sympathy for a person who insulted them this reduce effects of the this basically reduce the effects of the insult and the activity of the left frontal cortex came down and the activity of the right frontal cortex gradually went up.

So, again you can see how these two parts are complementarily working with each other with respect to feeling insult or forgiving people by feeling sympathy for them. Together these findings suggest that the reason of experiencing sympathy for another individual actually reduces aggression towards that individual and it could be because sympathy reduces the left frontal activity associated with approach oriented anger. it is very interesting say for example if somebody has really done something bad to you but that person is a very near and dear one somebody is your very close friend or a family member or your you know mother father sister brother anybody you are angry towards them and you are basically you know in the mood to you know fight with them or something but if you understand their condition if you are sympathetic towards them then what it will do is it will reduce your aggression that you would be going to act out it will and the neural basis for the fact is that it will reduce the left frontal cortical activity and make you more understanding of the situation thus tempering down your anger a little bit. Again while we are doing this neuroscience this is again something that you may remember that when you are angry towards somebody or extremely angry towards somebody you want to take an offense you want to basically go out and attack and thrash them out for example it might be an interesting idea to look at you know the other side of the story understand them sympathize with them because it will obviously lower down your aggression and again aggression you know higher aggression is not beneficial you

know to you or the other person anyways. Now, let us look at a slightly different angle of these studies.

So, let us look at independent manipulation of approach motivation within anger, ok. so far the experiments that we have reviewed were tailored or they were designed in such a way as to evoke anger that was approach oriented you know we are talking about offensive anger I make you angry you can shout at me you can hit me with something and so on but let's look at other instances of anger for example although most instances of anger actually involve approach inclinations it is possible that not all forms of anger are associated with approach motivation you might have heard of passive aggression you might have heard of people who are angry and get withdrawn into themselves, they don't talk, they don't eat, they are not expressing their anger explicitly. So, the that kind of anger is basically you can call it a little bit of a defensive aggression, but it is an aggression that is inclined inwards rather than outwards. So, to manipulate this approach you know the approach motivation independent of the situation of anger, Harmon Jones and colleagues performed an experiment in which the ability to cope with the anger producing event was manipulated, ok. So, they wanted to manipulate the ability to cope with the anger producing event, something is making you angry and you have to decide how will you react to it.

Based on past research that has revealed that coping potential affects motivational intensity it was predicted that the expectation of being able to take an action to resolve the anger producing event would increase approach motivational intensity relative to expecting to be able to to be unable to take action what does this mean it basically means something is making you angry and you can do something about it as long as you have a sense that I can do something about it I can say for example scold the person hit the person beat the person up so that they do stop making you angry if you have a control over that if you have a control to the sense that you can eliminate the anger producing event that basically leads to approach motivations more that basically feeds into the approach motivational intensity more but for example the person who is making you unhappy, who is making you angry, who is harming you in that sense is so much above you in terms of you know age, power or anything you may, then what will happen, then you will not be able, then you know that I don't have any control over the anger producing event, if I don't have any control over the anger producing event how will I really work ok, let's look at that in some more detail. So, they manipulated this, they put participant in a situation where they could do something about the anger producing event or when they would could do nothing about the anger producing event. Let us look at the experiment in more detail. participants who are strongly opposed to a tuition increase were angered by a radio editorial that argued in favor of a 10 percent tuition increase at their university, ok. It is a typically you will know that all cognitive psychology,

cognitive science experiments are carried out in university, the undergraduate, post graduate students are part of it.

So, here the scenario is created that there is a proposal of increase in tuition fees at a particular university. and the participants are selected such that they strongly oppose this idea, but while they strongly oppose this idea a radio editorial is basically may you know they are made to listen this radio editorial that argues in favor of a 10 percent tuition increase. So, you definitely hate it, but then there is somebody who is saying oh no no this should be done these are the reasons etcetera etcetera. What does this do? It makes you really angry and annoyed. Alright, so to manipulate the coping potential or the expectation of acting to change the situation two conditions differed regards to as to whether it was possible for participants to act to change the event that caused anger, so how did they manipulate this? They basically two conditions were there, in one condition it was possible for participants to act and change this, in another condition it was impossible for participants to act and change it.

Let us see what are these conditions. In one condition participants was led to participants were led to believe that the tuition increase might not occur and that the petitions were being circulated to stop it. This is action impossible condition. The other condition participants in the other condition were led to believe that the university administration had already voted in favor of implementing the said tuition increase then nothing could be done to change that. So this is the action impossible condition.

The screenshot shows a web browser window displaying a video annotation tool. The browser address bar shows the URL: chitrallekha.ai4bharat.org/#/task/65823/transcript. The page header includes the Chitrallekha logo, the text "Powered by EkStep Foundation", and navigation tabs for "Organizations" and "Tasks". The user's name "Irfan Ahma" is visible in the top right corner. The main content area is titled "Lecture 33" and features a video player on the left and a transcript on the right. The transcript includes several annotations:

- At 00:18:06.601, there is a blank annotation box.
- At 00:18:06.642, the text "The scenario is of a possible tuition increase, what is the anger producing event?" is annotated with a score of 14.
- At 00:18:10.112, there is a blank annotation box.
- At 00:18:10.132 and 00:18:41.863, a large blue annotation box contains the text: "This radio editorial that are used for tuition increase and now there are two possible conditions in one condition they can do something about it what can they do they can basically create a petition a petition can be signed by thousands of students and the petition can be conveyed to the university administration the other side is the action impossible condition where they are basically told that oh this decision has already been taken and from the next semester onwards this decision is going to be implemented nothing can be done at this moment anymore". This annotation has a score of 96.
- At 00:18:44.075 and 00:19:01.162, a blue annotation box contains the text: "both conditions however evoked increased you know significant increases in anger over their baseline thing there is a typo here ok and they did not significantly differ from each other so in both cases when they could do something about it versus when they could". This annotation has a score of 50.

So, what is the scenario? The scenario is of a possible tuition increase, what is the anger producing event? This radio editorial that are used for tuition increase and now there are two possible conditions in one condition they can do something about it what can they do they can basically create a petition a petition can be signed by thousands of students and the petition can be conveyed to the university administration the other side is the action impossible condition where they are basically told that oh this decision has already been taken and from the next semester onwards this decision is going to be implemented nothing can be done at this moment anymore both conditions however evoked increased you know significant increases in anger over their baseline thing there is a typo here ok and they did not significantly differ from each other so in both cases when they could do something about it versus when they could not do something about it this whole thing made them really angry alright. More importantly and consistent with previous predictions results indicated that participants who expected to engage in approach related action evidenced greater left frontal activity than participants who expected to be unable to engage in the approach related condition. So, for example, participants who were in the action possible condition showed relatively higher left frontal cortical activity as opposed to participants who are in the action impossible condition. Both were angry good, but those people who could do something about it they showed a higher left frontal cortical activation as opposed to those who could not do that. So, just make that you know clear.

Interestingly within the action possible condition participants who evidenced greater left frontal cortical activity in response to the angering event also evidenced greater self-reported anger. So these things now correlate providing support for the idea that anger is often you know treated as an approach related emotional response when you can do about do something about some you know a particular thing. then is where you will be angry and anger in that sense you can see it spurs on to do something I am angry about a particular law in my college in my hostel I want to do something about it. Interestingly in the condition where action was not possible greater left frontal cortical activity did not relate to greater anger, ok. When action was not possible the coupling between greater left frontal activity and anger was not there.

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Organizations Tasks

Irfan Ahma

Lecture 33

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This whole thing made them really angry, alright.

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greater left frontal activity than participants who expected to be unable to engage in the approach-related condition.

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What does this tell us? This is a very important finding. It tells us that greater left frontal activity is more tied to approach related motivation rather than the valence of the emotion. Okay, this is if you are piecing all of this together you can sort of go back and forth, but this is the crux of this idea. In the author's view they try and explain this, they say this could be because although anger usually leads to approach motivation, but when action is not possible approach motivation will remain low and even if angry feelings are high. So, therefore it will not spur the left frontal cortical activity to be higher.

Finally, again with the action possible condition participants who evidence greater left frontal cortical activity in response to the event were more likely to engage in behaviors that would reduce the possibility of the angering event from occurring in the future. So, not only you know we are sure that this is related to approach related motivation, this is causing higher left frontal cortical activity, it is evident in their behavior also people who are showing higher left frontal cortical activity in response to anger are also trying to do something about it, they are also trying to act out, they are also trying to address these events from not happening in future, ok. So, indeed in this case they were more likely to go ahead and sign a petition where you know to prevent the tuition increase and to take petition with them for others to sign. So, they are rallying together and trying to make this event an impossibility. What does this tell us? This tells us that greater approach motivation as reflected in greater left frontal cortical activity was associated with more action to current the anger causing situation or the negative situation, alright.

So what does this research enterprise tell us? The research of Harmon Jones and colleagues suggest that the left frontal region is most accurately described as a region that is sensitive to approach motivational intensity, how impassioned you are, how excited you are to perform something in response to what is causing anger to you ok. It was only when anger was associated with an opportunity to behave in a manner to resolve the anger producing event that the participants actually showed higher left frontal cortical activity as we just saw. So, the effect of approach motivation and anger on left frontal cortical activity has recently also been reproduced using pictorial simile that evokes anger. So, it is been done it is not only in this scenario in several other experiments this particular finding has been replicated. In this experiment this the one that I am just talking about where they use pictorial stimuli, participants who are low in racial prejudice were shown either neutral, positive or fear or disgust related pictures from the IAPS database.

Mixed among those pictures were depicting nuances what pictures that were depicting nuances of racism and hatred for example the pictures of neo-nazis the pictures of the Ku Klux Klan who are racial figures who are discriminatory figures, okay. Prior to viewing these pictures before they have seen these pictures half of the participants were informed that they would write an essay on why racism is immoral unjust and unfair at the end of the experiment so they want to prepare themselves to do that. This manipulation basically what it does is it serves to increase their anger related approach motivation. If they are angry at seeing these racial pictures then they would actually have something to act out to. They would write their essays more vehemently saying oh you know we saw pictures of neo-nazis, we saw pictures of the Ku Klux Klan and we want to write and vent our anger and say oh why this is immoral, why this is unjust, why should not be there in the society.

What really happened here results reveal that participants showed greater left frontal cortical activity to anger pictures than other picture types only when they expected to engage in approach related behavior so when they had an avenue to act out then they showed higher left frontal cortical activity and in other cases they did not. So, it seems very clear now that higher left frontal cortical activity is not only at you know related to anger, but it is actually related to higher approach related motivational aspects of anger rather than a negative valent aspects of anger. Similarly, there is another study that we can look at. It revealed that individuals who scored lower in racial prejudice evidence even greater relative left frontal activation. See, these things were ideologically opposite to what they believed in.

Since they were ideologically opposite to what they believed in, they were more angry. Since they were more angry, they really, you know, wanted to act out and vehemently write a strong essay disapproving of racialism, disapproving of discrimination and so on. So, these participants they who scored lower in racial prejudice, they evidenced even

greater left frontal cortical activation in response to the anger evoking racist pictures in this approach motivation condition. So, you can now see that the relation is rather clear. Together if you just take a step back and look at this together these findings suggest that relatively greater left frontal activity will occur in response to an angering situation only when there is an explicit approach motivational opportunity.

8:50 Sun, Jun 1 ...

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Lecture 33

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39 Together if you just take a step back and look at this together these findings suggest that relatively greater left frontal activity will occur in response to an angering situation only when there is an explicit approach motivational opportunity.

25 If you can do something about it then the left frontal cortex sort of shows higher activity otherwise it does not really care that much.

35 Okay, however it is also possible that an explicit you know action may not be necessary for increased left frontal cortical activity for anger to occur, but that it only intensifies left frontal cortical activity.

22 So, there is a bit of a typo here I believe, but the idea is an explicit opportunity may not be necessary.

23 If you have in mind that I want to do something about it, it would still spur on higher left frontal cortical activity.

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If you can do something about it then the left frontal cortex sort of shows higher activity otherwise it does not really care that much. Okay, however it is also possible that an explicit you know action may not be necessary for increased left frontal cortical activity for anger to occur, but that it only intensifies left frontal cortical activity. So, there is a bit of a typo here I believe, but the idea is an explicit opportunity may not be necessary. If you have in mind that I want to do something about it, it would still spur on higher left frontal cortical activity. Now in other words there may be other features of the situation or person or the overall context, remember in social neuroscience context is the key, context is the most important thing here.

In other words there may be other features of the situation or person that make it likely that an angering situation will increase approach motivational tendencies and activity in the left frontal cortical region. See if you are angry at somebody if you have the opportunity to act out hit them say something to them and so on versus if there are too big for you to be able to do anything about that obviously the approach inclination sort of will vary in these two situations. possibility along these lines could be also the personality characteristic of trait anger that is individuals who are chronically high in trait

anger may actually evidence increased left frontal activity and approach motivational tendencies in response to angering situations that would not necessarily cause such responses in individuals who are not as chronically angry. So, there are personality types as well there is situations as well who you are angry upon what is the situation, but more importantly in this case the personality characteristic people who are typically trait angry generally seen as angrier people will show these higher left frontal cortical activity as opposed to people who become angry every once in a while who typically experience only state anger. Now you want to test this probably so this prediction is basically derived from the idea that angry individuals have more extensive angry associative networks than less angry individuals and that angry evoking stimuli would therefore activate parts of the network more readily in these angry individuals.

Somebody who is always angry you know you can think of that interesting dialogue from Marvel's Avengers you know Hulk is asked oh are you angry no he said oh I am always angry or I am always ready you know so if somebody is typically angry throughout the phase is agitated the brain sort of aligns with those kind of activations. So a larger distributed area of the brain will be involved in maintaining and sustaining that kind of anger and every time there is an anger producing event that entire a circuit that entire network becomes involved all right, but it will not happen in case of people who occasionally become angry or typically experience state anger. So, in other words among individuals that are higher in trait anger even milder anger cues might activate parts of this anger network through established associations and leads to expressive motor responses. If you are typically an aggressive person it will lead to these kind of responses physiological reactions feelings thoughts and memories. for people who are inherently trait angry have this anger throughout their you know as a part of their personality as an indispensable part of their personality will be invoking will be recruiting the larger parts of the brain and anger will manifest in different ways through emotional reactions through motor responses hitting somebody throwing things here and there physiological reactions you know the parasympathetic system sort of gets activated feelings of negativity thoughts and memories everything starts coming so if you are angry It sort of makes you more angry by the day if you are not resolving that immediately and it happens more with trait angry people than with people who occasionally experience anger.

Now as we have seen along the lines that we have seen in this you know study so far along the line suggested by what we call the cognitive new associative model of aggression, you should read this by Berkowitz. Research has revealed that participants who are high in trait anger, they show selective perceptual and cognitive biases towards angry words and facial expressions in stroop type experiments and also visual search task. So, anger in some sense it is very interesting that it becomes a pervasive feeling, it becomes a pervasive characteristic of your cognitive or mental functioning, alright. It

may be a good thing or a bad thing, everything is good you know in within a particular region, everything sort of can turn odd if it is beyond a certain proportion.

So, again something for to remember here. Now, interestingly no previous research has tested whether anger evoking stimuli are more likely to activate neural structures involved in approach motivational tendencies in individuals who are high as compared to low in trait anger. So, this relationship per se has not really been selected investigated in great detail ok, if it were such results if we get those would actually extend our knowledge of the neural circuitry that underlies ah you know the likelihood of ah these individuals engaging in angry responses. So, if you can make a connection between anger and approach motivation how does anger recruit approach motivational circuit then we will actually understand that ok now this person is angry this is how he is going to act out in this particular way. So, the authors predicted that individuals high in trait anger would actually show relatively greater left frontal cortical activation even to mild anger cues when explicit motivational approach motivation opportunities were not made salient ok. So, even if there are these milder anger cues they will actually show this you know increase activation to anger even when these explicit approach motivation you know what to do with my anger is not evident.

So, in this study what they did was participants were exposed to anger inducing pictures things that would make them angry and other pictures as fillers and they were given no explicit manipulations of action expectancy. So, they were not sure of whether you can act out on this or whether you cannot act out on this, alright. Across all participants what did they find? They found a null effect of relative left frontal asymmetry overall. However, they found individual differences in trait anger related to trait anger related to higher left frontal cortical activity in the anger inducing pictures such that individuals high in trait anger showed greater left frontal activity to anger producing pictures ok, controlling for activity for neural picture. So, people who had high trait anger typically showed irrespective of the possibility of action they showed higher left frontal cortical activity.

Together, these results suggest that explicit manipulations or providing or not providing the opportunity for approach motivated action can actually potentiate the effects of approach motivation on relative left frontal activity, but it is not really always necessary, ok. So, you can see that anger is linked to positive approach motivation or approach motivational tendencies and approach motivational tendencies typically moderate the same areas of the brain such as anger does. So, here I will just conclude this and I will talk to you about this whole thing in more detail in the next lecture. Thank you.