Social Behavior and the Brain: An Introduction to Social Neuroscience

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Week - 07
Lecture – 34

Hello and welcome to the course social behavior in the brain and introduction to social neuroscience. I am Dr. Ark Verma an associate professor in the department of cognitive science IIT Kanpur. This is the seventh week and we are going to be talking about manipulating frontal cortical activity with respect to anger. Now more recent research is consistent with the hypothesis that anger is associated with increased left frontal activity. For instance d'Alfonso and colleagues used slow RTMS to inhibit the left or the right prefrontal cortex right frontal cortex sorry and why did they do so because slow RTMS actually produces inhibition of cortical excitability.

And we were saying in the previous lecture that when people are angry the left frontal cortex sort of becomes you know more activated and the right frontal cortex basically tries to suppress that activity. So what these guys did was they used slow RTMS to inhibit the left and in some cases the right frontal cortex activity. Slow RTMS produces this inhibition of cortical excitability so that the RTMS applied to the right PFC decreases its activation and causes the left PFC to become more active. In which case what will happen? people will experience more anger, so when whereas right TMS when it was applied to the left PFC basically you know reduce the experience of anger or expression of anger and it cause the higher activation of the right PFC, so it is done in a complementary manner.

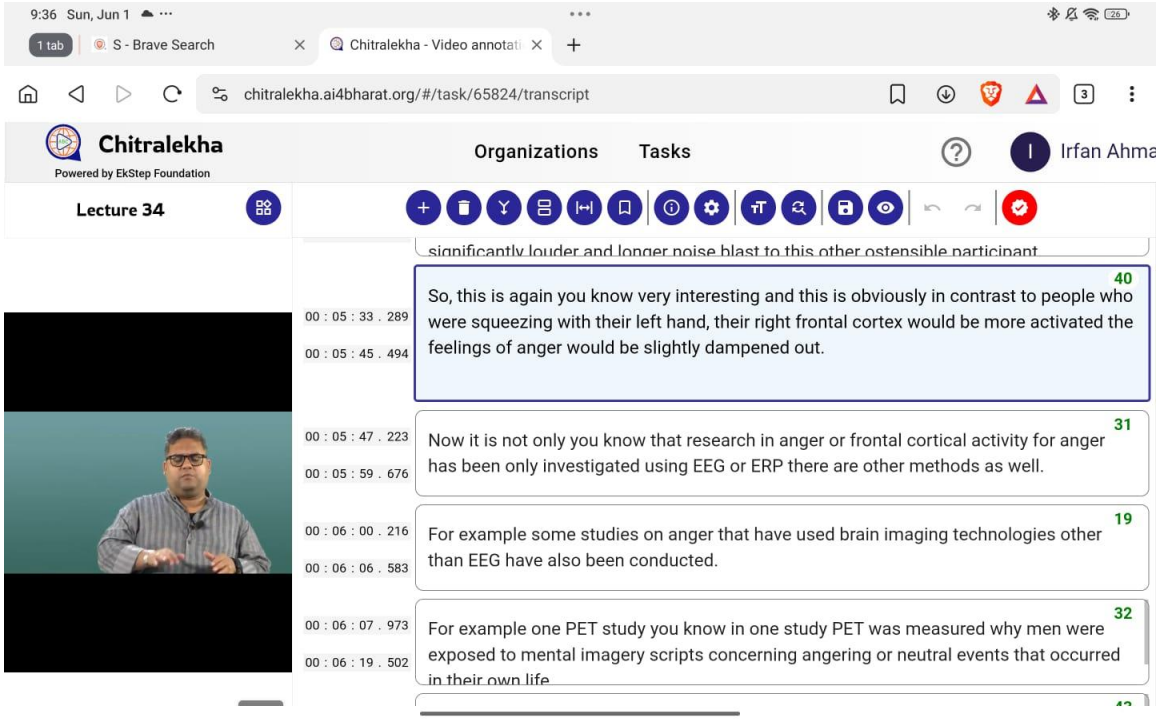
What did these researchers found? Okay, these researchers found that the RTMS applied to the right PFC caused selective attention towards angry faces, people's attention were being drawn more towards anger inducing stimuli whereas RTMS applied to the left PFC caused selective attention away from the angry faces again. So this is in line what we have been talking so far when the left prefrontal cortex is activated then it will basically draw your attention towards anger inducing events. When the right prefrontal cortex is more activated then it will take your attention away from anger inducing events. So, an increase in left prefrontal cortex activity led participants to attentionally approach angry faces as in an aggressive confrontation. So, if you are seeing an angry face it is causing anger in you, you are trying to approach it, you know it is an approach inclination.

On the contrary where there was an increase in right prefrontal activity it led participants to additionally and diligently avoid angry faces as for example in fear based avoidance or

let's say defensive aggression for that matter ok. And these results are not limited to this particular study they have also been reported by other studies for example van Honk and Schutter in 2006 also found you know reported very similar results. Now the interpretation of these results which basically these researchers advanced conquers with other research that has demonstrated that attention towards angry faces is associated with high levels of cortisol production which is actually associated with fear. So, cortisol is a hormone that is involved and it is basically associated when people become afraid, it is basically making your body ready for action and this is basically what is happening in these scenarios as well. Now the authors wanted to extend this work, so they extended the line of work which was produced by van Honk colleagues by examining whether a manipulation of asymmetrical frontal cortical activity would also affect behavioral regression, actual action.

Based on past research that shows that contraction of the left hand increases right frontal activity and that of the right hand increases left frontal activity, the authors manipulated the asymmetrical frontal cortical activity by having participants either contract their left hand or their right hand. Then the participants received insulting feedback ostensibly from another participant. They then played a reaction time game on the computer against this other ostensible participant. Now participants were told remember anger is linked to approach motivation so what will happen here participants were told that they could actually give this other participant who had previously insulted them either a blast of 60 decibels, 70 decibels, 80 decibels, 90 decibels or 100 decibels of white noise for up to 10 seconds you know acting out their anger opportunity to act out their anger. if they were fastest to press the shift key when an image appeared on the screen.

As soon as a particular image appeared they can press the shift key, the longer they press the larger the amount of white noise shock that these other parts will receive. What did they find? Results showed that participants who squeezed with their right hand actually gave significantly louder and longer noise blast to this other ostensible participant. So this right hand contracting their right hand increase their left frontal cortical activity allowed them to express anger more vehemently and therefore these people provided significantly louder and longer noise blast to this other ostensible participant. So, this is again you know very interesting and this is obviously in contrast to people who were squeezing with their left hand, their right frontal cortex would be more activated the feelings of anger would be slightly dampened out. Now it is not only you know that research in anger or frontal cortical activity for anger has been only investigated using EEG or ERP there are other methods as well.

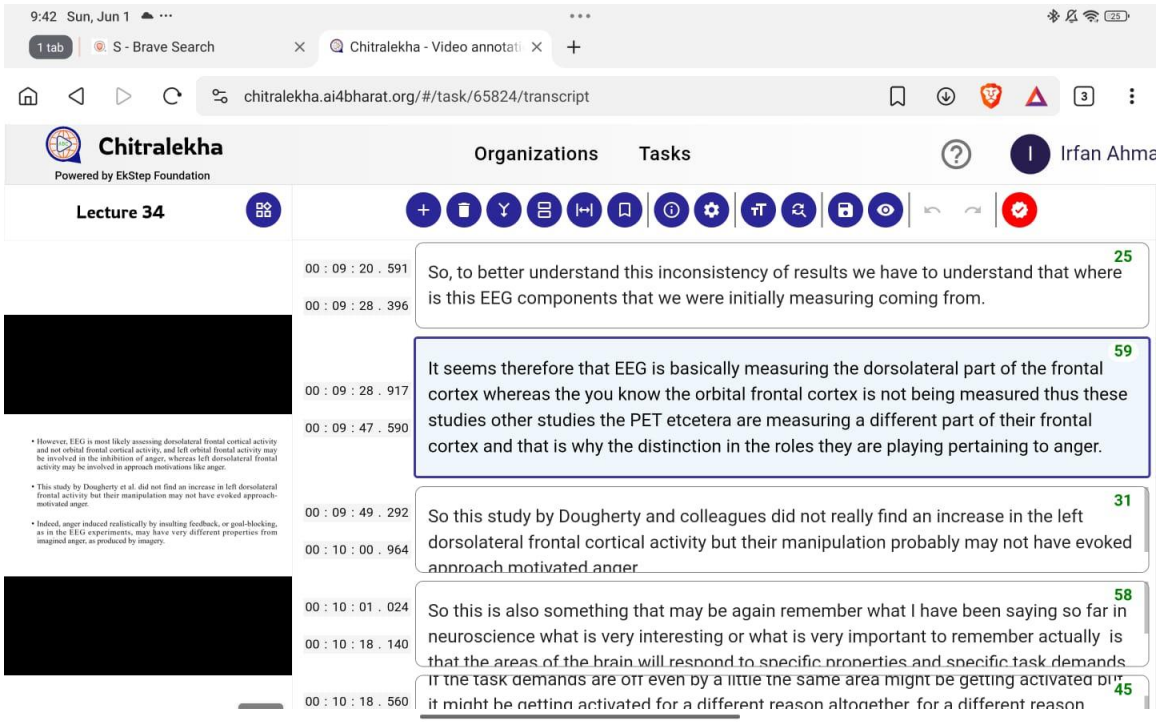


For example some studies on anger that have used brain imaging technologies other than EEG have also been conducted. For example one PET study you know in one study PET was measured why men were exposed to mental imagery scripts concerning angering or neutral events that occurred in their own life. So they were basically supposed to you know shown these mental imagery scripts get you know imagine this happened this happened that happened either events that were make that would make them angry or they were just neutral events about their own life. So it's a more of an autobiographical scenario. What did they find? Results revealed that as compared to neutral imagery, anger imagery caused an increase in the left orbital frontal cortex activity, the right ACC activity, the bilateral anterior temporal poles, the left precentral gyrus, the bilateral medial frontal cortex and also the bilateral cerebellum.

All of these things you can see are linked with the significant inclination for approach and action, alright. Now Dougherty and colleagues basically looked at this and they understood that the increase in the left orbital frontal cortical activity could be corresponding to inhibition of aggressive behavior in the face of anger. So they said that this left orbital frontal see when we were talking about anger we were talking about left frontal cortical activity we are not talking about the orbital frontal it's a slightly different region. Now Dougherty and colleagues think that while their anger was being experienced the left orbital frontal cortical activity is basically trying to inhibit the aggressive behavior in phase of anger ok. Although this interpretation is inconsistent with some speculations of the role of the left orbital frontal cortex in response inhibition because there is a lot of work related to the frontal cortex and its role in inhibition and

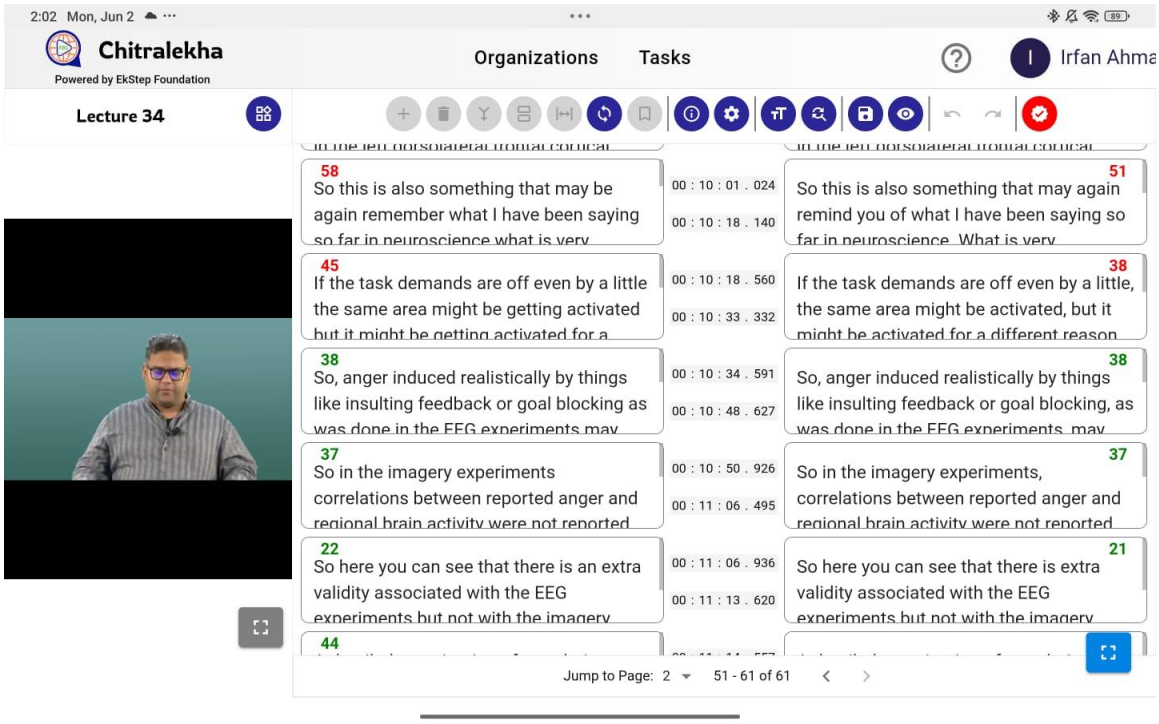
executive processes that does not really agree with this kind of a thing, it is inconsistent also with EEG results showing that increased left frontal cortical activity is associated with increased aggression and approach behavior.

So, there you can see that there are there are a lot of times findings that may not agree with each other or be consistent with each other. Now this interpretation that the left frontal cortical region is involved in the inhibition of anger and aggression is also inconsistent with lesion studies suggesting that menial results from damage to the right frontal region you know it is not linked with the damage to left frontal region it is linked with the damage to right frontal region And the results obtained when the left related to the right frontal cortex is activated and angry attentional processes are measured. So, some of these results that are coming out from these PET or fMRI studies are somehow not found to be super consistent with the earlier EEG findings ok. So, there is obviously scope for more research in this area. Interestingly EG is most likely therefore you know assessing dorsolateral frontal cortical activity and not orbital frontal cortical activity and left orbital frontal cortical activity may be involved in a different function, it may be involved in inhibition of anger whereas left dorsolateral frontal activity may be involved in approach motivations like anger.



So, to better understand this inconsistency of results we have to understand that where is this EEG components that we were initially measuring coming from. It seems therefore that EEG is basically measuring the dorsolateral part of the frontal cortex whereas the you know the orbital frontal cortex is not being measured thus these studies other studies

the PET etcetera are measuring a different part of their frontal cortex and that is why the distinction in the roles they are playing pertaining to anger. So this study by Dougherty and colleagues did not really find an increase in the left dorsolateral frontal cortical activity but their manipulation probably may not have evoked approach motivated anger. So this is also something that may be again remember what I have been saying so far in neuroscience what is very interesting or what is very important to remember actually is that the areas of the brain will respond to specific properties and specific task demands, specific properties of the stimuli and the specific task demands. If the task demands are off even by a little the same area might be getting activated but it might be getting activated for a different reason altogether, for a different reason altogether as opposed to the reason that you have theorized and hypothesized about.



So, anger induced realistically by things like insulting feedback or goal blocking as was done in the EEG experiments may actually have very different properties from imagined anger as was produced by imagery in Doherty and colleagues' experiment. So in the imagery experiments correlations between reported anger and regional brain activity were not reported whereas in the EEG experiment self-reported anger has actually been found to correlate significantly with relative left frontal cortical activity too. So here you can see that there is an extra validity associated with the EEG experiments but not with the imagery experiments. A detailed examination of correlations between reported emotion and physiological measure is a very good thing and it assists in determining whether the brain activation is actually related to the emotional experience in question or it is coming because of some other non-emotional variables. So, this is again something that we really

need to be very careful about when we are designing neuro imaging experiments with appropriately strong hypothesis.

So I will stop here I will continue this discussion in the next lecture thank you