

Social Behavior and the Brain: An Introduction to Social Neuroscience

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Week - 06

Lecture – 30

Hello and welcome to the course Social Behavior and the Brain, an Introduction to Social Neuroscience. I am Dr. Ark Verma, an Associate Professor in the Department of Cognitive Science, IIT Kanpur. This is week 6 and I am on to the last lecture where we are going to talk about Emotional Decision Making. Now, a possible explanation for the discrepancy between the behavior and emotion is that orbitofrontal patients actually have been shown to lack insight in their behavior. So, one of the very interesting things remember in the last experiment that we were discussing the orbitofrontal damage patients are not aware of the contextual relevance of their behavior.

They do not have an insight of whether their behavior is contextually appropriate or not. they do not know whether the way they are behaving is suited to that context or not. Say for example, remember in the in the teasing task they were not aware of how insensitive these people were when they were teasing these others they were actually proud of their behavior. In the over praise task they were not aware of the fact that the praise is entirely undeserved and rather than you know understanding the humor or the irony there, they were actually showing embarrassment which comes actually in place of you know deserved praise.

So, these are some of the things that we discovered so far about the orbitofrontal cortex. Now, a possible explanation for this discrepancy between the behavior and the emotion is that these patients seem to lack some insight into their own behavior. In other words, they may reflect in erroneous belief that they had actually acted appropriately during the task. Now, without the awareness of their mistakes an individual therefore, has no reason to become embarrassed and therefore, experience of embarrassment cannot really motivate the selection of new behaviors to avoid the repetition of this mistake you know look at the over praise task that we are talking about. Now, in this context, orbitofrontal cortex may actually be important for insight into behavior and it only affects emotional decision making in a slightly distal manner.

It seems that it is coming from somewhere else. To investigate this association between self insight, emotion and orbitofrontal damage, the authors actually conducted a study in which they could actually measure these things together. So, in which they could measure self insight and they could measure emotion and then explain how emotion you know change as a result of self you know insight becoming more and more accurate.

Interestingly, what has been observed is that orbitofrontal cortex patients, healthy controls and brain damaged controls were all you know made to take part in this self-disclosure task, wherein an experimenter asked each participant a series of questions. Some questions were appropriate for a discussion with a stranger for example, what would be an ideal day for you? And some questions were more appropriate for you know be in exchange between close friends.

So, for example, oh if you are going to pass away this evening with no chance of talking to anyone, what would you most regret not having told someone and why haven't you told that them yet. that thing to them yet. So, these are this is actually a more private sort of a conversation, this is a more conversation that will happen between two very close friends or family members and so on. Now, the measurement of appropriate self disclosure actually relied on participants understanding of the social norms. how is one supposed to behave against excessive disclosure of personal information of strangers.

So, if you know that you know because we are you know the experimenter and the participant are actually strangers only one kind of question is warranted whereas, the other is entirely unwarranted. Interestingly, the orbitofrontal patients and both the control groups demonstrated equal knowledge of the social norms. So, both of them knew that this is appropriate, this is not appropriate. After the self-disclosure task was done, participants reported on their perceptions of social appropriateness and their emotional experiences during the task. So, they are probing it a bit deeper.

The authors then manipulated insight into behavior by showing the participants a videotape of their task performance and examined how the emotion was changing when these people were viewing these videotapes. There is a study found that the orbitofrontal patients disclosed more personal and inappropriate information than the other participants, both the brain damage controls and healthy age match controls. So, it seems that there is this lack of insight, lack of self-insight in these orbitofrontal cortex patients and that is what is manifesting in their behavior. Also, before viewing their video tape behavior, orbitofrontal cortex patients had positively inflated perceptions of their social appropriateness. So, in their mind, they understand what social appropriateness is and they are behaving exactly in the appropriate manner, but this is miscontrolled, this is not some I mean this is erroneous.

In actuality they do not have a very good sense of social appropriateness and therefore, their behavior is also not according to social norms or appropriateness norms. In contrast to their and moving further in contrast to their initial emotion ratings, orbitofrontal patients embarrassment significantly increased after they viewed their videotaped behavior, not while they were actually behaving, but when they are observing themselves behave in these videotapes. So, these findings if you look at them they support the theory that orbitofrontal cortex mediates in the online monitoring of behavior with reference to

social norms. Emotional decision making therefore, may be impacted by orbitofrontal damage because emotional experience may be driven by faulty perception of one's behavior. So, person might be feeling oh this is the right way to behave in this context and because that you know perception of rightness or correctness is misplaced their behavior will also be consequently misplaced.

The screenshot shows a web browser window with a video player and a transcript. The video player is titled "Lecture 30" and is powered by EkStep Foundation. The transcript is from "Chitralekha - Video annotation" and is titled "Lecture 30". The transcript text is as follows:

00 : 06 : 15 . 204 emotional experience may be driven by faulty perception of one's behavior.

00 : 06 : 15 . 224 So, person might be feeling oh this is the right way to behave in this context and because 35

00 : 06 : 27 . 697 that you know perception of rightness or correctness is misplaced their behavior will also be consequently misplaced.

00 : 06 : 28 . 443 They are they have an idea about how I should behave or they have an idea oh this is 69

00 : 06 : 48 . 498 perfectly right you know in the teasing task if you remember they seem that they you know they thought that this is the way you know I should be participating in that task and

00 : 06 : 49 . 899 Through that task they realize oh this is and if you show them say for example, these 32

00 : 06 : 58 . 767 media tapes only then they realize that the behavior was out of place and inappropriate.

00 : 06 : 59 . 067 So, this monitoring of behavior in reference to social norms seems to be a primary 29

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So, in other words impaired self-insight may preclude the generation of emotions needed 17

They are they have an idea about how I should behave or they have an idea oh this is perfectly right you know in the teasing task if you remember they seem that they you know they thought that this is the way you know I should be participating in that task and they were participating in their minds correctly, but once they are you know once they are Through that task they realize oh this is and if you show them say for example, these media tapes only then they realize that the behavior was out of place and inappropriate. So, this monitoring of behavior in reference to social norms seems to be a primary purpose of this particular task, the orbiter this particular region called the orbitofrontal cortex. So, in other words impaired self-insight may preclude the generation of emotions needed to guide decision making. So, it is not let us say as the somatic marker hypothesis said it is not their inability to experience these loss or you know sadness on loss and happiness on gain, it is because they are not being able to. even understand that you know this is loss or this is gain and therefore, they are not being able to generate correct and appropriate emotions.

Now, monitoring how does monitoring influence decision making let us talk about that. So, as we have seen so far if the orbitofrontal cortex you know indeed serves a

monitoring function then it should affect emotional decision making from you know aside from just impacting self inside there should be something else it should affect decision making also. Now, although neural models tend to assume that emotional information may be either helpful or hurtful it is implied that emotional influences on decision making may be both ways you know they can go they can be helpful as well they can be hurtful as well. Emotions actually influence the attention and amount of cognitive resources that you will allocate to a decision making and the direction of attention and rapidity in decision making can sometimes be advantageous such as fear motivating the decision to freeze upon seeing a snake on a trail you know this is contextually appropriate this is the right thing to do. On the other hand sometimes there would be residual anger from a frustrating you know commute it would motivate to take snap decisions you know where deliberation may be more advantageous.

The screenshot shows a video player interface for 'Lectrue 30' on Chitralkha. The video is paused at 00:08:38. The interface includes a navigation bar with 'Organizations' and 'Tasks' tabs, and a user profile for 'Irfan Ahma'. The transcript is displayed on the right side of the player, with segments numbered 31, 36, 11, 45, and 4. The text in the transcript is partially obscured by black redaction boxes. A 'Settings' button is visible in the transcript area.

I do not really want there or say for example, I have come back I am irritated I am doing I have had a hard day and therefore, I may be taking some snap decisions. So, it seems that this is a slightly more complicated story. The complex role of emotion in decision making and the previous findings that the orbitofrontal cortex may serve a monitoring function basically led the authors of this chapter to ask a slightly new question about the involvement of the orbitofrontal cortex in emotional decision making. What is that question? For example, does the orbitofrontal cortex monitor whether emotion should be incorporated or whether it should be inhibited in the situations of decision making? Where should emotion come in? Where it should stay away? And in to that effect, they conducted a series of fMRI studies with healthy individuals and they found that these

studies had supported the theory that the orbitofrontal cortex is involved in mediating emotional influences on decision making by evaluating the relevance of emotional information. If the emotional information is relevant to the decision, then people will let the emotions influence their decision.

If the emotional information is irrelevant to the decisions being made, then they will keep the decisions and keep the emotions out of the process of decision making. Now, participants just to sort of understand this task in some more detail, participants were presented with negative neutral pictures as they placed bets in a gambling task that is a negative or neutral picture sorry that is in a rule a game. In the helpful condition where the emotions might be helpful for decision making, participants were told that the pictures actually held a clue about the upcoming gamble. So, pictures become informationally relevant to that task. So, the negative pictures indicated a high risk in comparison to neutral pictures.

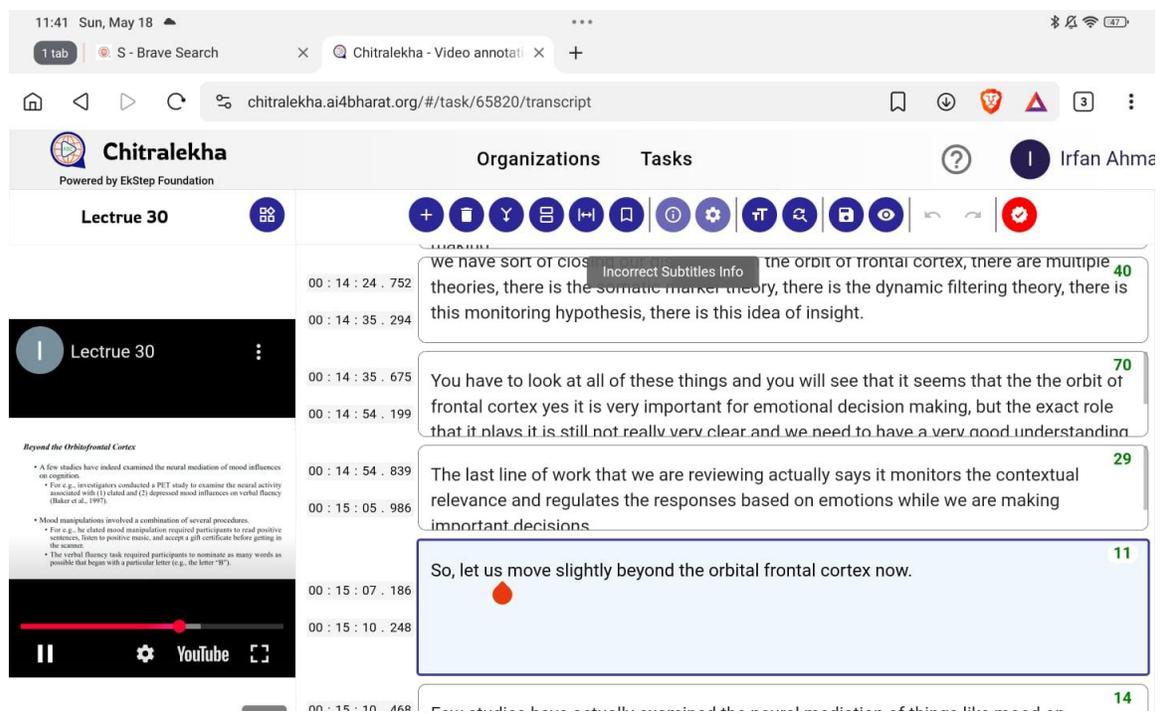
In previous studies or as per previous studies it was suggested that individuals are highly likely to reduce their gambles in relation to fearful pictures because they think that there is some threat there is a it is a bad you know omen if you may call it that. because it increases the perception of risk. So, people will not engage in gambling if they see a fearful picture. Now, in cases where emotions can be hurtful to decision making in that kind of condition participants were told that the pictures did not hold any clue about the upcoming bet. So, it is giving absolutely no relevant information about the betting game.

This required the participants to suppress the normative influence of the negative pictures on betting decisions. So, in the second condition it would really require the participants to suppress the influence of emotion on the decision making because whatever the picture be whether it is negative whether it is neutral it should not it does not carry any relevant information for this decision making and hence it should be kept out of business. Now, what did they find? Orbitofrontal cortex was found to be recruited for appropriately applying the information emotional information to subsequent gambling decision. So, what the orbitofrontal cortex is doing is it is basically deciding whether I should let the information emotional information partake in this process or whether I should keep the emotional information away from the decision making process. In other words, the orbitofrontal cortex was recruited for betting that was influenced by helpful emotional cues and recruited for inhibiting the effect of hurtful emotions, hurtful emotional cues.

So, when it is relevant the orbitofrontal cortex allows the emotions to influence, when it is not useful or hurtful then it disallows them. to partake in the decision making process. These studies together suggest that orbitofrontal cortex is involved in emotional decision making by regulating response selection in relation to the helpful or the hurtful nature of emotional information given a particular decision. So, what is the orbital frontal cortex doing? It is regulating the response selection based on the emotional information. If the

emotional information is important, it will allow the response selection to account for those things to include those information.

If it is not useful, if it is hurtful, then it will disallow that altogether. The social neuroscience approach seems to suggest that the orbitofrontal cortex is really important for monitoring functions rather than getting you know in terms of dynamic filtering theory or somatic state you know somatic markers in terms of somatic marker theory. Together these functions may be influenced emotional decision making by either supporting insight into the appropriateness of behavior that affects the emotions that are generated or monitoring whether the correct emotional decision is being taken here. However, primary function of the orbitofrontal cortex is actually not to apply emotion to decision making it is something else what is it. together if you see these studies should not be considered as evidence against the view that emotions can have an adaptive role in decision making. Instead the implication from these studies the last point that I just mentioned is that the neural investigation of emotional decision making should actually move beyond just focusing on the orbitofrontal cortex.



Because there might be other areas other regions of the brain that actually you know examine how and whether the adaptive influences of emotion happen on decision making. we have sort of closing our discussion on the orbit of frontal cortex, there are multiple theories, there is the somatic marker theory, there is the dynamic filtering theory, there is this monitoring hypothesis, there is this idea of insight. You have to look at all of these things and you will see that it seems that the the orbit of frontal cortex yes it is very

important for emotional decision making, but the exact role that it plays it is still not really very clear and we need to have a very good understanding of what is it really that the you know orbit of frontal cortex is doing. The last line of work that we are reviewing actually says it monitors the contextual relevance and regulates the responses based on emotions while we are making important decisions. So, let us move slightly beyond the orbital frontal cortex now.

Few studies have actually examined the neural mediation of things like mood on cognition. What are moods? Moods are temporary emotional states, transient emotional states that make you feel sad or happy or frustrated, but just for a very short amount of time after that the mood sort of changes. Now, investigators they conducted a PET study to examine the neural activity that is associated with either elated or depressed mood and how does that influence a very simple thing like verbal fluency. Mood manipulations, interestingly mood manipulations involved a combination of several procedures. So, different ways were used to manipulate mood.

For example, the elated mood manipulation required participants to read positive sentences, listen to positive music and accept a gift certificate even before getting in the scanner. So, this would elevate their mood. On the other hand, the verbal fluency task actually required the participants to nominate as many words as possible that began with the particular letter. Say for example, generate any number of letters from a, b, c or d that is basically the verbal fluency task. Now, even though the differences in activity were found during the verbal fluency task for different mood conditions, no behavioral differences were actually found across these conditions.

They actually behave in the same way similar you know output verbal fluency output was there. So, if you if we need to understand this in terms of neuronal activity it may be necessary to replicate this effect in the context of behavioral differences to be able to draw strong in conclusions about how mood relates you know to decision making and how does how changes in mood are reflected in differences in brain activity. Another study, another study also sought to examine emotional influences on memory for words and faces. Participants were shown emotional films and they were performed they were asked to perform a three back task for you know words and faces. You know the three back task is a typical working memory task you have to match the current picture with three one that has come before three trials.

So, this task required participants to remember the sequence of words and faces as they were being presented in a rapid manner. A marginally significant behavioral effect was found that is memory for words you know was reduced by negative emotions, but memory for faces was enhanced by negative emotion. You know there is perception of threat, amygdala activity boosts memory processing and therefore, you remember threatening faces or unpleasant faces a bit more than you would remember words. For

words it acts in a contrary manner. Neurally speaking activity in the right dorsolateral prefrontal cortex was you know found to account for the differential emotional influences for on the memory for words and faces.

So, this the authors of this current study noted that the psychological mechanism through which emotion differentially affects the memory for words and memory for faces is basically not super clear, but obviously more future research is needed to more to better understand what is the psychological. what happens is in these fMRI studies you can ask the person to do a task, you can ask them to perform the task, you can basically measure corresponding neural activity, but unless we have very strong and clear behavioral hypothesis it does not make a lot of sense. And in that sense studies like the two that we just saw they do not give us very clear outcomes, they do not give us a very clear impression of what is it that has mechanistically happened in the brain. The brain anyways gets the areas of the brain get activated when we are doing any task, but why were they getting activated, what is it that the you know that they were achieving is something that is not super clear ok. Now, so direct evidence seems to be a bit you know all over the place here, but indirect evidence for the neural systems that support adaptive emotional influences on decision making actually comes from more recent research.

The main focus of these recent studies is not really emotional decision making and therefore, emotion is not really directly manipulated and then examined in relation to decision making. What happens here interestingly however, is that these studies have found that decision making tasks significantly recruit brain regions that have been previously associated with emotion you know past experiences. For example, in one study you know decision making was examined using the ultimatum game wherein participant must split a sum of money with another player. So, if you remember the ultimatum game there are two partners they basically have to offer a portion of the sum to the participant you know to the other player and this could be either a fair division 50-50.

If I get 5 dollars I will give 2.5 to my friend and 2.5 to me or it could be unfair I will take the 4 dollars and I will give just 1 dollar to my friend. Now, when the consideration of unfair offers happened, the consideration of these unfair offers were found to be associated with activity in the insula. Insula activity remember from previous lectures has been associated with you know experience of negative emotions such as disgust or anger or pain and distress, which suggest that when the participants were getting these unfair offers, they experience these emotions while considering these unfair offers. also, but you know from a rational economic perspective it seems that you know if they act on this negative emotion by refusing the offer it is actually maladaptive because see if you are not participating you are not getting any money at all.

So, while the emotional response is bad oh I am not really getting this is an unfair offer I am not getting fairly treated. So, you will be tempted to refuse this, but actually from a

rational economic perspective this is the it is a bad decision. Interestingly, from a broader perspective if you look at it refusing to participate in these you know or considering these trials is actually advantageous because the acceptance of unfair offers over time will create social status if you keep accepting bad bargains. if you keep accepting being treated unfairly it brings down your social status. So, while immediately the people are losing money broadly they are actually maintaining their status social status maintaining their status quo.

So, this is one there is another there is a prisoners dilemma game. Where if you remember you know participants win money as a function of their own decision to cooperate or betray and their partners decision to cooperate or betray. See remember this is a very classic social cognition experiment where there are two people they have been both caught in a particular crime for example, or you know they have looted they have this money interestingly and the and they are being interrogated in separate rooms by a particular police officer. Now, if they both cooperate and do not divulge the details, then they both get out and they get the rewarded money and so on. But if either of them does not cooperate, if either of them betrays the other, they are actually both go to jail.

So, the choice to cooperate here is a double edged sword. Basically, participant will win the most if both players choose to cooperate, they will both win, but they will lose the most if they decide to cooperate and the other one decide to not cooperate. So, there in this particular study cooperation was associated with areas you know that are associated with reward processing and so on. The nucleus accumbens, the orbitofrontal cortex, the anterior cingulate and the caudate nucleus. So, they are processing reward and they are processing reward in deciding they are processing this possibility of a reward anticipating reward with respect to whether they should cooperate or whether they should not cooperate.

So, based on the findings of the study the authors actually suggest that the activation in these areas reflects positive emotional experience that reinforces pro social decision making. So, typically a person will be inclined to cooperate in the broader interest of you know their social status or in the broader hope that you know both of us will cooperate and both of us will get to win. So, this is the exciting part of this. The positive emotional reaction that is elicited here is actually adaptive in this case, because although the player makes slightly gain less monetary units, because he is not taking all of their money by themselves. Social cooperation basically is a very very important aspect and it prevents ostracization from the group.

If you are loyal, if you are friendly and if you keep up your promises obviously, you praised in the group rather than ostracized because people who are disloyal who are you know for example, they are rats you know they rat out on other colleagues they will obviously be ostracized not praised in that group. So, in that sense the decision that

people are making are actually adaptive they are helping their social status. So, in this chapter we have basically looked at the overall idea of how does the orbitofrontal cortex mediate decision making, emotional decision making at that and we have also seen some of the other possible hypothesis and we have tried to consider other kinds of experiments as well. In the next week I will continue this discussion about how you know different aspects of social cognition emerge with respect to emotional decision making. Thank you.