

Social Behavior and the Brain: An Introduction to Social Neuroscience
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Week - 06
Lecture – 27

Hello and welcome to the course Social Behavior and the Brain Introduction to Social Neuroscience. I am Dr. Ark Verma. I am an associate professor at the Department of Cognitive Science in IIT Kanpur. This is the sixth week where we are going to talk about different aspects of regulating social behavior. And in this particular lecture, I am going to talk about the development of regulation in social behavior.

So, when an individual basically lies on the continuum of reflective processing really depends on the confluence of factors. So, you remember in the previous lecture we were talking about a combination of automatic evaluations and reflective evaluations. We were talking about the various factors like motivational factors, initial impressions and so on. We were talking about how each of those factors combine together to give us a more nuanced, a more complex evaluation of the situation.

Now, in that regard just continuing that discussion in this lecture as well where exactly an individual lies on the continuum of reflective processing. For example, if all the decisions are taken on just automatic impressions or all the decisions are taken in highly complicated highly elaborated ways it depends on a number of factors. For example, how much time is available if very little time is available then obviously, a lot of deliberation lot of reflection is not possible you cannot over analyze ,you cannot analyze in detail, you cannot intake a lot of information, you cannot reach a nuanced understanding of the phenomena or the person or the concept and hence in these situations the stereotypes might galore you know they might become the primary sources for how do you decide to act or how do you let your prejudice you know manifest regulated, dysregulated in that sense. Also the opportunity you know sometimes there is very little opportunity to be able to do that you have never interacted with these people, you have never really had any interaction. So, whatever your overall impressions and you know stereotypes tell you, you think that that is the easiest and the most economic way to behave.

Also motivation are you really looking to do that for example, remember we have been seeing so far in several chapters before or several lectures before that sometimes people or a lot of times actually people are you know there with egalitarian motives. Nobody wants to be specifically unnecessarily biased against somebody else, but even if people have these egalitarian motives a lot of times they let the you know prior associations get the better of them. So, time is important, opportunity is important, but the motivation to

do you know do these things nicely is also important and together these things decide how inclined you are to engage in reflective processing or how much you let the automatic impressions take the better of you. So, an important another important factor that may influence reflective processing is the functionality of the prefrontal cortex. Remember the brain sort of matures it has a particular timeline of maturation also there are obviously, individual differences in the overall activity overall engagement of the prefrontal cortex in different individuals.

So, in this case a very important factor is the functionality of the prefrontal cortex, which is defined in terms of either brain damage or in terms of overall neural development that continues from childhood until adolescence. It must be therefore, noted and we have been talking about this key by the prefrontal cortex is engaged in conscious if a elaborative deliberative processing and if the prefrontal cortex is not functioning optimally then maybe we will not be able to have the benefit of this kind of elaborative processing. So, and self regulation also comes from you know various aspects of the prefrontal cortex the ACC, the DLPFC and so on. So, self regulation therefore, in in these specific circumstances depends critically on the prefrontal cortex and the development in these regions or the development of these regions is thought to underlie the emergence of various cognitive processes. a moral reasoning, you know causal reasoning, detailed analysis of things, having a nuance or a mature approach towards things.

All of this actually depends upon how well the prefrontal cortex is functioning. Remember all sorts of social inhibition you know all sorts of regulation of behavior you remember the case of Phineas Gage we have talked about this I do not know whether in this course, but also in the course on brain and behavior we have talked about that in more detail that Phineas Gage was a railroad worker and you know during an accident. An iron rod enters his left cheek and comes out you know through the frontal part of the skull takes away the prefrontal cortex and after that the regulation of behavior becomes extremely poor in this person. He goes around hurling profanities and fighting with everybody abusing everybody becoming really you know unpleasant individual to be around with. So, the prefrontal cortex optimal functioning therefore, is you know cannot be overstated its importance cannot be over emphasized.

For instance, with the cognitive and neural development children and you can see this in children also. So, as they are developing cognitively and neurally the brain is maturing, children become more and more sophisticated in their ability to consciously reflect on thoughts, actions, peoples and people and situations. Initially, you will see they will not have a bright, they will not have a broader view, they will be deficient at perspective taking, they will have for example, just a black and white good and bad kind of view, but gradually as they are growing up you can reason with them, you can tell them more causes and outcomes and you can expect them to be able to develop a slightly more nuanced approach and world view about a bunch of things. Now, even though very very

young children are still capable of quickly evaluating whether a stimulus is broadly good or bad, their capacity for conscious reflection allows children to make increasingly complex you know evaluations as they are growing older. It does not come immediately, it is not happening from three years old.

They have a sense of good and bad yes, but they do not have a you know a more nuance sense of this. Remember we were talking about in the last lecture of the blacks and whites and the grays. to understand that there is gray, it takes a lot of time for the child to develop and you know reach that stage. Development of the prefrontal cortex, yes it underlies the child's transformation from stimulus bound infant infants to goal oriented individuals capable of regulation and reflection. So, initially what will happen is you take a you know edible thing maybe an ice cream or a toffee or a lollipop to a child and the child will not be able to regulate it will say oh I want this even though they have just have had their food ok.

So, their initial interactions are basically stimulus bound you show them something they get excited and they want that all right. later they start inculcating things like oh I have had my food I do not think I should have something at this point or maybe you know it is not good for me my mother has told me that I should not be eating this goal oriented individuals motivated individuals that happens a bit later and again remember that is contingent to how the stage of development the prefrontal cortex is in. just take an example. For example, one very initial very important marker of prefrontal cortex maturation is this shift in the ratio of gray to white matter. Gray matter volume reaches adult levels earlier in the orbitofrontal cortex than in the more lateral areas of the prefrontal cortex.

And which achieve maturity only towards the end of the adolescence. So, for example, 16, 17 years of age and only at around this age you will see more nuanced reasoning, more you know mature reasoning that you will sort of associate with older children as opposed to younger children. So, the protracted developmental course of lateral you know the developmental course of the lateral areas of the peripheral cortex have therefore, been documented using different kinds of measures one of them is the measure of cortical thickness. Now importantly the regions of the brain that are involved in relatively automatic effective responses to stimuli they develop somewhat earlier than regions associated with more controlled processing. So, this is also very interesting regions that are involved in automatic responses, automatic evaluations, non non deliberative processing they mature much earlier.

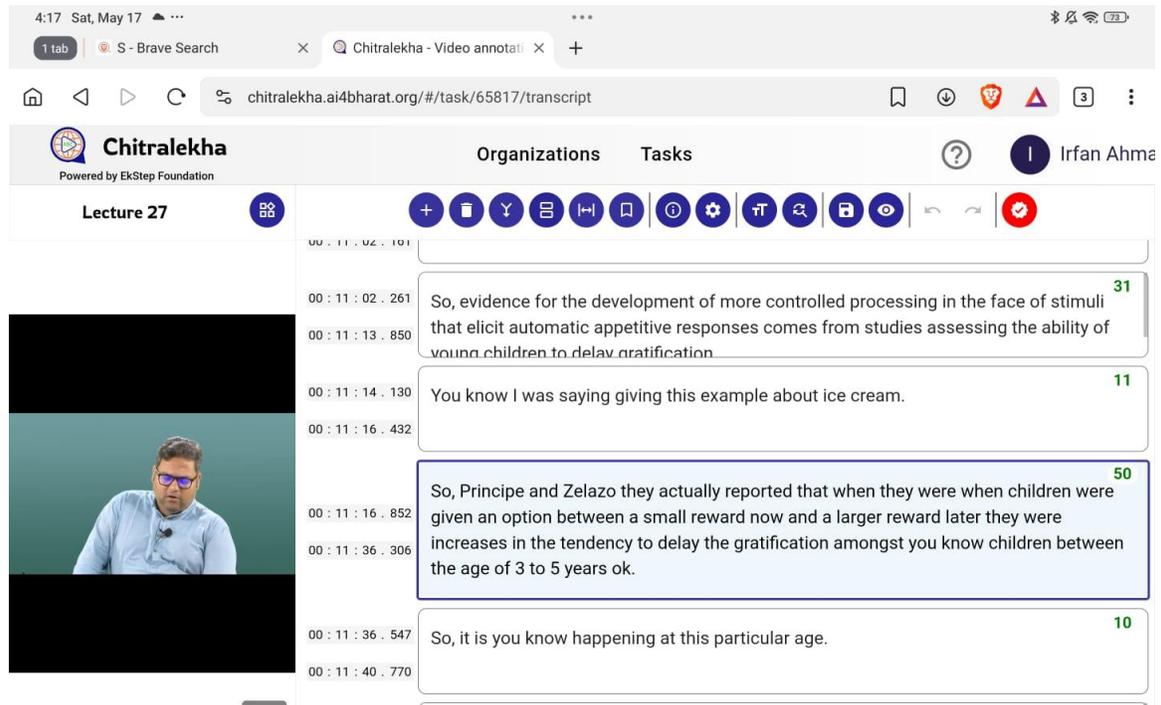
The screenshot shows a web browser window with the URL `chitrallekha.ai4bharat.org/#/task/65817/transcript`. The page header includes the Chitrallekha logo, "Powered by EkStep Foundation", and navigation options for "Organizations" and "Tasks". The user is identified as "Irfan Ahma". The main content area is titled "Lecture 27" and features a video player on the left and a transcript on the right. The transcript includes the following text segments:

- 00 : 07 : 51 . 526 - 00 : 07 : 58 . 953: Gray matter volume reaches adult levels earlier in the orbitofrontal cortex than in the more lateral areas of the prefrontal cortex. (Score: 21)
- 00 : 08 : 00 . 894 - 00 : 08 : 04 . 536: and which achieve maturity only towards the end of the adolescence. (Score: 11)
- 00 : 08 : 04 . 556 - 00 : 08 : 20 . 345: So, for example, 16, 17 years of age and only at around this age you will see more nuanced reasoning, more you know mature reasoning that you will sort of associate with older children as opposed to younger children. (Score: 39)
- 00 : 08 : 21 . 125 - 00 : 08 : 35 . 248: So, the protracted developmental course of lateral you know the developmental course of the lateral areas of the peripheral cortex have therefore, been documented using different kinds of measures one of them is the measure of cortical thickness. (Score: 38)

So, you will see that you know we describe children sometimes as being very impulsive. Why are they impulsive? Because the capacity to reason or the capacity to reflect in more complicated manner happens or develops anyways much later. You cannot obviously say that everything is contingent to brain maturation because there are also very old people who behave rather foolishly or impulsively, but then that is another discussion. With children the regions again reiterating this point the regions of the brain that are involved in the relatively automatic effective responses to stimuli they develop and they mature much earlier. So, they are active and influencing children's behavior at a very early age. When or with the development of the prefrontal cortex children become able to override the relatively automatic affective responses mediated by the amygdala and the OFC.

For example, again a 3 year old, 4 year old child you know cannot do that, but a slightly older child 8 years old or 10 years old if you tell them that you know this is in this weather eating an ice cream is not good for you. That child bit older although may find it very difficult will still be able to suppress that urge to have an ice cream just because an ice cream is there or somebody in their friend circle is eating an ice cream. Younger children because these areas the prefrontal cortex is not fully developed they will find it extremely hard and may not be able to do that as soon as the ice cream is there they will just you know want to have it and eat it. So, rather than simply responding to the salient aspects of a stimulus, conscious reflection allows children to integrate both positive and negative information and generate a slightly more considered evaluation of a stimulus.

Remember this will happen much later in age 13, 14, 15, 16 years when the prefrontal cortex is closer to its maturational state.



The screenshot shows a web browser window with the URL chitrallekha.ai4bharat.org/#/task/65817/transcript. The page is titled "Lecture 27" and is powered by EkStep Foundation. The interface includes a video player on the left and a transcript on the right. The transcript contains several annotations with time codes and scores:

- 00 : 11 : 02 : 261 - 00 : 11 : 13 : 850: So, evidence for the development of more controlled processing in the face of stimuli that elicit automatic appetitive responses comes from studies assessing the ability of young children to delay gratification. (Score: 31)
- 00 : 11 : 14 : 130 - 00 : 11 : 16 : 432: You know I was saying giving this example about ice cream. (Score: 11)
- 00 : 11 : 16 : 852 - 00 : 11 : 36 : 306: So, Principe and Zelazo they actually reported that when they were when children were given an option between a small reward now and a larger reward later they were increases in the tendency to delay the gratification amongst you know children between the age of 3 to 5 years ok. (Score: 50)
- 00 : 11 : 36 : 547 - 00 : 11 : 40 : 770: So, it is you know happening at this particular age. (Score: 10)

Is are there any evidence about these things what I am saying. So, evidence for the development of more controlled processing in the face of stimuli that elicit automatic appetitive responses comes from studies assessing the ability of young children to delay gratification. You know I was saying giving this example about ice cream. So, Principe and Zelazo they actually reported that when they were when children were given an option between a small reward now and a larger reward later they were increases in the tendency to delay the gratification amongst you know children between the age of 3 to 5 years ok. So, it is you know happening at this particular age.

This development of the ability to control effective reactions to stimuli has also been studied using a modified version of the Iowa gambling task what is this task about a version of this task was used that only which had only two decks of cards one was advantageous. So, if you keep pulling out cards from here eventually you will have net gains and the another task another deck of cards where you when keep pulling cards out of that you have net losses. And, they presented the information about rewards and losses in form of happy or sad faces. So, happy faces will say there is more reward here, sad faces will say there is more loss here. Now, over the course of the task, 4 and 5 year olds developed a preference for the advantageous decks.

They could realize, they could reason that, but the 3 year olds could not do it. So, it tells you that there is a progression of maturation from 3 years, 4 years and 5 years. Now, if

you consider this data it seems that the ability to make advantageous decisions based on a sophisticated evaluation improves during pre school years and continues to develop over the course of childhood. So, remember in the previous task we said there was some evidence of delayed gratification in 3 to 5 year old children, but not earlier than that. and if you compare let us say 3 to 5, 6 to 8, 9 to 12, 13 to 15, if you compare you will see a progression of the development of the prefrontal cortex and you will see that gradually the reasoning will become more matured, the delayed gratification will be easier to do and all of these things which are contingent upon the development of the prefrontal cortex.

So, if you look at this evidence together it is such as that with the development children are indeed able to make increasingly reflective evaluations and they are able to integrate information about the current situation with more accurate predictions of long term consequences. They start understanding causality more, they start understanding that you know in in this particular scenario if I listen to my mother I will have a reward later. They will start understanding for example, that oh this is at this time where my basic urge is to just go out and play and so on, but because I have my exams even the next day, if I just wait till I have completed studying the important syllabus, I will get the chance to play as well and I will score good marks in the exam as well. So, that comes with time with the development of the neural structures. and these are rather sophisticated decisions that the children have to make they and they gradually learn to make it.

So, these these kinds of more sophisticated evaluations probably result in part from the you know more complex reflective processes which are instantiated in the higher order prefrontal cortical regions. Remember the iterative pre-processing model. So, with each iteration of this evaluative system more and more complex processes have the ability to shape their evaluative responses to match goals and situational constraints. So, what are your goals? Remember we talked about in last class that the motivational goals of an individual are also very very pertinent in the kind of evaluations they are making. The constraints that are placed on them are also important in the time in the view of the evaluation that they are making.

So, as new information becomes available, it can be used to in create a more complex representation of a stimulus to the extent that it is incorporated into one's evaluation. So, as in when more and more information becomes you know available and as in when the individuals become capable of including this, analyzing this and including this in their evaluative structure. they basically get this ability to do that, they basically get this ability to make their evaluations more nuanced, more complex in line with how you know elaborative or reflective processing would dictate. So, with neural maturation with the maturation of the brain which includes increases in processing speed as well, children should be able to iterate you know run these cycles more quickly, add more information in every cycle, add more analysis in every cycle. They will be able to do that rapidly and

more efficiently which will allow for them to make more complex evaluations as they grow up.

It does not happen at 1 year, 2 year, 3 year, 4 year, 5 year of age it happens keeps getting better with age is what we should say. So, the developmental course of evaluative processing including its neural and cognitive underpinnings it is it therefore, seems a very important area of future research. Now, let us move on to a different side a little bit. We have seen so far that evaluation basically you know an attitudes possess a relatively children possess a relatively sophisticated evaluative system, which is capable of split second pre conscious judgments as well as drawn out complex deliberative decisions. You know as we grow up we keep having this we have a split second sort of evaluation, but we have and we have pre conscious judgments, but we also have drawn out complex very well analyzed deliberative decisions.

So, it seems that neuro imaging research is beginning you know to unpack the neural correlates of the different components of evaluation and enhancing our own understanding of the evaluative system. So, it is gradually the neural research the fMRI studies and the PET studies the ERP studies are actually gradually trying to understand how what are the different components and how do these different components mature over time and what role do these different components play going further in allowing us this you know dual ability to have a split second rapid evaluations as well as more drawn out deliberative evaluations. So far, we have seen for example, that you know the current model that we have been discussing working model of attitudes, wherein current evaluations of stimuli are continually updated and integrated with additional attitudinal situational and motivational information seems to work fine. So, we have a sense by the last two three lectures we have a sense of this fact that yes there will be some initial evaluation and then these initial evaluations can be made richer and more complex and more nuance by this iterative addition of newer information. The data that we have reviewed so far it suggests that this evaluative cycle supported by effective regions which are for example, the amygdala and the insula is actually sustained and it is modulated by activity in the prefrontal areas allowing for more reflective context and goal appropriate evaluations.

So, this is what we have seen the bunch of studies that we saw they basically support this whole idea. but there are also very interesting implications of this, there are also a very interesting takeaways from this. For example, a very important implication of the reviewed model is that a person's evaluative state is dynamic, it is not fixed and it is not rigid in any which way, it changes from time to time as and when more and more information is coming in the nature of the evaluation is changing, the evaluative state is changing. So, social psychology literature in this case has recently grappled with the apparent dissociations between implicit and explicit measures. Remember we have been

talking about dual modes automatic and elaborative, there is also implicit and explicit which is a similar kind of a dichotomy.

For example, people may report pro-black or egalitarian attitudes on self-report measures, but they can actually be shown to have a pro-white anti-black you know attitude when response latency is measured. So, in an experimental task versus in a self report task you can see that you know explicitly when they are asked they will say something else implicitly when you are measuring the response will be something else. Remember we have seen that implicit measures may amygdala activity keeps showing up when the white participants are watching black faces irrespective of the fact that they profess or not profess egalitarian you know equalitarian attitudes. So, in this in this regard some questions can be asked for example, do people really have different attitude representations that are activated through different processing routes and is one real attitude and the other is just a pretension, it is just a professed attitude or an artifact. the proposed model that we have been talking about.

So, first suggest that these differences may actually reflect evaluations that are at different points in time different you know stages of evaluative processing. Initially they have a particular kind of attitude positive negative based on automatic processing, but later after 3, 4, 5, 10, 20 iterations have happened the evaluation has itself changed. So, it is not that the person is pretending something on this side, but pretending, but performing differently on the other side. It is basically that when new information comes in they sort of you know are able to integrate that new information and they are able to update their current evaluative understanding. So, given this understanding there seems therefore, to be no real value in inquiring about or worrying about what is your real attitude or what is your true attitude.

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Lecture 27

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An important implication of the reviewed model is that a person's evaluative state varies from moment to moment.

The social psychology literature has recently grappled with apparent dissociations between so-called "implicit" and "explicit" measures (Unsworth et al., 2001).

* For e.g. people may report pro-black attitudes on self-report measures but be shown to have a pro-white bias on a response latency measure of attitudes (Unsworth et al., 2004).

Some questions have been raised earlier, for instance: "Do people have different attitude representations that are activated through different processing routes?" Is one the real attitude and the other an artifact?"

The proposed model suggests that these differences may reflect evaluations captured at different points in time or at alternate stages of evaluative processing.

There is no real or true attitude as such it is just the matter of time, it is just basically how much information was available at that point when the evaluation was made and after you know 5 years, 10 years, so many years when more information was added may be 5 minutes, 10 minutes and so on. More information was added the attitudes and evaluations are bound to change. and it is not hypocrisy for example, a lot of us say oh this is hypocritical it is not hypocritical. When you learn more information you are bound to and you know allowed to update your evaluation about things. Now, to the extent that these evaluations actually shift over time for example, as attitudinal motivational and contextual information is reprocessed and reintegrated the same individual can be said to possess multiple real evaluations of the same stimulus again.

One is not real, one is not pretended. It is just that each of at each of these stages, the new evaluations are all real. They are in sync with that point in time, the knowledge that you have till that point. It is all real. Also if one accepts the idea that individuals may not have one true evaluation a very interesting issue for future research could be to basically understand how evaluations arising at different points you know how do these different kinds of evaluation arise during different points at this iterative continuum and how do they relate to different sorts of behavior. So, is it that for example, one day I am very harsh towards these other people, by next day I have so much more information that my attitude completely flips 180 degree.

Does that really happen? So, in this regard people basically you know have investigated they have tried to study this. The studies that we have I mean so far we have discussed

you know informers that brain imaging does not really have a very clear idea about the content of a persons evaluation. We know that the evaluation is iterative, but we do not know at what point evaluation was you know what is the content, what is the evaluation like it is positive negative is all right, but what are the things that the individual are considering at least the brain imaging data does not tell us that may be other kinds of experimental paradigms may be able to tell us that. So, rather patterns of neural activity are only interpretable when they are used in concert with more traditional behavioral measures and when context and motivational states are also included and or taken into account. An example, heightened activity in the amygdala and insula is observed in response to both positive and negative stimuli depending upon motivational states as well as evaluative focus.

You are evaluating to promote, you are evaluating to prevent, you are you know wanting to positively interact, you are wanting to negatively put down somebody. All of these things modulate the kind of activity that will be observed in the amygdala and the insula. Similarly, prefrontal activity has been observed in response to social targets towards whom the participants were either motivated to suppress their initial negative reactions or towards targets that the participants were comfortable in expressing negative reactions. See some people who become more powerful in the society, you do not want to say bad things about them. Some people for that matter you are you know who cannot really harm you, they cannot really do anything about you.

You are comfortable in expressing negative reactions with them. So, prefrontal activity also changes with respect to how you are interacting with these guys. So, our knowledge about neural activity at this point it does not really allow us a lot of details into how someone actually evaluates a particular stimulus. It can tell us a little bit, it can tell us the mechanisms I mean the model that we have been talking about the iterative reprocessing model Cunningham and Zaleso 2004. It tells us how the mechanism works, it does not tell us in much more detail about how does the content really change.

So, sort of closing this the discuss model also highlights a philosophical point a very interesting point at that about the nature of automatic versus reflective evaluations. For example, according to this you know one can view the automatic evaluations that are as arising from phylogenically older limbic areas you know basic the older brain the basic brain where you know primal sort of animal like less moral things are coming from and from that perspective the increased prefrontal activity basically acts as a civilizer. Remember Sigmund Freud you know in whatever discussion we are having in social or cognitive psychology somehow Freud keeps popping up and there is very interesting idea here that So, the initial evaluations, the initial impressions positive negative and so on, the initial want of someone or the initial discussed towards someone are all primal urges are all animal like primal urges and they are coming from the older limbic areas ok. As and when the prefrontal cortex even evolutionarily it would have developed and it would

have started sort of functioning in particular ways, it seems to have added a more civilizing influence.

It seems to have. added this sense of tempering and that this should be done, this should not be done. See, as the society evolved, as individuals evolved, as they started living together, as this notion of uniform, as this notion of civil code, civil laws, coexistence, peace and you know lawfulness came, they exert a civilizing influence. and this is also happening in a in a species level brain if you want to look at that or in individuals brain as we just saw as the child is developing the more in as the prefrontal cortex is coming into its own it adds this civilizing tempering you know influence on people's decision making. Similarly, at a societal or a species level the prefrontal cortex as and when its activity decreased increased sorry and its capacity increased, it exerted a civilizing cognitive influence on more primitive emotional responses holding in check aggressive and other primal urges you know so that they do not at all times disrupt or you know put you in a hard position is with respect to social behavior. Also, the iterative reprocessing model suggests that making a firm distinction between emotional and cognitive evaluations may not be the right thing.

It may not be even possible for that matter rather what should we should be focused on is you know these are processes look at these processes as driven by sub cortical or prefrontal regions a and b that these are rather interactive with each other. So, they are not isolated regions that are pulling you in different directions. So, from that regard although prefrontal activity may be able to modulate early automatic responses, sub cortical regions are very very important and they remain involved in the reprocessing in the reconstruction of evaluative states. are not separate things the brain does not work as much in modules as say for example, Fodor had you know would have thought it works in concert the different areas of the brain you know even for the same cognitive function that areas of the network are working in concert with each other. Also, as has been observed the manner in which automatic evaluations are modulated depends upon a bunch of things for example, the goal of the receiver as well as the social context.

You know you may be completely angry on somebody, but you may express that anger in your closed group, but not in public ok. So, people do all of these sorts of things. At times, the same may result in dampening of situationally inappropriate responses or negativity. At other times, it is however possible that the negative responses may be left unchecked. If you are in a see people you might I will take this example of social media.

When social media affords you anonymity, people behave like animals. They go on and troll somebody, they say all sorts of things, they become completely unchecked sometimes under the garb of anonymity. So, they do not because nobody will know you know my identity is not that I can do or say anything that I like, but if you ask these same people to come and hurl the same kind of abuses in public in front of the same persons

they are abusing then the behavior actually changes ok. So, in some situations this negativity will obviously, be suppressed and managed in other situations when you are with a close group when you are feeling powerful when you are feeling influential maybe you will leave these unchecked and sort of let them have a full go. So, in all it has been suggested that reflective processing may actually be used in some circumstances to even justify negative evaluations by embedding them in complex cognitive structures.

Basically saying sometimes you have justifications of negative outcome, sometimes you use those as rationals to behave badly, sometimes you will not have them. So, relatively automatic processes therefore, should not be viewed as necessarily resulting in less moral appropriate or inappropriate or adaptive responses than relatively control processes. It is not by default that all automatic outcome of all automatic processes is negative that is not really the case. It may depend on different attitude objects for that matter. To summing sum this up the complexity of the evaluative system if you look at this as we have been discussing in the last few lectures, it is likely that the proposed model will require some more revisions or more detailed specifications ok.

With more recent neuroimaging research that is coming in conjunction with more social psychological methods, the kind of experiments people are doing to give rise to a even better understanding of how attitudes and evaluations function, how do they arise, how are they moderated and so on. So, I will stop here. I will start with the next lecture in a bit with a slightly different topic in mind. Thank you.