

Emotion, Consciousness and Decision Making

Speaker:

Antonio Damasio

Chairman

I would like now to formally introduce Antonio Damasio whose coming to the end of a rather gruelling schedule of lectures and radio interviews in Britain and I'm delighted that he still has time to give one final lecture.

The title tonight is Emotion, Consciousness and Decision Making.

Antonio Damasio

Thank you very much, Jeremy, thank you, Ray. It's a pleasure to be here at the LSE and to talk to you tonight. The topic of the lecture is in essence the neurobiology of emotion with some comments made about the relevance of emotion to decision-making and to consciousness.

I would like to start by saying that, of course, all of these topics, emotion, decision-making, consciousness are very old in terms of their studies in neuroscience, cognitive science and philosophy, but there's something new that is happening now – by now I mean recently – that allows us to take a new look at these topics and that is really the developments in neuroscience in terms of the different technologies, the different findings that those new technologies allow us to gather and, of course, the remarkable changes in theory and hypothesis that result from all the new findings that we have been able to gather, especially over the past decade. So I would like to start by telling you some of the reasons why we can get to the new findings that we will discuss today and make a very brief allusion to some of those techniques. I presume many of you in the audience are familiar with these techniques, but if I can just have the first slide, I will just give you an example of some of those developments. First, it's quite obvious that any problem of neuroscience, any problem of neurobiology included, of course, all the problems that have to do with a relation between mind and brain can be tackled at many levels, and those levels really span all of the levels of structure and organisation of biological organism, all the way from molecules and cells to microcircuits and large circuits and very importantly also to the levels of organisation that I like to call social and cultural because you can not really make sense of what is going on in that biology a good part of the time if you don't bring in the effects that come from society and from a culture. But one point that is very important to make at the outset is that anything we can talk about in the realm of mind and brain, be it emotion or vision or motor system or consciousness cannot be properly understood if an appeal is not made to all of those different levels. In other words we're not likely to produce comprehensive and reasonable explanations of the neurobiology of, say, consciousness or memory if we do not intervene at different levels and if we don't bring to bear on the problem all the knowledge that is being gathered at all those levels. Now, needless to say, none of us as researchers, or even as entire research groups, ever control all of those levels in terms of hypothesis and experiments and appropriate their togethering which means that what we're facing is a co-operative job that will require the work of many, many different investigators from many different perspectives.

The perspective that I choose to speak about tonight is one that pertains most closely to my own work, although there are many individuals in my laboratory and my department that work on other levels and that has to do with a large-scale system level. In other words, the level of organisation of the kind of brain that we can actually see with the naked eye and that has underneath very interesting sub components that form systems that are related to all of these

marvellous mental phenomena that we take for granted, be they memory or emotion or consciousness.

The first image that you have on the screen is just to illustrate how we have techniques available now that we did not have even ten years ago. You are looking at an image of the human brain, it's a perfectly normally human brain, and you are seeing it reconstructed in three dimensions at a computer screen in our lab. It happens to be the brain of a living person as anyone in this room, not a post-mortem. But, in fact, it has all the characteristics that we use to encounter only in post-mortem studies. So it is now possible using techniques such as magnetic resonance scanning to reconstruct the living human brain with an enormous amount of detail and, in fact, look at the structure, at the computer screen, slice it in different directions, look for instance at the middle view of the brain where you can see here a <NOT KNOWN> and then the brain stem, and slice this structure in every direction you wish in order to get the understanding of what is in that structure and to get at something extremely important in terms of method which is the precise localisation and definition of the anatomical extent of a lesion, an area of brain damage and then, with that, have the possibility of relating that area of brain damage to particular function and test, for instance, if the hypothesis that you have formulated regarding a particular function really matches with the results that that particular lesion in that particular point allow you test.

Now, one other thing that you can do in terms of modern techniques is to actually look at the brain in action. This is a whole new development in imaging techniques that is relevant, I am going to talk about some results on emotion that really use that set of techniques and I am going to give you at the beginning an example of yet another. The two most common techniques now are functional magnetic resonance and the other positron emission topography and rather than looking at the structure of the brain and looking at, for instance, how one area of damage interferes with the natural cognitive process that you can study in a living individual. Here we take a different approach, we look at a normal individual generally without any damage to the brain and we find out how different tasks, for instance, the act of retrieving a word from memory, or the act of being in a particular emotion will alter different functions in different areas of the brain. I am going to show one example of this, which actually has nothing to do with emotion but it is one that could be illustrative for you and I'm going to show you in the following way. When I ask to have a tape, but not now yet please. You will see on the screen a slice of the human in somebody who is very much alive and in somebody that is being subject to the following: the stimulation of the visual field in all of its quadrants. Now, those of you who know about how the visual fields are organised know that the kind of stimuli that appear in our upper visual fields are going to be transmitted via neuro-signalling to the lower part of the visual cortex and visa-versa, with the lower part of the visual fields into the upper part of the visual cortex. You probably also know that everything that will come to you in terms of signalling from the right side of the visual field will go to the left brain and everything that will come from the left will go to the right. So, you have an interesting crossed organisation up/down and right/left that entirely criss-crosses the impressions of the retina into the visual cortex. What happens is that because of the way the <giri> are distributed one can predict and in fact this has already been shown in animals that stimuli in those different points will lead to the activation of different <giri> different circumvolutions in the <NOT KNOWN>. So, what I am going to show you is a very short video in which you will see, on the one hand, one single slice of the brain that is cut more or less like this. It will, in that slicing, pick up different <giri> of the visual cortex. Those different <giri> correspond to different points in the visual field. Some will be on the left, some will be on the right, some will be corresponding to the up, some to the down of the visual field. Then you will also see on the side a little clock that will mark the way in which the stimuli are impinging on the retina and the clock will be running clockwise, indicating that there is actually a checkerboard pattern that is going to go like this and describe a complete circle in about 30

seconds. Then what you ought to see is that as the different points of the visual field are stimulated, different points of the visual cortex are going to become active and this activity is being picked up by one of these new techniques, the one known as functional magnetic resonance.

So, we could now have the slides off and the tape on, we might be able to show you this if the technology is not temperamental. So far the technology is calm, not temperamental, and there it is you see the clock? Here you see in different <giri> activity and activity there and the activity here corresponds to stimuli that are coming from there. The activity here corresponds to stimuli that are coming from there and the different ways in which you have activity or not depends on whether <giri> above or below that line of slicing are being picked up. So, I bring this as a very simple illustration of something that probably ten years ago it would have sounded like science fiction. That is the possibility of having right now one subject involved in something as simple as this stimulation of the retina and then being able to look in the visual of that same subject at the way in which different <giri>, different bits of cerebral cortex are being activated as a result of the stimulation and of course this is shown more as a demonstration than as any kind of new finding, we know that this is precisely the way it should run and what we are is making the point that it is now possible to get this finding in a way that conforms entirely to our knowledge of how the visual system operates physiologically from the retina on to the cortex in the central nervous system.

Now, we move on to the subject that I wanted to tell you about (and that we don't need), and that is the subject of emotion and I would like to start with this slide which evokes the name of four major thinkers of the past, not because I am going to endorse specifically the ideas of anyone of them in relation to emotion but only to make this very simple point. If you were to turn up 100 years ago and look at the field of emotion studies in what was then psychology/neuroscience you would have encountered major thinkers very much concerned with the problem of emotion and very much devoted to proposing solutions to that problem, all the way from identifying the possible role of emotions in psychopathology to identifying how, for instance, the body would be involved in the process of emotion, which is the case of William James, to studying with great interest the expressions of emotions in animals and man in the case of Darwin, to even proposing a very first kind of locus for the processing of emotion in the human brain in the case of the neurologist of the foursome, which is <NAME>. You would have expected the problem of emotion to have been attacked in a very forthright way throughout the 20th century. Well, as it happens it didn't happen and in fact throughout the 20th century, whatever neuroscience became it certainly did not become a science of emotions and the topic of emotion was, in fact, systematically neglected. I could go into the reasons why I think that neglect took place but that would be a very long story and I just want to make the point that we need to wait something like a century for emotions to return to some kind of centre stage in what is now neuroscience. Let me make the other note, which is that it doesn't mean that there were not major contributions made by psychologists and pharmacologists and psychiatrists and neurologists to the field of emotion, of course, there were and very important ones, but the rarity of those exceptions simply confirmed the point that unlike, for instance, vision or language or the motor system, emotion did not become a hot topic that was to be solved rapidly. On the contrary, right now that seems to be the case and it's a topic of great interest for many researchers. The other point is that along with this relative neglect of emotion there was a neglect of some interesting, for me, perspectives on the study of biology in general and on the study of brain and mind in particular and what I regard as fundamentally missing is, 1) an evolutionary perspective and, of course, we're all aware and you here in particular because you have had a very interesting series of lectures on this topic, you are very aware that this has changed, but it has changed only recently and, in fact, it's quite intriguing to go to textbooks of neurology or neuroscience or psychiatry or to a number a major

scientific articles with contributions to different aspects of neuroscience and to find how rare the mention of evolution is ever made. It's as if, in fact, Darwin never existed and we were simply dealing with a kind of machinery that was put in place on one given day without a historical past and that is something that I think accompanies this neglect of emotion and this neglect of something that is tied to emotion which is the notion of a body attached to a brain. The other point that is missing is the organismic view. How rare it is for say an attack on the problem of memory or language to take the point of view of an organism and how frequent it is that in fact only the specifically function is considered, or the specific parts of the brain that are presumably related to it are considered. So the organismic view which goes together with the evolutionary view has also been missing much and I don't think it has been recovered as much as the evolutionary perspective.

Now, the notion of <NOT KNOWN> again is quite tied and it is also quite remarkably missing and one point that I would like to make is that whatever your dealing with, whether it is emotion or memory or language, there is a way in which directly or indirectly you're going to have to consider the fact that that function and those operations of that brain are related to the basic regulation of an organism that is <genomically> intent on survival and that requires a very elaborate set of devices in order to maintain that survival and, of course, one of the fundamental aspects that we have long understood about this is that in fact there are devices in the brain that regulate, that survive in very intricate ways and in very non-conscious way, by the way.

Now, let me turn after this preface to a notion of emotion and I think I need to give it because my notion of emotion and the distinction I make between emotion and feeling may not be clear to all and I want to make it very clear. I would like to start by reading some of those slogans on the screen, I don't know how well you can see them, but I'll read them for you.

1. "Emotions are collections of chemical and neural responses that form a pattern". This is absolutely key, because some might conceive of emotions as some kind of reflex, some kind of simple response that is triggered by a particular stimulus and a very important point to make here is that this is not the case. When we talk about emotions, we're dealing with something very complex that engages not only a neural system but a chemical system and in fact it engages a chemical system before it does the neural system at least from the point of view of the history of organisms because these responses probably existed at chemical level in very simple organisms, even before there was a proper central nervous system that would produce a response towards a part of the body via a neural signal. But the idea that they are patterns and the idea that you have a very elaborate multiplex form of response is, I think, key to the definition of an emotion.

2. "Emotions play a regulatory role and lead to the creation of circumstances that are advantageous to the organism that exhibits them". I think this is very important to make because in some quarters of science and philosophy, emotions have become somewhat of a luxury, something you can have or not have and it doesn't really make that much difference, when in fact emotions are, from all the evidence we have, regulatory responses that lead to some kind of advantageous condition for the organism that engages that response.

The third point is that emotions are about the life of that organism and assist the organism in maintaining life because those emotions, unless we take the case in which they are running unchecked and they are in fact pathological, are quite adaptive.

One other point is that emotional responses are responsible for profound changes in body landscape and brain landscape. Let me say a few words about the poetic license with which I talk about landscape, the word is chosen very carefully and the point I want to make is that when you

generate an emotion, or when an emotion is generated in you. The landscape of the brain, the way the brain looks, the way the body looks change quite remarkably over the ensuing hundreds of milliseconds and in fact seconds and in some case minutes. So, there is a state of profound change and the change happens in both of those structures. This is important because if you go back to William James, who is one of my heroes, he had a very remarkable insight into the problems, but it didn't actually specify that the brain landscape changes and probably he couldn't because it didn't have the knowledge of anatomy or physiology that we have today. He did specify that the landscape of the body would change, with which we, I think, can perfectly well agree. So, the two things change and one's a stimulus of whatever kind, think of a stimulus that might make you happy or fearful, once that is engaged and very often it can be engaged even in a non-conscious manner, you trigger a volley of responses that are going to alter the state in which that organism was prior to the onset of the stimulus interacting with the organism.

One other point there is that the collection of these changes constitutes the substrates for the feeling of emotion and this an absolute key for me, because I don't want to fall in the trap of using the term emotion or feeling interchangeably and I don't want to use the term emotion if what I'm really referring to is the very internal representation I have of the changes of my body landscape, for instance. I want to reserve the term feeling for something that is private, internal in the first person and something that I believe physiologically follows in time the set of changes that occur in the brain and in the body for which I reserve the term emotion. In the proper sense of movement outward, in the proper sense of something that can actually in good part made public. So you can talk about the two in connection, emotion first, feeling after, but this distinction that emotion has an element that can be made public and that can be made accessible to a third person who sees, for instance, changes in posture or in facial expression or in a variety of other emotional behaviours is very key. There are many ways in which you can guess my feelings, but there's no way in which you can "see" my feelings. There are plenty of ways in which you can "see" my emotions if betray them in my face or body.

The final point is that emotions depend on evolutionary set brain devices. I think that we can all agree on this, although learning and culture can alter the expression of emotions and give emotions new meanings and I think this is equally important. There's no question that we come to life with devices that will allow us to perform an emotion, to execute an emotion, and there's no question that that is so general across human beings and even across non-human beings that it allows a very strong language that crosses cultures, otherwise it would not be so easy to communicate across different cultures and different languages. But it is also the fact that though it is certainly the fact that you don't learn your emotions, but there's also the fact there are changes in the expression that are learnt and certainly the meanings you oppose to those emotions can be very different, depending on the situation.

So, to summarise this point I look at emotion not as something independent from biological regulation but rather as something that is part of a continuum, that is organised here vertically, but it doesn't make any difference. One level is the level of basic life regulation where you can find things such as the, for instance, metabolic regulation, the way you run your metabolism totally non-consciously and the way every now and then you have that drives that motivation that leads to hunger and thirst, or the way you have the kinds of signals that allow you to have pain and pleasure, the things you call pain and pleasure, or simple reflexes. Emotions set in at the middle level, which is more complex, in which the responses are in a pattern and which the responses are connected with specific kinds of stimuli, not specific stimuli but specific kinds of stimuli out in the world and those responses engender a pattern of behaviour that either prepares you to deal with the problem posed by that kind of object or actually sets you on a course of resolving the problem. This distinction that I made with feelings which I think is important,

because whereas emotions get you the beginnings of a behaviour that can be very conducive to something adaptive, say for instance, the behaviour of fear that can allow you to freeze or run away and all the preparations that go into that, for instance, our brain makes a very beautiful distinction between a freeze condition in which there are remarkable changes in the heart rate and even in the way our chest wall moves, so that the freezing can be as discreet as possible and not seen by another and you have other kinds of fear response in which what you have is an organism setting off on a run away from the cause of the fear. When that happens, actually, it so happens that in an animal the hind legs receive a lot of extra blood flow just in advance of the running behaviour so that running behaviour can take place. We know now, for instance, that different columns in one particular part of the brain stem control one kind of freezing or the other kind of freezing and the choice is made in a non-conscious manner so that these two behaviours can be engaged. Now all of this is, of course, adaptive and nice and happens outwardly and demonstrably and visibly to others, but there's something else which is the feeling level that is quite critical also because it allows the mind to take notice of that entire behaviour that emotion has just engendered. So, over and above the possibility of having a behaviour that in of itself leads to a good solution or at least to some possible solution to the problem posed by the bad stimulus you also have this other fact that the mind can be made to notice that this situation took place and let me just say in advance of my final comments at the end of the lecture that this does not mean that there is consciousness at that point, at least not the way I see it, this simply means that something else, some representation of the state has taken place and that if you indeed after feeling, you have the possibility of knowing that you have a feeling, something that does require a consciousness, then you are in an even better position because you have the possibility of influencing all the thought process by that knowing of that particular feeling as opposed to just taking notice of that particular feeling.

Now, let me turn to giving you an example of some results and I chose a few from different aspects of our studies of the emotions so that I can illustrate a little bit the range and I hope that you may find some of these results interesting. The first thing I want to point is that they are different to make a very important point is that there different aspects of emotion and they have to be studied in different paradigms. For instance, it is different to recognise the expression of emotion in the face of another, or to have an emotion and feel that emotion, these are very different processes and curiously until quite recently they were actually treated in terms of experimental paradigm the same way. Obviously they need to be separated and we are in the process, by we I mean not only us in our laboratory but many other colleagues for instance, <Raymond Dolan> here in London, in separating all of these different aspects and in trying to find about a specific <corollas> of these aspects.

So, I am going to start with a little story and it's about this patient, there are now nine such patients studied by us, and it's a patient that had a very normal brain when you look at the brain externally or when you look at any part of the brain except for this structure over here which is known as the < amigdella>, it's a set of nuclei that form the <amigdella> nucleus and you see there those two dark spots, those two dark eyes, you see them there too, and they are very abnormal in this patient, everything else is normal in terms of structure. If you look at the control you see how the <amigdella> ought to look, which is in that grey shade and you see it there in a different section. This one corresponds to a section this way, on top, this section this way is shown here. What happens when you have this particular kind of lesion which is caused by a neurological disease, I'm not going to go into the details of that, is that as calcium in this disease is deposited in the <amigdella> the <amigdella> stops functioning and the <amigdella> as some of you will know has been thought for many many years as a critical structure for the processing of emotion and in fact the idea was that it would be important pretty much across the board for all emotions, a sort of Grand Central Station of emotional processing. Well, it so happens that

when you have this kind of damage the patient has one particular major flaw in behaviour and that is the inability to recognise faces that represent fear, but there's no problem whatsoever in recognising happiness or surprise or anger or disgust or sadness. So, here we have somebody with this remarkable destruction of this particular brain structure and, in fact, the process that is impaired by it pertains to one emotion not to all emotions. Even with very extensive study of other patients we have found that anger can also be in part altered in terms of the recognition in faces, but all the other emotions are intact.

So, this tells you, without any further ado, that certainly the <amigdella> and the system that it is part of is not involved with all emotions equally, it is involved with some emotions more than with others and this, by the way goes very nicely with the fact that for reasons that were purely by chance as far as I know, it was demonstrated also in animals that the <amigdella> was very good in terms of participating in fear conditioning. So the relation between the <amigdella> and fear has been well established in animals and humans, but the human studies show you that there is something very specific about fear patterns that involve the <amigdella> and in all likelihood about fear patterns that are triggered visually, even more than auditory and probably just those two sensory systems. So, this gives us a different entry. One other thing that studies of the <amigdella> with lesions as demonstrated is that even when you lose the ability to recognise fear in another and even when you lose the ability to feel fear once it is triggered in you, somehow you know perfectly well what fear is in terms of the factual description at the level of a dictionary entry. So, for instance, the patient shown here who we have been studying for over ten years, if you ask her "what is fear?" she gives you a pretty good definition in terms of a dictionary and she can even give you examples, such as "it would be what I would feel if somebody were to put a gun to my head" and yet that person does not give any evidence of having fear in situations in which she ought to have it in real life and real time, nor does she give physiological responses that are compatible with fear.

So, that is food for thought because it tells you that there can be a remarkable disassociation between your notion of what an emotion is and the ideas that you have attached to a particular emotion and feeling that emotion in the flesh once it has been instantiated in that flesh. So, food for thought.

We'll jump over this quickly just to tell you that in nine subjects with <amigdella> damage the fear disturbance is the most critical and the pattern is very different from you get in normal controls or in brain damage controls, in other words, patients with lesions elsewhere in the brain but not that particular lesion in the <amigdella>. I will tell you just one brief story that maybe of interest to you, some of you may have read this it was published in Nature last year, but I think it's interesting if some of you may think "well, so what, you don't recognise fear in others, what kind of consequence could that have for one's own life?" Well, the consequences are actually very grave and although persons in this condition can be regarded as of normal intelligence, their IQs measure nicely, and they can talk to you very nicely and appear outwardly normal, it's so happens that their social behaviour is not quite what it should be. The thing that is most dramatic about the changes in their social behaviour, and again it is rather narrow in scope, is the fact that they can be very easily exploited by others and they let others take advantage of them for something that for lack of a better explanation I would say they trust others too much. We decided to look into this and my colleague <Ralph Adolf> decided to run an experiment and here's what we did.

We created a very large library of faces of people, men and women, that did not have a specific emotional expression. In other words they were not looking happy or crying or anything like that, they were just run of the mill faces, very large library and we asked a large group of normal

individuals to rate them in terms of trustability and approachability. So the question we were asking people to answer is this, "Look at this face and tell me how much do you trust this person? To what degree in a scale of 1-5 would you go to this person in case of need?" Perhaps unsurprisingly we came up with a beautiful distribution that ranged all the way from people that everybody would run to, to people that nobody would like to be near and you know, the traditional person that you would not buy the second car from. Then we chose the 50 faces with the highest positive ratings and the 50 faces with the lowest ratings and we decided to give them to the following groups: one, another group of I think 46 normal individuals, another group of patients with bilateral <amigdella> damage, damage left and right, another with damage only on the right or only on the left and then a group of controls that had remarkable amnesia. These were controls with damage to the <heapacampus>, they could not learn new information and they had an amnesiac syndrome and we asked them to produce ratings for all these faces. When it came to the 50 most positive faces the results are very obvious, they all judged the faces in the same direction, they were all positive faces, and you know there is some degrees variance with intensity but these three patients basically did very similarly to the amnesiacs, to the controls and so on. Now, look at what happens with the negative faces. With the negative faces everybody judges them negatively except the people with bilateral <amigdella> damage. So, if you have damage to the <amigdella> on the right or on the left you're still okay, but if both of you're <amigdella> systems are gone then all of a sudden you are looking at the world through Pollyanna eyes and you are finding that everybody's really wonderful. That is no doubt very well correlated with the fact that these people are so trusting of others and, of course, I don't have time to give you the explanations that we have produced for this but one possibility is this. As you accumulate experience in a life time you tend to categorise faces fairly or unfairly in terms of those that were associated with relatively positive experiences or, for instance, experiences that might be described as unpleasant or even frightening. So again, fairly or unfairly if a certain face falls by general design or by specific features into the range, into the category of those that were associated with an unpleasant experience there is some kind of signal that will be generated, that will tell you to watch out, that may not be good. It may be, but it may not be good and that is presumably an advantageous bit of learning because it allows your past experience to influence your current behaviour. Now, if you lose this you will have, you can still operate nicely on the positive system but you no longer operate well on the negative part and so you cannot make those discriminations regardless of how fair they are.

Let me make one other point that is important I think for the upcoming field of social cognition as we study more about the neural basis of social behaviours is that if you look at these individuals and you give them descriptions of people who are very honest and nice and people who are dishonest they make perfect discriminations and they say "I will not go to the dishonest person" and they are no different, these bilateral <amigdella> patients are no different from all the others. In other words, if in fact of showing them a face you show them a prepackaged verbal description of a bad person they say, "Of course I'm not going to go to that person" which tells you something about the tremendous power of the human face and the tremendous power of the face and it's expression and it's design in terms of social intercourse. These people are very smart about what's good and what's evil and their very smart about who's a good person and who is not and yet when it comes to the face they can no longer make that discrimination, which I find intriguing.

Let me make one other point. This one has to do with consequences for emotion in one particular area and that is decision-making and to make a very long story short and maybe some of you even know this story from articles of ours or from <Decartes' Era>, my previous book, and the story goes like this. If you have damage in the frontal lobe in both medial and ventral regions as you see depicted here, you are likely to remain after you incur that damage, say, in your

adulthood, you are likely to remain as intelligent as you were before in terms of your IQ measurement. You are going to have normal language, you are going to have normal memory, you can acquire information, you can retrieve information. All of that is going to be fine after these lesions set in. This is a group of lesions plotted onto to same brain space. But there are two things that happen to you that are not so good. One is that your ability to make decisions that are advantageous to yourself personally and that accord so social convention and that are advantageous to those that depend on you is forever lost, forever lost at a good level. In other words, people in spite of their intelligence, their knowledge, their ability to manipulate logic and language and so on are no longer able to make good decisions in terms of their work, in terms of their finances, in terms of their relationships with others, so there is a profound change in personality that leads forever to a dependence on others. People like that do not lead an independent life from the moment of those lesions, in spite of this outward normalcy of their neural-psychological faculties. Now, there is one aspect that is also impaired and that is their ability to have normal emotions and feelings, especially those emotions and feelings that are more related to social aspects, for instance emotions such as guilt or embarrassment or shame and they no longer have those emotions, they no longer perceive those feelings and they look remarkably aloof in relation to situations that would make others around cringe. They no longer have empathy in relation to others and, to make a long story short, we proposed several years ago that this big puzzle, this by the way is something that has been known to exist as a disturbance for many, many years and the explanations have ranged from problems with language to problems of attention, working memory, you name it, and of course, none of those explanations fit and you can demonstrate that they would not work properly to explain the defect. So, we proposed something else and that would be that once you lose, and it is part of the story that I was telling you in relation to the <amigdella>, when you lose structures such as this you lose the function of a system that includes many other components and that is in fact giving you on the moment of making a decision, on the moment of confronting a situation, is giving you information about the past history of your own dealings with similar decisions. So, once you corner the category of problem that you are facing with, what I suspect is that there is a call up of information that is in fact of an emotional nature that will give you an additional signal that will help you to cope with the decision-making process.

Now, I want to make it very clear, and I think I have a slide that will help me do that. I want to make very clear that I am not saying that decisions are being made by your retrieval of past emotions in similar situations, although that does happen sometimes when you are in situations in which you profess to have a gut feeling that told you to stop doing something or engage in another thing, you are in fact calling up very overtly, very consciously some emotional signal that obviously pertains to some similar situation in the past and that is telling you on the side of your own fact analysis, is telling you that this has been good or this has been bad. I don't have any doubt that this happens to us in numerous circumstances, everybody has felt that. But I think that most of the time we don't go around making decisions on the basis of gut feelings, or at least I hope we don't, and we do, however, have ways of managing our decision-making space under the influence of some of these emotional signals that I fully expect to be largely covert. So, what I think is that once in a situation you face the facts of the situation that you call up in <imageatic> form and the options for decision and the representation of future outcomes. You have not only a manipulation of this in very factual terms, in other words, knowledge based deciding processes using formal reasoning strategies, but you also have this other thing that is calling up from your history of such decisions, of such confrontations with events, signals, some of which may be conscious, and some of which may be perfectly covert and appear in the form of a bias that will make you, for instance, pay particular attention to a certain future outcome, or a certain pair of decision versus future outcome that may without telling you if you do...

[end of side one]

...going to have a terrible outcome, it may be in fact enhancing your representation of that bad outcome having in effect the result that you will stay away from the option at least at the outcome.

So, what I am proposing is that together with your fact analysis, you have something that has been part of our history of dealing with things always in terms of an effect, in terms of a positive or negative classification that is going to help manage that decision-making space. My expectation is that actually when the decisions we face are filled with uncertainty in terms of the outcome and perhaps the more uncertainty there is the more systems like this maybe helpful in order to manage what otherwise would be a literally impossible problem to manage, at least in a decent timeframe. In other words, if you're asked about whether or not you want to go to dinner tomorrow with a certain person, if you really are going to do all the costs, benefit analysis of going or not going and you are really going to do that in great detail, in the same way that Darwin suggested we should choose a spouse, it may take you several days, you know you may never go to dinner. You may, however, home in on the solution somewhat more rapidly if you have recourse to some signal that in the past has dealt with such situations and has told you that going out to dinner with a person of that type may actually turn out to be terrific.

I was and I am going to show you, let me just show you that there are many, many ways in which we can get experimentally at this situation but wanted just to show you one, I'm not going to be able to describe the entire experiment, but I can tell you that in experiments in which you ask for decisions on the part of normal individuals as well as patients, and the decisions involved making choices under enormous uncertainty and under limited knowledge of the premises that you constantly give information as to different schedules of reward and punishment. In other words you allow certain decisions to be highly rewarded and certain other decisions to be highly punished. What you get is a curve in which very rapidly even in spite of that uncertainty and that lack of knowledge normal individuals home into a solution and will stay with that solution which happens to be very advantageous. In this particular case, this is a gambling task that involves a loan of money that involves punishments, penalties as well as rewards in terms of how you play a card game and so that there's something that is obvious in terms of what you want to achieve, which is to conserve money or increase your portfolio and the only way you will have to make decisions is in fact very indirect by how much your choices are rewarded or punished. But the point I want to make is this, when you play a task like this and you monitor indices of emotional status, for instance, heart rate or skin conductance, they are very good indices of the presence of emotion. What you get is that in normal individuals, in this case, it happens to be that the individuals have to make choices from either two decks that are very good and advantageous and two decks that are very bad and what happens is that the normal individuals start having responses, skin conductance responses to the bad decks that increase as they play the game, whereas the good decks do not produce those responses. We have been able to show that that differentiation is something that occurs actually without the knowledge of the individual. So the individual is making these discriminations, that is the brain of the individual, the individual doesn't quite know that in fact these decks that are producing those signals of which he is not aware are the bad decks yet and it is only later that the full knowledge of what is good and what is bad is clearly represented and yet these physiological responses have been going on. I just wanted to make the two following points: 1) it now appears quite likely that once the are manipulations of reward and punishment that you actually begin veering towards choices even without knowing fully why you are making those choices in advance of making those choices or having them very clearly represented. Of course a little bit later you make that representation and everything comes beautifully together, but it is intriguing that there is a period during which you

are not quite there, intellectually and yet you are already making the right choices and there is a counterpart for that physiologically. Then something that will interest you is that in patients that have that kind of damage to the prefrontal cortexes that I mentioned, this is what happens and the record is entirely flat. In other words those patients are not only not behaving appropriately in terms of the choices but they are also not generating skin conductance responses in advance of the choices that they never make correctly. In other words there is a very clear physiological correlate to the inadequate behaviour of those patients and that physiological correlate happens to be one that indicates a <diminution> of the emotional signal in relation to something that ought to be causing alarm in the patient and is no longer causing alarm.

Now, let me just tell you very briefly about something different, from a different angle on emotion and that is from the angle, from the perspective of the perceiver of the emotion and I am going to tell you about results in long experiment that now involves more than 40 subjects, in this case normal subjects, not patients with lesions and this is a study that has been performed with positron emission topography, one of those functional imaging devices or techniques that I mentioned early on. The study that we did here consisted of attempting to, in fact succeeding in eliciting emotions in the following manner. The subjects were asked to recall a very powerful emotional event from their lives and once they could do so they were asked to re-enact that emotion and to go through a re-experience of that emotion, something that we have described as a sort of actor/studio technique, because what you are really trying to do is cease on a particular event and ask the person to relive the event, not just think about it, but go through the entire emotion and feeling situation. The four target emotions that were chosen were fear, anger, sadness and happiness. To our surprise this actually turned out to be fairly easily, especially in conditions such as sadness and fear, less so for happiness and anger but in fact we got a remarkable response, over 40 subjects could do this perfectly well, not for all emotions, but for several of them, could do it so well that, just to give you an example, in all subjects they were asked to engaged in sadness from a very sad event in their lives, they all cried, and this applied to men and women, and they did that in the prescanning phase as well as in the scanner itself when the actual experiment was being conducted. So what we wanted to do is have the subjects signal to us the onset of the feeling of the emotion and then we did the scanning so that we could take not just the emotional triggering but also the entire process of going from emotion to the process of feeling of that emotion and so retrieving data for that entire period. Of course, there are numerous results to report but I am just going to talk about two of those results that I think maybe interesting for you. One is that when you take all emotions together, I'm going to ask you to concentrate on this image over here. You're looking at the inside of the brain, this one the right hemisphere, and here the left and you're looking all the way down into the brain stem as well, this here includes the brain stem and the cerebella. These areas that I've marked in very dark red are areas in which there were statistically significant changes under direction of activation. In other words, this part of the statistical distribution and this means that these areas were very active during these processes of emotion, and the reason why I am concentrating on this is just to make some point that goes back to comments at the beginning of the talk, is that structures in the brain stem and in the hypothalamus which are devoted to fundamental regulation of life, to the regulation of metabolism, to the regulation of the <phiserer> to the regulation of wakefulness and sleep are structures that are engaged by the process of emotion, therefore linking, as I was suggesting to you, the idea of emotion as one more level of the regulatory process only a bit more complex in terms of the repertoire of responses. Now, there are many other interesting things to point to but this is the one that I would like to point to most specifically in terms of the general result on emotions and here that gives you a view of the structures in the brain stem that are most actively involved and one structure that maybe interesting for those of you who neuroscience is the <periaqueductal> grey, also shown here and you see that there's activation in that area, and also another called the <perabrakal> nucleus, also very active. It's interesting that

even when you use a very narrow filter to look at the significance of these results, the results are robust enough that they resist that small filter and they show the activation of the brain stem quite clearly.

Then I wanted to show you one other, for one of the specific emotions. I chose sadness because for one very practical reason, understanding the physiology of the emotion sadness is very relevant for our understanding of a very important disease which is depression. I wanted to tell you that in sadness, quite consistently, not only are those structures of the brain stem quite activated but also structures in the hypothalamus and also structures in the <ventromedial> frontal lobe. Precisely those structures that are part of the involvement in those patients that I told you about and we also now know from studies of other colleagues, namely, Wayne <Drewitz> in the United States, that in patients that have depression and mania, there are in fact not only structural, but also changes in activation in the same region. So we have a way of connecting the information from the normal state of sadness and extrapolating it to the very abnormal situation in which the emotion of sadness is maintained at a very level and quite inappropriately, not for a few minutes but for hours, days, weeks, and even months, as is the case of depression.

I wanted to make this very strong point that, you know, among many other structures that are active here these structures, this is the brain stem it's a design of a human brain stem, actually very similar to the brain stem in other species, but there is no question that these set of structures that is so involved in biological regulation is also involved in emotion and it is at this point that I would like to make a bridge to my next topic and that is the topic of consciousness.

You may think it's a big jump from emotion to consciousness but it isn't, it happens to be very simple and very direct. My idea being, and this is the sort of idea that I have been proposing in articles and now in the Feeling of What Happens, the new book, and that is that consciousness turns out to be at its basic level one more aspect of the regulation of our life. In quite intriguing ways the fundamental mechanisms for the achievement of consciousness happen to depend very strongly on precisely the same structures that I have just illustrated for you as being important for emotion and being important for basic life regulation. In other words, what we have in these structures is a spectacular overlap of functions which would be very hard to imagine would be by chance alone. It is something that points to a major devotion of all these structures to the process of regulating life in different kinds of environment with different kinds of demand and challenge from a more and more complex environment. So, what I am proposing for emotion and ways in which I think the proposal is different is: 1) an insistence that we have different kinds of emotion, one of which I think is extremely simple and I suspect is shared with non-human creatures, and that is what I call core-consciousness with a central protagonist that is the core self. Then another kind of more complex consciousness which is extended consciousness where the protagonist is the autobiographical self or extend self. Now, the way I look at consciousness is also different in the sense that I don't think we can limit the project of understanding consciousness to the understanding of how we make images, how we make mental images alone. I'm sure many of you know that this has been the tendency among several neuroscientists is to look at the problem of consciousness as the problem of how the brain makes images, for instance, visual images and that once we have solved how the brain makes images we will know how consciousness appears. Well, of course, that is part of the problem but I don't think it gets at the heart of the problem and the heart of the problem for me is not how we construct what I call the movie in the brain, this tremendous multimedia show that we all have right now in our brains which includes visual information, auditory information, many other aspects of sensory signalling that is fully integrated in time. Now, of course, that is critical to understanding consciousness but that is in the end nothing more than what we normally designate as mind.

What we want, if we want to understand consciousness is understand that conscious mind and what distinguishes the conscious mind is not having that movie or that set of wonderful images but knowing that those images pertain to us, knowing that the images belong to us alone in our first person perspective. If you don't deal with the issue of ownership of the movie in the brain which I designate as the problem of self then you don't deal with the heart of the problem and in the end your project is no different from the project of the remarkable visual physiologists or other sensory physiologists that have been studying how the brain makes images. That's wonderful and quite laudable but if we are to understand how we are conscious in neuro-biological terms we need to understand how we come to own the movie in the brain, that problem of self. That problem of self I think appears in these two levels, the very simple self, the core self that has to do with the here and now which goes actually very closely with the descriptions one gets about simple awareness in which without any issue with time before or after an organism keys into the fact that a certain stimulus is related to it from the internal perspective. But there is this other self that we all have in this room which is an autobiographical self which is a much more complicated matter, but I think is rooted in the previously, and that is the sense we all have, given our memory of our invariant past and the memory of our anticipated future, this notion we have of personhood and identity and even the name that we have to signal identity and personhood and that is a much more complex self that, of course, relies on abundant memory of the past, on abundant memory of scenarios of the possible future and also on the language that allows us to organise all this knowledge. But I see that autobiographical self as very rooted on the core self and to close I see the core self as rooted in something fundamental which is the representation of the changing organism states. I think that the reason why we have one self and not more, the reason we have one mind and not two or three is the same reason why we have one body and not two or three. We have one mind, one self per customer and it is rooted in representations of the organism as it is now and on the very interesting fabrication of a representation of the body as it becomes, moment by moment, when it is transformed by interaction with a particular object, be that object external or coming from our minds. Thank you very much.

Chairman

So I would like to invite questions from the audience.

Audience 1

The central importance in what you spoke of between when the movement goes and when it moves from emotion to feeling seems rather central in the way we talk about feelings being hurt we never talk our emotions being hurt. So you often used emotion where I would have expected you to use feeling sometimes during your talk. The landscape that's laid down of memory, it's not clear to me when one should say it's the emotions that have laid that down or on the contrary the feeling that resulted from them and I say that because the old intuition which otherwise would seem to be wrong, that emotions are bad things to have when you're trying to make clear decisions would become a bit more sensible if we thought that raw emotions were untransformed into something more subtle that humans have, like feelings, would interfere with making decisions <INAUDIBLE> but the feelings would be central and perfectly intuitive that <INAUDIBLE> memories or feelings and that landscape when making decisions. So that just seemed important to me to make clear when we're talking about and which are being laid down and making...

Antonio Damasio

Okay, let me see if I can answer from what I understand of the question. All I can do is give you a bit more clarification of where I want the label "emotion" and the label "feeling" to go even if I'm not terribly happy with labels like this but they are a necessity if you do research on this. For

reasons of terminologically what I would prefer to use "emotion" when you are dealing with responses that are organised away from the brain, towards the body, towards the brain itself and where you have at least some behaviours that you can describe externally in the organism that is having those emotions. In other words I'm prepared to accept if you are doing research on <NOT KNOWN> the fruit fly and the fruit fly is constantly being frustrated in its attempts to get to a certain point. If the fruit fly shows a tremendous amount of agitation in its behaviour I'm prepared to say that the fruit fly is having an emotion, because I am extrapolating from the behaviours of that animal to other behaviours are like it in other animals. But I am not going to make any comments about the fruit fly's feelings, such as they may be. You know, last year or two years ago I convinced Eric <Candell>, who is a very well known neuroscientist who works on a large snail known as the <apleasia>, that <apleasia> has emotions but perhaps not feelings. The reason why I think <apleasia> has emotions is that if you "frighten" the <apleasia>, if you touch it when the <apleasia> doesn't expect to be touched, the <apleasia> does all sorts of interesting things, he retracts the gills, the heart rate goes up, the blood pressure goes up, the <apleasia> emits black ink into the surroundings in case you are coming to it or for it, the <apleasia> can hide away, and all of this is exactly the kind of mini concert of responses that for me define an emotion. Something that you can describe, either from external observation of an organism or from probes, for instance, if you can go into the blood stream and find out whether there has been a sudden increase in cortisol level, all of these are demonstrable third party views of a change and let's leave the term feeling only for the internal representations of whatever happens in that organism, okay.

Audience 1

<INAUDIBLE>

Antonio Damasio

Oh, what you store? Ah-ha. A wonderful question.

Audience 1

<INAUDIBLE>

Antonio Damasio

You know, what I think you store is actually the way of connecting a certain stimulus with the entire apparatus that reconstitutes the emotion. In other words, I don't think you store the emotion per-se, what you store is that there is a link between a certain, say, face or a certain event and you connect that memory with the mechanism, with the device that will allow you to re-enact the emotion. There's no need to store the emotion because you can retrieve it, you carry the body with you always, we don't leave it at home and any time that you come to me with a stimulus that is supposed to produce a fear or happiness I can regenerate, I can reactivate part of that state and that's when I will eventually feel happiness. So that what you store is a link between a certain fact and the potential to reactivate an entire state.

Audience 2

In Francis <Crick's> The Astonishing Hypothesis, he seems to be saying something which goes against what you said at the end of your lecture that if you, he's describing the visual system and he tackles it from the bottom up so to speak, very simple representations to quite complex ones. He seems to be saying that in the end the description of being conscious in a visual way must only be describable by greater and greater detail and greater and greater synthesis. Would you agree with this as far as one very large brain system goes but say it still doesn't describe what consciousness is because that would involve inevitably other systems, autobiographical ones.

Antonio Damasio

I would certainly have to disagree with that and I have many, many times with Francis and I think that Francis <Crick's> position is a position that has to do with strategy for research and his position is that the thing that we can do well right now is to investigate how, say, visual images are created by a system like the visual system and also that gives him one advantage he thinks which is to be able to do that in animals and he's leaving out on purpose in terms of time dealing with issues such as the issues of self. So this is a matter of purely of strategy and my point is that I don't think you can do that. I think that if you do that you are going to limit yourself to a project of understanding images and that is a part of the problem of consciousness but it doesn't get to the central problem of consciousness. I think there's an additional problem and that is that the way you consider those images that are being generated is entirely dependent on how that self is operating and is going to be affected by the degree of selfness in a particular individual. In other words, the fact that the image that you study came in a certain way is not something that you can understand if you chunk that part of the brain and leave out all the rest. I think that the conditions under which that part of the brain is operating in vision or hearing for instance, depends on something much more central, which is the condition of self and the condition of consciousness. The reason why that is important, there are by the way numerous ways in which you can argue for this point, I can give you an example. You can have individuals with profound damage to the visual system, humans, that will not allow them to recognise familiar faces or familiar buildings, and <dilapidate> a great part of the abilities, and yet when they are confronted with a stimulus that they cannot recognise and for which you could in an acute way say he has no consciousness of that stimulus, they are conscious that they do not have consciousness of that stimulus. In other words they have a perfectly maintained consciousness of the fact that they no longer can relate that particular stimulus to past knowledge. So, there is something that is central and that is external to these different sensory systems that has to do with the self, that has to do with that single organism for the benefit of whom you have all these systems in operation and that's what I'm trying to get at.

So, I don't think you can understand consciousness by studying just sensory systems, although if we are to produce a comprehensive explanation for consciousness you do have to understand that. One other thing, I am quite convinced that contrary to some of the current beliefs the most difficult problem to understand, it's exactly the ultimate aspects of how you make images in your brain. I'm not even sure that with the current techniques we have and the current understanding of neuroscience we're going to get there. But, on the other hand, I have no problem with conceiving a solution for the problem of self at systems level and it might turn out to be that what apparently looks the most difficult is in fact the problem that we can manage first and then we will get to the problem which I think is remarkably beyond anyone's reasonable expectation which is to find how you go from a neuro-pattern which is instantiated in the circuits of neurones, buzzing away, and how you get a mental image of that. That is a pretty tough business.

Audience 2

<INAUDIBLE>

Antonio Damasio

I don't think it's a philosophical question except in the broadest sense of the term philosophy which I'm happy to engage. I think it is a scientific question and it is one question that we can deal with but we may not have the wherewithal, scientifically, to do it right now. I certainly don't know the answer to that and I don't know of anyone who does.

Audience 3

Sort of a general question that all the study of brain, these are quantitative studies but mystery in my mind, how does this quantity become quality in the terms of <INAUDIBLE>? How does it become, because we have done enormous quantitative study of brain and nervous system etc, but how does it become quality, from quantity to quality?

Antonio Damasio

Okay. Let me just say I'm not going to be able to answer that sort of frontally, it would take the rest of the week, but I can say one thing. I suspect that what you're referring to when you refer to quality is something that we feel when we are conscious, it's sort of the way in which consciousness feels like something. I think that the most interesting answer to your question would be to say that the way consciousness in mind feels the way it does is because there is in fact a feeling of the organism in which that mind is being created. So, for me the issue of consciousness and the way it feels has to do with the nature of feeling itself. I don't think we have a mind floating around unconnected to the fundamental representation of our organism in its multiple dimensions. What makes it feel the way it feels is exactly the nature of that representation, which really means that the central question is the conversion of a neuro map into a sensory map and far more interesting than the issue of vision or hearing is the issue of how you feel the human flesh the way we feel the human flesh. That is the central question as far as I can fathom.

Audience 4

Yes, my question's related to the last one. I was wondering how you would address the <NOT KNOWN> problem or the secondary quality problem. I'm very much an admirer of physical, chemical and biological science so I think they could in principle answer all these problems about consciousness, but do you think there could be some systems in a description term which could translate what are prima-facie not translatable in the <Lockin> sense or in the <Galelian> sense of internal representational perimeters such as redness or the feeling of pain inter-fundamentally descriptions which are couched in terms of mass, lend time, electric charge or any other of the concepts which are amenable to the physical and chemical biological scientist? I mean I assume this can be done, but have you got any ideas on this?

Antonio Damasio

Right, first of all there are all sorts of senses in which the term <NOT KNOWN> and I cannot deal with all of them. But, certainly the critical aspect of the <NOT KNOWN> problem for me is the way in which you can generate in a brain, obviously within a living organism, the sense of first person description. That for me is the central problem and I think one can generate that without having recourse to a <nomunculous> or anything like that. If we imagine that the same kind of "tissue" the same kind of process that generates what I call the movie in the brain also generates using precisely the same type of machinery the fundamental knowledge that that movie pertains to that organism that is inhabited by the movie. In other words rather than postulating an external spectator in the sort of usual sort of Cartesian theatre situation in which you see the movie and then you see somebody as spectator, an audience of one, what I'm imaging is something much more intriguing, is that you have a multi-dimensional movie, it's not the Hollywood movie, it's not on the screen only, it's on the screen, it's on a space, a multi-dimensional space that includes many sensory tracks, visual, auditory, <somitasensory> and within that movie there is a message being constructed which happens to be constructed without language but can be translated in language and the message is, "look, this belongs to you, this is happening here, this is happening in this organism" and the way in which that message can be plausibly constructed and transmitted is exactly through the language of feeling, a language of body representation. So, if you allow me to construct representations of body state, <pariparso> with representations of everything else that comes into our sensory systems and if you allow me

that those representations are continuous and never stopped because of the brain is a captive audience of the body then you will have the possibility of having this remarkable construction of a relationship between the body and its changing state and an object. When that happens you have a feeling of that change and that could conceivably be the source of that first person perspective, but it's all in the same movie, it's all in the same bath, it's not done out of a different kind of quality of process, it's done within the same kind of structures and without any <nomunculous> and of course it needs to be constructed all the time, moment by moment you begin anew and you construct this particular sense, for every object that comes into the organism.

Audience 5

Professor Damasio, most staff, students and alumni of this school you probably know are not neuroscientists, nor natural scientists of any kind though a relatively small number do study and are interested the philosophy of a science, but the great majority of us I think are social scientists and I rebel against your proposal that there is this clear dichotomy between feelings and emotion. My question will allow you, I hope, to take your answer to the first question a little further, but you did insist on that distinction very clearly and I want to insist on the opposite if I may...

Antonio Damasio

Sure.

Audience 5

...because it's very contentious. Surely, when I feel anger or fear or love or hate or envy or sadness and happiness, is it conceivable that I can experiencing each of those emotions in turn without in any case being aware of that fact, precisely because of my subjective feeling? Surely the feeling itself is an integral and indispensable part of what each of us understands intuitively by an emotional response. I would like to hear your argument more fully in supporting that proposal.

Antonio Damasio

Right, I would certainly disagree with you vehemently, as you can imagine...

Audience 5

Naturally.

Antonio Damasio

...although it's interesting to talk about that point again. First of all, the reason why you need to make those distinctions, my first reason is for being able to plan experiments clearly and to try to segment very complicated processing time. That's the first reason, you want to separate different stages in a process. The second is that you are assuming that the process of emotion and feeling happens in a fully conscious individual all the time and even in humans I don't think that that's the case and it's probably is not the case in many non-human species who, on the face of it, have emotions and may have feelings. To give you an example, you may, I'm sure this happened to you, you may have caught yourself at a given point in the day feeling in a particular way, without noticing what caused that feeling and it is quite likely that that feeling is the result of an emotion that you may have been totally unaware of and even of a trigger that may have come out of something you saw or heard but did not pay attention to immediately, or something that you thought that is preoccupying you. So, even in our situation in which we are prisoners most of the time of our consciousness and we have a process that is so rich that it sort of screens from our view the underpinnings of the process, even in our situation we can have situations in which we do not know of the source of an emotion, do not even know that we are processing a feeling at a

given time. So, all of these things are possible and I think that the separation of these steps along the way is helpful as you engage in the description, as you engage in the study of the phenomena. You know, I'm not saying that we should preserve it for ever, you know, it may well be that in a few years we will not even preserve the terms emotion and feeling and it might be found obsolete. That may come if the descriptions get so rich and in such different terms that you just do away with those.

Audience 6

Hi, I just wanted to ask the link between emotion and memory that you brought up, where you are talking about an to invite to dinner and you said that you might not be able to consciously process why you should either accept or decline the invitation, instead it's a prejudice or an emotional state that you just call up and it decides for you without you being conscious of why. My question is that the link between memory and emotion and the link between reason and memory is quite an interesting one, because that draws out whether there is the relationship between emotion and reason in that case because we can all think of examples where you are able to think of a past experience and consciously call it up and use that as your basis for saying "no I will not do such and such an action" but then the memory of that precise detail fades and instead you've got half a notion that there's something back there I know I shouldn't do this for a reason. But instead it's like a sub conscious thing now and that's, I would presume you would call that an emotional state. So if you can slip from emotion to reason in that kind of way through the mediation of memory, would you maintain a clear distinction in that way, in the way you just answered that man's question previously?

Antonio Damasio

Yes I would, but let me just try to answer your question by invoking a couple of facts. One is that the connection between emotion and memory is obviously a very powerful one and we could bring up numerous facts that indicate that memory is highly influenced by presence or absence or absence of emotion and up to certain degrees emotion can be actually a wonderful help in acquiring for instance the memory of a fact and beyond certain degrees it may be detrimental and in fact the acquisition may be impaired. So, the fact that there is a relation between emotion and memory which is rather intuitive is in fact borne out by scientific work. The second is about the relation between emotion and reason and I think there's one way in which it seems apparent that certain kinds of emotional signal that relate to a past experience have an influence on the decision process, I don't think there's much doubt about it. But there is something that is even more interesting is that if you look at other creatures, for instance, creatures that are not famous for their amounts of knowledge and for their reasoning abilities what you find is that a lot of very good decisions, in other words, a lot of very good practical reasoning is in fact enacted by emotions. So, you have species that do not know much about the world, certainly do not have our kind of knowledge and our kind of reasoning strategies and yet they will take cover, they will protect themselves or they will endorse going in a certain way or making something, availing themselves of something or finding a mate or food or what have you, that are very complicated decisions and those decisions are in fact being run by an emotional system. They very link directly to how good a thing may be and to how needed that thing is at that point in that organism and it is not a system of, you know, finding out which kind of grape you're going to eat, it's really about whether or not you are going to go for it right now in that particular place. So, there is a way in which you could say that a lot of the rational mechanisms of non-human species are in fact in the realm of the emotion. The emotions are one way into reason within a certain environment that is relatively well prescribed and embodied in a brain. So, it's one more reason not to make splits between emotion and reason, it's part of the evolution of what we call reason is high reason, you know, it's something that has now availed itself of a tremendous amount of knowledge and strategies to think over that knowledge, but creatures were reasoning before, they

were making very adaptive decisions that were critical for their success long before they could think about specific facts.

Audience 7

I just wanted to ask...

[end of side two]

...in emotions and consciousness is important to society at large and you mentioned the new field of social something which I lost...

Antonio Damasio

Cognition.

Audience 7

...social cognition developing and as an organisational scientist I'm particularly interested in what implications does that have for us in society and organisations in the new century?

Antonio Damasio

Well, you know, I can only speculate but I'll tell you about a few things that I think are important. One, there is a, especially over the past ten-fifteen years, there is a sense in which with all the developments we have had in molecular and cellular biology, in all the developments that we have had in the new techniques that look at systems level in human mind and brain, there is a sense that we can do it. For instance, I think the reason why consciousness has come back as an acceptable scientific topic when, you know, even 15 years ago, in fact even ten years ago the idea of somebody writing a book about consciousness or having a project on consciousness was not well looked upon, it was not the good thing to do, definitely the thing to not do before tenure. Now, all of a sudden it's not only respectable but commendable and people have an enormous interest. There's this notion, this sense that we can tackle with it, we can deal with the complexity and I think that comes out of the enormous success that we have had in understanding a little bit of memory, a little bit of emotion, a lot about language, a lot about visual systems. So, you suddenly think why not.

Now, the critical thing in terms of the future, what I think is very important is that the theory be good, in other words we need to have a very encompassing view and I think that's where it's important to look not at parts of the brain in a <frameological> tradition, but rather systems and look at those systems, you know, there are systems within a brain that is in place within a body, there is an organism that is in place within not just the physical environment but a social environment and a cultural environment and all of this has something to say and the interactions are there and are very beautiful because even those social and cultural aspects have a way of interfering with gene expression, so we are looking at a very comprehensive landscape and it's not easy to do, it's not going to be done very quickly, obviously, but I think there's a lot of hope for the future.

Chairman

Well, unfortunately, I'm going to have to draw things to a close. So I would just ask you to join me in thanking Antonio Damasio for a very stimulating lecture.