KEN NAKAYAMA: The social mind, let me see if I can just go through these slides here. One might ask the question on the origin of human intelligence. OK, I just want to give a little bit of background. Nancy summarized my career very nicely. I started out recording from retinal ganglion cells and animals. That was a very long time ago. And I was kind of into reductionism, trying to understand how retinal ganglion cells determined how we see certain psychophysical phenomenon.

So what am I doing here talking about some of that social processing? Well, it's been a long time ago, so in your career you do different things. But as I'll say in a moment, I happened to read an interesting paper. I was in the University of Tokyo library kind of bored and I found a book. And I found an article, which I'll talk about that. Didn't change my life, exactly, but it reoriented me towards this social processing. And you'll see there's many different ways of studying. I think the realization that social processing and the human mind are really very inextricably connected opens the door for kinds of investigations that I think are sort of really open-ended and somewhat limited just by your imagination. So I sort of encourage some of you with that bent to think about this.

Since I study vision I will just talk a little bit about the visual system as a preamble. And I was studying vision about 50 years ago. And I think I was sleeping for about 10 years. And all of a sudden I found out something interesting.

Here's a picture of the visual system when I started graduate school. There was the motor system, the somatosensory system, coupled sensory system. And vision was that area 17 V1 in the cortex I think I slept a little bit and all of a sudden I woke up and oops, little bit past 1970. Almost the whole half of the brain in the back and the front was devoted to vision. You probably had lectures by that. And so I think that's really an important fact because the fact that the brain is very visual-- I mean, that's human. So maybe in mice it might be different, they may be it's old fashioned, or something like that. But for primates I think it's very important.

You probably learned about the different systems. That the posterior part of the brain. There's a lot of anterior parts. David Marr said, anybody heard of David Marr? OK, David Marr said vision, where is what by looking, what is where by looking? I just want to say it's way, way more than that. The visual system-- I mean, if vision's half the brain, that's just a pretty, puny problem. So we have to think of all the things that the visual system might do. And we really haven't thought of them.

Well here's some more pictures of a visual system. So, it's a little bit like, it started over here on the west and you go east. It's sort of like Russia going all the way to the Pacific Ocean. Vision system really expand. I think it's kind of slowed down recently. I would just say the visual system is very big in primates. And if it's half the brain, well all the other stuff, like greed, sex, power, music, all that other stuff. It's about the same. So, that means that we just don't really understand. That's a lot of stuff over there on the right. That means, on the left, we don't know squat. So just have that in mind, there's plenty for you to do as young scientists.

So I don't know. It must be-- This is a very tiny list. It's lots of things. It's David Marr kind of thing. So it's more than that. I'm going to talk about visual motor control. I'm a psychologist. For some reason, I think a lot of our-- Roger Sperry said 70 years ago that the ultimate arbiter of your mind is action. I mean, if you don't do something-- if we can have-- I mean, I studied perception most of my life, but if you don't do something, you're not going to pass your genes on to the next generation. So action is it.

Psychologists, they don't study action at all. That's like, they've forgotten that. So I just like to put a plug-in for action. There's people who study the motor system that are kind of picky. So and even if they are, and don't let you into the field, it's important field. I think you should push your way in. I think it's extremely important for navigation. Most animals live in a widely extended space. They know how to go home quickly if they're trouble and things like that.

I'll talk a little bit about some kind of animals like that. The range of area that animals go over is astonishing. And so I think the understanding of animals in their natural environment, there's lots of work on it, but I think it's-- a lot of it's quite mysterious. But I'm just going to talk mostly about social perception. And this is the paper I read a long time ago. I never met this guy. His name is Nick Humphrey. And he wrote this paper, I don't know, maybe 30 years ago, and I just happened to come upon it. And it was in a book.

And he said-- he was not very nice. He said, experimental psychology in Britain have tended to

regard social psychology as a poor country cousin of their subject. So basically, he was putting down-- but he really wasn't because he really said something different. He said, wait a second. And he sort of turned psychology upside down. And he said, you know, actually, the social part of intelligence is the thing that drives everything else. I mean, he might be overstating it, but let's see what he says, here. Oh, I'll come back to that in a minute.

The intellectual faculties of primates have evolved as an adaptation of complexity of social living. For better or worse, styles of thinking which are primarily suited to social problem-solving color the behavior of man and other primates even towards the inanimate world. So he's sort of making the implication when I said, where does intelligence come from? One of the sources of intelligence are the nature of the social world. And it's a quite a complicated world here, because this guy, Dunbar.

You've heard of this guy. He sort of-- I'm not sure this is a really good study, but what he did was he made-- he got the size of the cortex of lots of different primates and he made some kind of estimate. I have no idea how he did this. How many animals were in their troop. But you can sort of imagine, if you have a different social group, it's not just-- it doesn't just go up by N. Because let's say, you know, it's not just how many people you have to deal with. Those people deal with other people and they might be plotting against you.

So in other words, the number of permutations of social behavior really-- I mean, it's only one other person, it's not too complicated. As you get like six, two people might be plotting against the third one over there. All kinds of possible things happen. And as some of the primatologist, if you read some of the accounts, there's planned murders of all kinds of people in the top. It really looks a little bit like the Medici's back in the Machiavellian intelligence. Doesn't sound so weird. OK.

So basically, the idea is that intelligence-- we have to think of intelligence in the social world. I'm just scratching the surface here. So let me just talk a little bit about prediction. That's kind of what we think one of the hallmarks of science is, prediction, right? So what are-- in what area is prediction better? Any thoughts. Suppose I took a rock and threw it down the mountainside. I couldn't do squat, right? I mean--

AUDIENCE: Well, you could do all the measuring, right?

PROFESSOR: Yeah, but nobody's going to do that, right?

AUDIENCE: That's what I'm saying.

PROFESSOR: OK. Biology, I mean, we know-- for example, we know that behavior of atoms, we can't really predict the behavior of atoms over long trajectories, but we can show that, you know, at a certain date, maybe next year, at Woods Hall, people from all over the world, including Nancy, are going to show up at 9 o'clock, here. We can predict that. And we can predict things like my alarm clock is going to go off tomorrow at a certain time because I set it.

So what I'm trying to talk about is kind of a point that Dan Dennett made, who is a philosopher. Who, I think, has really made really seminal contributions, at least to my understanding of psychology to a large extent because he really talks about explaining things at different levels. This is another-- I started out as a reductionist in a sense, but let me just give you, give you a sort of a thought, here. Have you ever noticed that when the moon is setting over the Western sky, it's the new moon. It sometimes seems kind of the whole moon seems to be illuminated a little bit. It's not, it's not just that crescent.

If you think of the, if you think of the sun, it should only be a little crescent. So why do you see the rest of the moon filled in? Well, there's the possibility that the sun reflecting off the earth, which then sends light back to the moon. That's an explanation. Do we need to know about photons? Do we need to know about duality of waves and particles? No. That's an explanation. That's all I'm trying to say. Some explanations are pretty darn simple. And in science, I think we're looking for any fun, interesting explanation we can find.

So I think Dennett has nailed it to some extent. OK. So he basically has three levels for predicting behavior. The physical stance. I mean, if we have ideal situation of Galileo dropping his balls as a flight that, assuming there's no resistance to air and stuff like that, we can make nice predictions. Biology and engineering, we know that you know, seven minutes, the coffee is going to be ready, because that's what it was designed for. But then he's got something called intentional stance, which is in order to really understand what people are going to do, Churchland would say, well, we go in to look at their nervous system. We record from their neurons and stuff like that.

But Dennett would say, no, we can't really use the physics thing or even design, we just use some other heuristic, which is very explanatory, what people desire and what their beliefs are. If we know that, we really can understand what they're going to do. And of course, your grandma knew that or your great grandmother knew that as well. So but these are really great

ways to understand people.

And so I think that we can't just turn our backs to these things. And I think Dennett-- the question is, and we might come back to the end. What's the sort of scientific sort of status of some those types of explanations. Are they scientific? Or what are they? Maybe if we have time, we can talk about that. OK. I'll skip that part, here. So I sort of feel, just as-- what I'm saying is it's a non- reductionistic way of looking at thing-- you should open your mind.

And actually, CBMM or brains, minds, and machines is kind of your kind of condition to that because some people come from computer science. I mean, you can't really understand a computer in terms of atoms and molecules. You really can only understand the computer at some kind of a higher level. So I'm just telling you, that's fine. If you're a neuroscientist and want to reduce it to synapses, things like at, good try, but it might be difficult to do. There are many other valid things to do.

But one of the things to do-- let's just examine some things about them and explore them. I think, as I say, there's so many possible things in this realm. Doing anything, I mean, people have all kinds of principles. My approach in the area, this kind of area of science, or any science that I've done, is to develop new tools, and then helps you explore. OK. So there's lots of things that humans do. But what I want to stress in the first part of this talk is that our human social behavior is really not unique in many ways. There are very, there are very important things that animals do. And I'll talk about them shortly.

Animals, really are very social. There are certain animals like octopus, apparently is not very intelligent, not very social, but by and large many animals are very social. Doesn't explain everything but it's-- I think we share some core things. And if we can understand some of the behavior of animals or why they're social and how their social mechanisms work, I think we have a treasure. So the area of animal behavior is very underfunded area right now.

I sort of feel-- I just happen to like to watch nature videos. And I'll show you a few, you'll have to indulge me a few of these. But I sort of feel these can be more important than careful psychophysics because I think they open your mind to things that you may not have thought about. So I'm a kind of devoté of these things. OK. So do animals have an intentional stance, etc., kinds of things like that? We don't know.

Here's a fun video I think maybe half of the audience have seen this video. And maybe I'll show the whole thing because I think we have time. It was taken just by chance. I think it's

been a TV program now. And I think it's got like 50 million viewers. It's about different kinds of animals interacting, their social behavior. It's about animals that you do not think are that smart and things like that. Ungulates. I don't know. I don't know what buffaloes are exactly, but we've never thought of them as highly intelligent or social.

AUDIENCE: That is a huge buffalo.

AUDIENCE: That's a huge buffalo.

AUDIENCE: That's a huge buffalo.

AUDIENCE: I love this.

AUDIENCE: Is it little?

AUDIENCE: They're crouching.

AUDIENCE: She's crouching.

AUDIENCE: She's going to get eaten.

AUDIENCE: Oh, my god.

AUDIENCE: Oh, my god. Oh, my god. [INAUDIBLE] Oh, she's going for him, she's going for him, she's going for him. She got him.

AUDIENCE: Jeez.

AUDIENCE: Oh, she did. She got him.

AUDIENCE: Ladies.

AUDIENCE: [INAUDIBLE].

AUDIENCE: No, the lions have won.

AUDIENCE: Yeah, but look at all those buffalo.

AUDIENCE: --Buffalo down.

AUDIENCE: They're like, go and try chase the lion, but I think they're too late.

AUDIENCE: They're going to chase [INAUDIBLE].

AUDIENCE: Look at the teeth, Jay.

AUDIENCE: You're too late. You're too late.

AUDIENCE: I think because he cannot believe what's going here. There's a big barrier between lions, crocodiles, and buffaloes.

AUDIENCE: Look at them all.

AUDIENCE: Whoa.

AUDIENCE: He swatted at him and kicked at him. He's kicking at him, look. He's kicking at him.

AUDIENCE: [INAUDIBLE] I mean, buffaloes is basically used to [INAUDIBLE].

[INTERPOSING VOICES]

AUDIENCE: And in deed, [INAUDIBLE].

AUDIENCE: Oooh, they got him surrounded.

AUDIENCE: And that one's--

AUDIENCE: Ooh.

AUDIENCE: Chasing-- go on, go. Chasing--

AUDIENCE: You got the lion [INAUDIBLE] right.

AUDIENCE: [INAUDIBLE]. Dave, can you get the peace?

AUDIENCE: The others are doing that. [INAUDIBLE]

[INTERPOSING VOICES]

AUDIENCE: Never seen that.

AUDIENCE: I've never seen--

AUDIENCE: The calf's still alive.

AUDIENCE: It is?

AUDIENCE: Yeah. It's trying to get away. It's standing up.

AUDIENCE: It is. It's still alive.

PROFESSOR: There's much more to this. There's many other videos about lions and buffalo finding a layer of baby lions and the mother is gone. And they just kill all the lions in there for revenge, or whatever it is, your interpretation, I don't know. But anyway, so I'm just trying to tell you. I'm not going to show you more, but in the lectures, there's going to be a number of videos here. I'll show one more I think. But I think this is-- I don't know, I think you can see this is better than an experiment, OK?

You really get-- to me, it really showed me a kind of, a kind of a social organization. A kind of-- are these animals conscious? All of these kinds of questions here that I think you should think about. OK. So on my website, on the lecture there's going to be some other videos that you can look at and things like that. I won't do this one, here. This is a very interesting video. Some of you might have seen it as well. I don't exactly know what the origin, I won't show it here today. But it's about a-- on the web, it says monkey teases tiger, it's a gibbon, or something like that.

But it's a really amazing show. It goes on for about five minutes. We're given just swinging around and making himself ready for attack. He runs along the ground, the guys are chasing, it's like playing tag. And he runs up a tree and he jumps over them and he their tail and he grabs their ears. There are two lions, two tigers there. And he's just putting his life at risk, but he's doing it. Maybe that's that the theory is, maybe that's his territory. He doesn't want those people around there.

But it's pretty amazing. So just Google monkey you know, teases tiger. You'll see the full video. It's a pretty damn amazing video. Another video that is fairly interesting and this is just-- just

shows you. This is a guy named Jaak Panksepp. I used to be on a study section with this guy. I couldn't figure out what this guy's talking about. This was many years ago. And he's now an expert on laughter in rats. And he tickles rats and they follow him around.

And can you hear them laugh? No, you can't hear them laugh. So he got this bat detector which takes ultrasonic sounds and brings it down to our frequency level. And you can hear the rats laughing. So try that out as well. So you can do that in your spare time. So he's got some very-- Oh. This one is kind of interesting, War. One of the interesting things about--

We have sort of a whole field called evolutionary psychology. And what's the reasons why animals might cooperate a lot? That's what we're talking about here. These are really-- a lot of these things are up in the air. And there's a lot of debates, but one possibility is, if animals cooperate, they can deal with a rival group of animals who might be taking over their territory. Animals have private property, you might call it territory. They don't have contracts or anything like that, but it's pretty close.

And if they have territory that they have and there's another group that has territory, there's going to be conflicts. And why not call it war? And humans have had war for many generations. And I just like to show a little bit that-- these videos are incredible videos. The guy's name is Timothy Clutton- Brock. He's a ethologist at the University of Cambridge. He studied many different kinds of animals. And these meerkats-- there's been a, there's actually been a TV show. Have you ever watched the BBC show? Anybody here? It's a BBC show and it's gone for four years.

I mean, how long did Dynasty go for? Or all these ones that you guys watch? I mean, four years of this life of these animals here. And the really interesting thing about-- they're about one foot tall and they run in troops. This group of animals is really interesting. There's more animals than you think. These are female- dominated societies. There's a alpha female. And she has, she has many children. And then her daughters are supposed to take care of her kids, not their kids.

What happens is sometimes the daughter wanders off and some Romeo was coming around and they had babies and stuff like that. That daughter has to really be nice to the mom to stay. Usually she's banished and she dies, or she joins that other troop. There's so many different things. And these animals-- you can see these guys, here. See the investigators on the BBC show-- these animals somehow have been totally inured to humans. So they're doing all their

thing and people are just walking around with their cameras.

So this is-- you don't have to set up a laboratory, you just go out there. And you have to go to the Kalahari Desert. But I think that this is an incredible research enterprise that's been going on for about 10 years. One of the things is they-- I think, in many ways, it's one of the most studied social animals because the Kalahari Desert is just open. You can see everything. One of the things they do is they dig down into burrows. And so when they're digging way down-- they can eat scorpions. They're not, they're not bothered if they get stung by a scorpion. But if they're down there and there's hawks going over, they can just pick them off. So they have these sentries and things like that.

So they sort of double up-- and then they have babysitting co-ops where they're teenagers that-- they have these burrows underground. But of course you can't-- if you're growing up as a meerkat. By the way, meerkats have nothing to do with cats, but they're somehow related to mongoose. They're sort of a little more in that category. But anyway, they have a baby sitting kind of thing where they let the kids out on there. They play a little bit and if it gets strange, they run back. And so there's a whole babysitting thing because every day they have to go out and forage for food.

And they go very long distances. The territory of these meerkats could be as much as a square millimeter. That's amazing. Just think of these animals, this big, going over a square millimeter, a kilometer. That's territory. So what we have, of course, in the human situation--

DOCUMENTARY NARRATOR: Moments later, the rest of the whiskers return from foraging. From the brow of the hill, they see that their home has been overrun by the [INAUDIBLE].

The rival group spot the owners of the burrow and the angry whiskers waste no time in commencing the attack.

[INTERPOSING VOICES]

DOCUMENTARY NARRATOR: --Straight towards the whiskers. They're going to defend this piece of territory as if it's their own. A bloody fight is inevitable. One of these sworn enemies will have to be in [INAUDIBLE].

The [INAUDIBLE] a hasty retreat.

PROFESSOR: The good guys won. What I'm going to tell you is a pale sort of version of all that stuff but I

think we have to study stuff in the laboratory. So a lot of my interest comes from the work of Nalini Ambady who is a colleague of mine, long ago in psychology department. And so what-- we're going to go-- I'm going to talk about humans now because that's what I've been able to do. I'm not-- But I do think that we really need to look at all different parts of the animal kingdom.

But she did something that's really quite interesting as a social psychologist. Mostly people have been handing out questionnaires and people how-- what do you think about things? Social psychology has mostly been about attitudes and had a rightful good history about prejudice. And how people who have-- a lot of the social psychology came out of the-- was stimulated by what happened in the Second World War, the atrocities and things like that. How could people do things like that? And so those are really important things. And you read about them.

But she did something sort of more at an everyday level in a sense, and just take pictures, very few pictures of different people. And just see what people get from these pictures. So clip, movie clips. And basically, she did one thing and just had people rate teachers that they-- this is at Harvard. We had teaching fellows and they were just talking to their class and things like that. And then students just rated them, what they thought, how good a teacher they were, just on different adjectives. And that really predicted the student ratings of the whole course. In other words, 10 seconds was able to predict the ratings of the whole course. So remember that when you do teaching.

I'm hopeless, but who knows. Anyway-- Basically, here's another thing they did. OK. There's that. Gaydar, you can tell if somebody is gay or straight or something like that. It only presenting the thing for about 15 millisecond. I find that hard to believe. If you look at a video, two people talking together, you can tell whether they're friends or strangers. There was a really interesting one. This is really-- outcome is you have an interview or tapes between doctors and patients. And you can outcome variables like whether that doctor got sued or not.

You can have people rate, have adjectives and it's sort of like, a little bit like-- you can think of doing machine learning, just taking all those adjectives and then sort of predict whether that person is going to be sued. You can see just by this a kind of a crowd-sourcing way of dealing with all kinds of real world, social, significant things. OK. So I've worked a lot on face recognition. That's a very important thing in the sense that in order to negotiate our social world, if you can't do facial recognition, you're in trouble.

I work a lot of people with prosopagnosic. Oliver Sacks. May know who Oliver Sacks is. He's definitely prosopagnosic. And if he's at a party, he's a little bit lost. But he's a-- he has so many other charming characteristics that he can manage. People come up and talk to him. But you can imagine, if you're not that charming, witty, funny person and you don't recognize people who you're supposed to recognize, you're in trouble.

One of the subject I worked with, she's a quite a well-known author. And she goes on book tours, she's happy, and she is she does very, very well. She has a problem with face recognition, but she can't really recognize a lot of the guys in her departure. She teaches-- She's an English literature professor. There's about four guys in our department. She can't really recognize one from another. That makes social interactions very difficult. So we all are experts at face recognition but I've studied something called face blindness.

But I just want to step back because the thought occurred to me. This is one thing that's really-- we've just published, not myself, but my collaborators, we've-- well, I'll come back to that later. It's called face recognition under early stress. I'll come back to that later. Remind me. OK. So over the last 100 years or so, there's something called acquired prosopagnosia which means that, I think, the best case was, I think, World War II victims, the German soldiers in the Second World War. And those people, you could tell they had face recognition problems because of course, they were able to recognize faces, and later, they weren't able to do it.

And so-- but more recently, and I've studied hundreds of these people, and we've actually signed up thousands of them. People-- we just we put a website out and we basically have studied huge numbers of people who are just naturally occurring people who can't recognize faces very well at all. And we've got about 6,000 registrants. We really don't test them that much now, but we can test them on the web. As Nancy mentioned, we do that kind of thing. Just some testimonials from these people, one or two, just shows the problem they have.

This week, I went to the wrong baby at my son's daycare and only realized he was not my son, blah, blah, blah. So in an audience like this, you don't have to identify yourself since you got so many people who are STEM people. STEM people sometimes have these problems. Usually if I give a lecture to an audience like that, somebody will come up and say that's me. So this is a lady I know quite well. She's got a PhD in differential geometry. She's a mathematician. She has lots of problems. She is one of the few [INAUDIBLE] that I think is kind of mildly on the spectrum. But most of the people I've studied are not autistic or Asperger's in any way.

But a lot of people have problem. I claim it's a visual problem. It's not a psychiatric problem or a social problem, but it does lead to social problems. And with Brad Duchaine, I've studied these people quite extensively. And the thing that-- I just want to say, in order to study them, we developed a face recognition test. I got into the testing business in this way because the tests that were out there weren't very good. They were really bad. I mean, they were-- I won't go into how bad they were.

So we spent three or four years just making up a test, which is now used widely around the world. And I don't want to go into the details of the test but it basically enables people to sort of over-learn about six faces. It's a little bit like natural face recognition. It's not-- I think it's a very good test. I won't go into why and things like that. And it gets harder and harder. But I just want to say that we've been able to characterize these prosopagnosia people. But somebody all of a sudden shows up and says, well, I'm not one of them. I'm super. So we've study those people as well.

I won't go into detail. We made a lot of studies about them. Just a couple of testimonials. I pretend I don't remember people because people think I'm stalking them, or something like that. So now we've studied half a dozen of them. And now we're studying a much larger population of them. I would-- All I'd like to say is these people are as good as prosopagnosics are bad. They're really-- but we haven't found that many of them. We've probably identified about 30 of them and we've been looking.

And we give them much harder tests of face recognition. Some of you, if you can recognize all four of these people before they were famous, I'll come up and you might be one of our people, but I doubt it. Most people think they're very good at face recognition. When we test them, they're not that good. So nature versus nurture. Make sure I don't go over my time, here. You know, most of you are not psychol-- how many people are psychologists here? OK.

So you know that there's some experiments called twin studies where you study some characteristics in monozygotic twins and then different, dizygotic, dizygotic twins. And so the idea here is that they sort of share the same family environment. Of course, each person's different, and they have a different way of dealing with the family and stuff like that. But that's the best we can do. But if you can show that the correlation between twin 1 and twin 2 is very, very high, and in our case, it's going to be extremely high. In fact, it's just as high if twin 1 took the test twice. That indicates-- and then if you compare it with dizygotic twins, there's a real difference there.

And that's what we've shown essentially, is that-- I'm just saying, the test reliability is very good. It's tech has a R of 0.7, which is very good. And we had-- There's 350 just random people who took the test twice. But now what you can do, we have this online way of doing research where we can just have people come up and-- the real hard thing in twin studies is not to get monozygotic twins, it's to get dizygotic twins. Dizygotic twins don't really care about being twins that much, but monozygotic feel, hey, I'm a twin. My wife is a monozygotic twin so I know all about this.

So we have something called the Austrian twin registry. And we pay them and they-- a very nominal fee and they do our tests online. And what's really interesting, we found if you correlate twin 1 and twin 2, they have to be obviously the same gender. The correlation, you'll see here, is 0.7. It's just as good if the twin took the test twice. That's pretty darn amazing. And the dizygotic is 0.3. So in this particular situation, I think we've shown to our astonishment that the ability of this face-- the ability to learn new faces is almost entirely heritable, whatever that means.

I mean, it's a technical definition, but it indicates that your ability to recognize faces is strongly controlled by other factors than experience. And that's when I want to bring up this childhood adversity thing, here. Laura Germine has done a very large survey of I think, over 1,000 people who were-- and these are things-- we had trouble with the IRB here, but people talked about all of their horrible things that happened to them, childhood sexual abuse, neglect by their parents, all kinds of things that are really bad when you're growing up.

And then we did a lot of tests on the web. And everything, all our tests showed real deficits in cognitive abilities, in even emotion recognition, but there was no deficit in ability to learn faces. So that's pretty-- so what I would like to suggest is that somehow we're sort of topped out. We have enough experience seeing faces and we've reached our asymptote. That's just a point that might be of interest here.

So another thing we've done recently, I don't have any data here, but we just got it paper accepted, was to show that using the same sort of paradigm of monozygotic and dizygotic twins that face attractiveness is not-- there's no genetic component at all, basically zero. So here's a face attractiveness test that we've cooked up here. Here's a bunch of faces. You have a bunch of cards, you sort them. That's all you do. You get the mean ratings for all the faces and then you rate the faces. And I'm going to say, OK, you're-- let's say that upper left- hand

corner, that's one person's ratings versus the mean ratings.

That's a correlation of 0.74. The next person's 0.91. That's really unimaginable to me that, that person there's correlation with the mean rating is so high. And look at these ratings. They're very, very high. Of course, these are Harvard undergraduates. They all have the same kind of mentality. Perhaps that's maybe that's the point. But the correlation with the mean, this is just from one of my courses. It's unbelievable. The correlation, the agreement of who's attractive and who's not attractive is astonishing.

So what we did was we had these MZ versus DZ twins and had them rate them. We have a kind of a jingle. We say, how quirky are you when you're a beauty judge, or something like that because our web site, we don't pay anybody. In the twin study, we do, but we like to make the tests fun and interesting to the people. And we, most of the time, give them feedback as to how they done. So all I'm trying to tell you there is that we don't see any genetic component there at all when you do the monozygotic and dizygotic twins, here.

Gender versus attractiveness. Where you give a bunch of pictures to people and you say, which looks more feminine, more masculine? You do that with girls and then you do it with boys. Which was more masculine, feminine? Those are very reliable ratings also. It's hard to see but female attractiveness correlates very well with the gender judgment, male attractiveness doesn't. Actually male attractiveness is quite robust. People can agree on male attractiveness, but it's not the gender axis. Maybe you know, 2000 years ago it was machoness or something like that. But in our society, it's agreed upon but it's a little bit mysterious.

Alex Todorov has published a paper on this, which I don't understand. But he says he explains it, but I'm not sure. But that's an interesting area of what constitutes male attractiveness. A fellow, who is an MIT student, Richard Russell, found one of the things that is related to female attractiveness. It's basically contrast, facial contrast. Not how dark you are, but your facial contrast.

And he just found that if you just measured the contrast of pictures, you find the female average contrast is higher than the male contrast. And if you take a picture like that, which is an androgynous person here, and you just change-- you have the same picture and you just increase the contrast, the one on the left looks more female. And maybe that's the reason that Richard thinks that this is the basis of some cosmetics. And he works with a cosmetic

company. He's not doing--

OK. So the final part of this talk, I'd like to talk about is that, which I'm more involved in right now. Is I sort of feel that most of social psychology is involved in kind of asking people questions and things like that about sociology. But as I said in the beginning of the talk, I feel that the realm of human action is something that has not been investigated. So I just feel it's something that we need to probe. And what I would like to argue is that by studying our human actions, we can actually reveal our social perceptions. That's kind of the point here.

So most of you have been in very crowded places and you don't bump into people and stuff like that. And there's many reasons for that. But basically it's pretty amazing that people, pretty much, don't run into each other in very crowded and when they're very rushed. And there are many situations in which your social interactions with people are extremely skilled in a sense, in different kinds of dancing or fencing or different kinds of athletics. So I claim this is the domain of what I call rapid social perception. So how can we study rapid social perception?

Well, I'm OK with all these things, showing movies and stuff like that. But we've sort of put it into the laboratory, in a more discrete fashion just because we can study it easily. Now one of them is that most of you watch the World Cup, is the penalty kick. It doesn't happen all the time, but every once in a while, it happens. And you know, that's a really dramatic moment. And of course, you have to predict which way the kicker is going to go ahead of time if you're the goalie.

So we've set up something which was sort of parallel to it which I call the lab version, here. So here's the kicker, here. But the job is not to kick the ball into the area, but just touch target left or right. That's your job. That's all you do. Go boom, boom. That's it. That's the trial. So it's very simple. And we tell people it's a game. If you are up to the game--

The blocker-- if you get there within 150 mil-- we sort of titrate it to match the skill of the two people. But it's a game. Harvard undergraduates love the game. They get tired because a little-- but there's no problem. Harvard undergraduates don't know each other usually so they're not friends or anything like that. They just, they just come in there. So I think there's a movie here as well. Let's see if I can get this going here. Oh, here, go this way. OK. So this is the game, here.

Is it moving? There you go. Here. That's it. That's the game. I like pretty simple experiments.

OK. So but then what we do is we just measure the finger position of the two players. You can just buy these things. They are off the shelf. They're not very expensive. The one I had like you know, a couple of thousand dollars these days. This is very low tech. It measures the position of the fingers and at a high precision, very fast, and stuff like that. You can buy this thing. It takes a while to get it going and stuff like that.

So basically, we can map the trajectories of the various people. And you can see that they're well- behaved. And just like that. So what's interesting is the timing here. So the kicker goes like this and the blocker-- so you can make little measurements, here. And so we can just measure the horizontal positions, here. So the blue is the kicker and the red is the blocker. And so obviously, they can't do at the same time. But the reaction times are interesting. What's that difference in the launch point, there.

And what we found was it was actually very low. You can see it there. Some were as low as 100 milliseconds but it's 150-- it's lower than choice reaction times normally. So if you take-- if you could have a button box and put a buzzer or something like that, choice reaction times are usually about 100 milliseconds longer. So what's going on here? But maybe choice reaction time isn't a really good choice. So what we did was we took-- we actually can take the position of the finger and map it on the screen.

And we have a little experiment here, where you actually-- instead of playing against a person, you just, there's a little dot that zooms up there and you do that. So maybe it's that-- the fact of that. So we do this, and that's the experiment. And it turns out this experiment, we're about 100 milliseconds longer. So in other words, if you're playing against the human being, that's on average about 100 milliseconds. So you are faster when you're dealing with human being.

I will just skip over some of this stuff, here. And again, there's no learning here. Basically, it's just, it's flat. So what's going on here? We think what's happening here, and this is the punch line, I'll just elaborate a little bit more. You think all through your life you've seen people do different kinds of actions. And if you do any kind of action, there's all kinds of postural adjustments. I was just talking to one of the guys in Emilio Bizzi's lab.

If you're sort of in different kinds of sports, if you lunge like that, what's the first muscles that contract? Anybody want to know? Your butt. Because that's to maintain your center of gravity. So there's all kinds of-- I'm not saying people will watch you know, their butts and stuff like that. But when you make any kind of motion, it's your whole body is connected. And somehow

we have knowledge, implicitly of this. So what's going on here? We talk about 90 milliseconds or so.

What section of the body informative? Well, in a sense this is kind of-- you just block off different pieces and stuff like that. And we just, we have all different kinds of ways we can just-- limited. And we do-- we did all kinds of experiments like that. And basically, if you show all, there's an advantage, just the torso or just the head and there's the computer, it's all over the place. That the information is all over. But that's not unreasonable because when you're doing something, all parts of your body are connected.

So there's quite an advantage. I think basically, oh, this is your question. We're moving this stuff. So we have-- we call them cut videos here. So what we do is we play a video, here. By the way, we now have shown that people would behave exactly the same to a video than they do to the other person. So that makes the life a little simpler. So there we go. There's-- I don't know if you can tell, but essentially, nobody, except a couple of star athletes, could tell what it was. And it turns out, in the cut videos, in other words, you don't have that preparatory stuff. You just have all that if the person is still, we don't even know what those motions are. But basically, they're 100 milliseconds slower than the cut videos.

So another thing is, oh, we even did stuff-- we did another series of experiments. Well, maybe it's eye movements. And basically, we just did some more blocking. And shoulders are important, you can see, here. Oh, I didn't show that. I don't have the data there. But basically every-- even the head, there's a little-- all of those, the first five, except the last one, were very good. Even the last one, you can hardly see anything. You just see the head then you see the eye movement is a little bit of an advantage, even there.

OK. So basically, what I'm trying to say more broadly, is that our ability to understand humans probably more to predict what they're going to do is something that we've learned somewhat unconsciously. We're going to do a lot of machine learning of what parts of the body it is. And all kinds of stuff like that. I'm interested in if you people have some ideas of what other kinds of things we can do to generalize this. But I think it's an area where we-- it helps us understand all the kind of knowledge that we do have of other people that we can weed out in ways that are very subtle, but reliable.