How a Mouse Crossed Scientist's Mind

a conversation with Ebrahim Mamdani

Dr. Ebrahim (Abe) Mamdani has graduated from Imperial College, London, UK, with MSc, and then obtained there his PhD. His pioneering work on fuzzy control was carried out starting in the early 1970s and had since then found many applications in many fields, notably in appliances and other consumer products exemplified by washing machines, cameras, and automobile automatic transmissions. He had also been active in other fields like: neural networks, pattern recognition, artificial intelligence, reasoning under uncertainty, communication services, and knowledge based systems for industrial control. He was also involved in many research projects for various commercial companies, for instance, in the research and development of knowledge based systems for British Telecom. Dr. Mamdani joined Imperial College 1995 to take up a newly created Chair of Telecommunications Strategy and Services (endowed by Nortel Networks and the Royal Academy of Engineering).

Dr. Mamdani helped establish FIPA, Foundation for Intelligent Physical Agents, a group formed by industrial organizations from all over the world whose aim was to develop basic standards in the area of intelligent software agents. He had also worked for the European Commission research funding bodies, within the ACTS (Advanced Communications Technologies and Services), Information Technology and Telematics subprogrammes.

Dr. Mamdani is a fellow of many international societies, notably the IEEE, IEE and Royal Academy of Engineering.

Born in India, he grown up in Tanzania, and then moved to the UK. His interests include digital photography and Indian national cuisine.

JAMRIS: What experiences and interests in your childhood shaped your life and career?

E. Mamdani - I had always beenhad always been interested in science, so science is what shaped my career quite a lot. When I finished my undergraduate school education, I came to a conclusion that I should do something. According to My family tradition, I should become a doctor. I said, "No, I am interested in mathematics and science".

J: Were your parents disappointed?

No, they were not disappointed. It was strange that I wanted become an engineer. "Why an engineer, not physicist, not chemists?" Living in Africa meant that you had to do something that will bring you money. Engineering appeared to be crazy. Happily, it is not true anymore, nowadays engineering appears as a more practical degree to get.

Professor Ebrahim Mamdani

J: When you decided to become an engineer?

Immediately after high school I started to study civil engineering. I did not like it – it did not have enough mathematics in it. It is much more practical and I wanted something more complicated, with more mathematics in it. Electrical engineering is much better kind of an area because you have mathematical models in it, and they work. Moreover, all the representation of everything you are doing is mathematical. It was electrical engineering in those days.

J: When I am listening to you I am starting thinking that you have been looking for challenges endlessly?

Maybe, because electrical engineering was a very interesting subject. Remember, this was electrical engineering not electronics. Electronics came afterwards. Computer science did not exist at that time. This is a very new branch of study, which maybe appeared in 1960s, therefore electrical and electronics were the most interesting areas.

J: Brave new world?

Yes, it was so modern and exciting. Since 1950,when the first computer was built, everything had changed. I wanted to work with computers when I was an undergraduate student and there were not computers yet at universities at that time, so I started taking more and more interest in electronic, but also in artificial intelligence. I did my PhD in neural networks with Professor Hugo Alexander, who worked for my primary college. I joined him and I started my PhD there.

J: What is the most exciting thing for you in artificial intelligence?

I am experimental. Another words, I do not believe that a computer will solve everything, but you have to use ideas to build a system. I am not mathematical in my approach. Experimentation is my approach. I do not believe in theory. Mathematics is not going to be the answer. Mathematics will help you building good models, but the centre has to be experimental. I like building things and watching how they work. I think that artificial intelligence is an experimental science, not a mathematical science.

J: I heard about the "emotional wardrobe" project. What it is?

That came very afterwards, and we were working on it very recently. At first it was fuzzy control. When I finished my PhD, I got a student. I said "Ok, Let's do an experiment. If a human being is controlling something, can a machine learn from the human being by observing what the human being is doing?" That was the thesis that we were working on, before we found out that Professor Zadeh had written suitable paper in 1973. He wrote in this paper that showed how you could tell a machine what to do; we applied it and it worked. It was an experimental study which became very popular. Immediately we had a steam engine, and the idea was to control the steam engine. We started working on Friday, and – I do not remember clearly – by Sunday it was working. It was continuously working and we were controlling it by using fuzzy logic. We had a good relationship with the Danish Technical University, via an exchange program, I used to go there and give them some seminars. There was a student there, who said, "Look, this steam engine control rules are very similar to semantic control rules", so by 1975 the thing was applied in semantics. Again an experimental study on some kind of Web intelligence. The idea was that when you are interacting with a computer on the Web you only have the mouse. Therefore, the computer knows which part of the screen your mouse is in, whether you click or not. At least it knows what you are reading if you move your mouse. The feedback with a computer system is via a mouse and a keyboard. The computer does not know your face; it does not know anything about you. We decided to give the computer another feedback which is a skin conductor. It immediately shows you how your emotional state is. In another words, if you are angry or you are getting frustrated, then your skin conductance changes very, very quickly. We resolved the problem of measuring skin conductance in many different ways. One was to put two measurements on the mouse, on two buttons. It is not intrusive but measures your conductance. But if you leave the mouse taking hands away, it stops measuring. We designed a ring that people wear that gives a continuous reading of skin conductance. We were using skin conductance for giving a feedback to a website trying to sell something to you, mobile phones, something like that. As you find something more interesting on the Web, your skin conductance changes.

J: It is immoral!

No, it is not! We did an experiment in Science Museum, when people went to the audio exhibition. We have got the permission but, because there is a big protocol involved, you cannot do experiments like this without the participants' consent agree. We did several experiments to find out if people who are actually enjoying their experience, and if they do not change web pages based on how they enjoy it. You do not just relay on how they click. You take all this information into. It was an experimental subject. Then somebody read about it. She was a research student in St Martin's art school. She was doing her PhD and she heard about it, and she said "Can we give this as a feedback to a dress. Maybe we can build a dress that can change colour." There are many different ways to do this. An interesting idea is to give the dress a feedback from your skin conductors. If you are with somebody you like, your skin conductors change and the colour of your dress changes too.

J: People like different colours. I like red, for example.

And if you wear a green dress, when you meet someone who you like quite a lot, your dress becomes red (laugh). It was not our idea, we just used skin conductance measurements to help the designer.

J: Why?

Why not? The design of a dress is an open problem. People who are in this kind of design area will build anything. You may not like it but there are other people who like it. I do not like to wear something changing its colour.

J: But the humans can feel reactions and mood of another person without touch. We do not need so bright signals.

You should speak with designers. My collaborators and I only gave our device. We even did not know details how a changing-colour dress is to be built. I thought that it is a very interesting idea to take feedback from your emotional state and put it not to the website but also to something else.

J: What are you doing now?

As I have said I like experimental work. This particular one has many different applications. It is very similar to lie detector equipment. There are many measurements you can take from the body and give them to the computer. My lie detector is different. If you want to run a lie detector it has to be calibrated for each person. Each person has got different skin conductors etc. and if they do the lie detector test they can spend a long time to calibrate their instruments before they ask questions. If you use it not as a lie detector but as a feedback to these devices, you cannot calibrate it, and they have to be self-calibrating and reusable. Everyone can use it and the device will self-calibrate for you. This is a great research area to find out how to perform self-calibrating, and if we can use fuzzy logic for self-calibration. When we are talking to one another, is not just my sound you are hearing, but you are seeing my face, how it is changing, where I am looking. Information is coming not just from the sound. Lots of non-verbal communication is taken place. When you are communicating with the computer you do not have all these dimensions and it would it not be a good idea to build these dimensions for the machine to pick up from you. This is the biggest enquiry. There are many different dimensions, not just skin conductance. Also eye tracking, which is very easy to build the machine tracks your eyes movements, so that the machine knows which part of the screen you are looking at. You have a big screen with a lot of information on it, but your skin conductors are changing only when you are looking at one point.

J: Sounds like spying.

It is not spying; it is an integral part of communication. When I am talking to you and my eyes keep going somewhere, I am giving a lot of information about me. That non-verbal communication is very important for interlocutors.

J: People use telephone because it does not allow them to be seen and felt byto one another. An old example "Honey, I will be home late. We have to prepare some documents immediately"... Your device makes this situation impossible.

Well, you are right. Which is more serious: the machine that allows you to tell lies or the machine that does not allow you to tell lies? In another words, you are passing more information to the machine by your eye tracking, what is happening with your skin conductors or heartbeat. The machines are not evil. It iIs how you use it – there are always two sides: good and bad.

J: Isn't like the nuclear bomb problem?

Yes, it is. An excellent example is the Web. It is used by the terrorists and by the police. My thesis has been the following. Machines have very little and narrow information that they pick up. Firstly there was only the keyboard. The mouse is very new, it came together with the Windows, and allows you to have a feedback to the machine. The mouse allows for an exchange of a lot of information with the machine. Look at us. Sensors cover every square inch of our body. I know where I am, and the machine does not know. Should there be given sensors to the machine, so it can know when you are touching it? There are also different types of touch. Artificial intelligence and artificial devices haves so limited an amount of information gathering capacity compared to us, the humans. It cannot be compared.

J: What is the best application of your research?

It is hard to say, because there are so many. I cannot say "this one is better that that one". The situation with the websites and the emotional wardrobes is a good illustration.

J: We have reached present time in our conversation. What is the future of your field?

Improvement of communication between the man and machine, not just relying on verbal communication but on a non-verbal dimension in that feedback also.

J: Could the marriage between the man and machine will be possible?

That is a very interesting question. That is the final thing that is said to stay between the man and man, and the machine and machine. The communication is not possible. This is my opinion and other people disagree with me. Meaning is experience. The machine can never understand the meaning of what we understand. For example, the machine cannot get quite a lot of experience based on: hunger, thirst, satisfaction, sex, mercy, pity, taking care of somebody – all this kinds of things are important. These are dimensions of a personal experience. Just take food – sex is too complicate a subject – or eating a good food. The human experience of food is not all about getting satisfied. It is a pleasure of mind too. The taste, drink, combinations... It is such an important human experience that machine can never, never share it.

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