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Nuria Oliver

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“The world needs more female engineers, researchers and inventors”



Nuria Oliver | Telecommunications engineer .

Holding a PhD from the MIT (Massachusetts Institute of Technology) Media Lab, the telecommunications engineer Nuria Oliver (Alicante, 1970) is one of the most frequently mentioned female researchers in Spain.

Her work on computational models of human behaviour, artificial intelligence, human-computer interaction, mobile computing and big data for the benefit of society has earned her international recognition and the honour of being the fourth woman to occupy a seat, alongside 56 men, at the Spanish Royal Academy of Engineering.

She is also an independent director of Bankia, Chief Scientific Adviser at Vodafone and Chief Data Scientist at Data-Pop Alliance. In this interview, she talks to us about the importance of promoting female role models in the STEM disciplines, the role of AI in controlling Covid-19 and the need to create diverse teams to design the systems and technologies of the future.

Occupying a seat at the Spanish Royal Academy of Engineering is an honour, but also a responsibility. Will it serve to inspire future female technical degree students? And, above all, is the mentality of academy members changing with respect to the appointment of women?

Yes, indeed. The Spanish Royal Academy of Engineering has sixty seats, and only four of them are occupied by women. In my particular case, I am the fourth and youngest, which shows a strong gender imbalance, and this is something that we need to change. Fortunately, at the Spanish Royal Academy of Engineering they are

very aware of this lack of gender diversity and are extremely interested in the appointment of more female members.

Positions at the Royal Academy of Engineering are for life and more cannot be created. It is therefore necessary to wait until there are new vacancies in order to be able to appoint new members. However, the Royal Academy of Engineering is looking to identify more female engineers to join its ranks, and this is something that is also a personal crusade of mine.

It is essential to create female role models in the engineering sciences and IT, because without female role models it is very difficult for young girls and teenagers to be inspired when the only figures out there are male, and on top of that foreign, from the United States, for instance. It is necessary to create real, tangible role models who have more in common with young girls and teenagers so that they can motivate them to study technology-related degrees. The world certainly needs many more female engineers, researchers and inventors.

Woman and engineer seems to be a combination that the collective imagination still struggles to grasp. In your opinion, are we making any progress as a society in this regard?

Unfortunately, the percentage of girls studying IT or the engineering sciences most closely related to IT has been falling consistently since the mid 80s. At that time there was close to 30% of us in Spain and the trend was rising. However, the figure has been decreasing since then, and we currently have on average 12% of women in IT. In other words, the trend is the complete opposite of what we would like.

We are finding it incredibly difficult to attract female talent to disciplines that are defining the world in which we live and that will ultimately define the future, and these are the most powerful disciplines right now. Unfortunately, we women are not playing a key role in the creation, design or implementation of all these technologies; we are merely consumers. For that reason, it is absolutely essential to break stereotypes, create role models and encourage our daughters, students, nieces to consider IT or another engineering science as a future career option. This is probably the best choice in the long run, since these are the careers with the lowest level of unemployment and the most opportunities, besides being the most versatile, since they are cross-cutting and can be applied to any domain.

In your research work on computational models of human behaviour, do you consider the gender perspective important so as not to repeat stereotypes or biases?

Artificial intelligence, which is the discipline within engineering or IT that aims to develop intelligent computing systems, is being used increasingly in decision-making. This is because we have realised that human decisions are not perfect. So if we have a lot of data on an underlying situation and we train algorithms

“It is essential to create tangible female role models who motivate women to study technology-related degrees”

to learn from those data, the algorithms might not be affected by the biases or prejudices that we humans have. They don't get tired or hungry, or have a bad day, either. That's the idea.

However, what we have discovered in the last ten years is that not only do these algorithms replicate bias patterns that actually exist, but they often amplify them. This is basically because the data with which we train the algorithms contain those biases. In fact, we have many examples of gender discrimination or racial discrimination in systems used to help judges hand down court rulings, for instance, or in personnel recruitment systems, where if there are very few female candidates for technical positions, the algorithm immediately thinks that women are no good and only recommends making offers to men. Another example is in credit systems that offer less capital to women than to men.

A very active line of research has therefore opened up on how to design algorithms that guarantee non-discrimination. Specifically, the research programme that I co-direct, Ellis (European Laboratory for Learning and Intelligence Services), and the Ellis unit in Alicante, which we have just created, focus on this area of research.

In this regard, is the fact that a woman is heading this type of research key in order to prioritise values such as equality?

Having diversity in any kind of team is a key factor. Countless studies show that diverse teams create more innovative and inclusive solutions. A diversity of minds and experience means that the team members have had different life experiences and can create a more inclusive solution. It is absolutely critical for diverse teams to participate in the design of intelligent services and IT systems that billions of us use in our day-to-day lives because, if not, these solutions will project, albeit unconsciously, the reality of a very homogeneous team and will not be sufficiently inclusive.

That is why it is so important to design ambitious actions to attract minority groups, and also women, even though they aren't actually a minority. All kinds of diversity are essential in order to ensure that the technology that we are inventing actually includes everyone, represents everyone and is not perpetuating biases existing in society. This is absolutely vital.

From the pioneer Ada Lovelace to the visionary Grace Hopper, who were your IT role models?

My main female role model doesn't come from the IT industry, but she has inspired me since I was in high school. It's Marie Curie. I've always been fascinated by her. It seems incredible that a woman of her time achieved not one but two Nobel Prizes. Nowadays, roughly 97% of the Nobel Prizes for the so-called STEM disciplines, in physics, chemistry and medicine, go to men. To think that a woman achieved this so many years ago is very inspirational.

The second large area relates to clinical decision-making. Artificial intelligence algorithms are used to automatically analyse radiological tests, for example, and to predict the likelihood that the patient has coronavirus. Artificial intelligence algorithms are also used to predict the likelihood that that person will require ICU care based on symptoms, medical history and demographic factors such as age and gender.

The third large area is the use of artificial intelligence and data science to support public decision-making. It is precisely this third line that we are focusing on at the commission of the President's office for the Valencian Strategy for Artificial Intelligence. This is an honorary, altruistic and voluntary position consisting of heading a team of more than twenty researchers from the Valencian research system, which had been working intensively in four areas until the end of June and is now stepping up the intensity again in view of the second wave.

“We women are not playing a key role in disciplines that will define the future; we are merely consumers. We must break stereotypes and create female role models”

I have then had male role models in the area of IT, since there are very few women in this field. One of my biggest role models in the area of artificial intelligence is my doctoral thesis supervisor, professor Sandy Pentland. There are also other highly distinguished professors such as Michael Jordan and Yann LeCun, who won the Turing Award a couple of years ago. An MIT professor who is one of the mothers of affective computing, Rosalind Picard. I mean, I have some female IT role models but, historically, my ultimate role model has always been Marie Curie.

You are now a commissioner of the Valencia Autonomous Community Government for Covid-19. What is your mission and how can artificial intelligence help control the pandemic?

Artificial intelligence is already helping with respect to the pandemic in three large areas. Firstly, it is helping to speed up the development of effective treatments and vaccines. Artificial intelligence techniques are being used for molecular modelling and to predict whether a certain treatment or vaccine will work.

The first line of work consists of modelling human mobility on a major scale, since an infectious illness such as coronavirus, which spreads from human to human, doesn't spread if people don't move. That's why we are locked down, so that it doesn't spread geographically. Being able to quantify and measure that human mobility is very important in order to predict how it can spread, and also to ascertain whether the lockdown measures are working, whether or not mobility is actually being reduced. This is what we did during the first wave. We were the pilot autonomous region, so defined by the deputy prime minister Nadia Calviño, in the use of aggregate and anonymous data taken from the mobile telephone network in cooperation with the Spanish National Statistics Institute (INE).

The second line of work consists of developing computational epidemiological models. What does this mean? It means creating computer models of how we think the pandemic will evolve. Not only is this very useful for predicting how the epidemic curve

will evolve, but also because it enables us to create simulations under different scenarios. For example, what would happen if we reduced mobility? Or what would happen if we traced the contacts of 80% of the population? Or what would happen if 30% of the population was immune for some reason? In such cases, how would the curve evolve?

The third line of work is the development of predictive models for hospitalisations, ICUs and deaths.

And the fourth line is one that I find highly inspirational. It consists of a major citizens' survey called "Covid-19 Impact Survey", which we launched at the end of March. The aim is to involve citizens in this pandemic situation and understand their actual situation and perception of the pandemic, and to fill in gaps in data availability. There were many questions that we were unable to answer because we didn't have any data on the subject. We launched the survey at the end of March and it went viral. We obtained over one hundred thousand responses in forty hours, and we currently have almost three hundred thousand responses in Spain. I would encourage everyone reading this interview to complete the "Covid-19 Impact Survey". It is totally anonymous and consists of twenty-five questions. The survey has provided us with clear insight into people's social behaviour, how much they support the lockdown measures, the prevalence of symptoms, whether or not there is testing, whether or not contacts are being traced, what individual protective measures people take, the emotional impact of the pandemic, the impact on employment. It is very brief, but at the same time very rich and multi-dimensional.

"AI is increasingly used in decision-making because we know that human decisions are not perfect"

Since the past cannot be rewritten, is there still time to write a new present thanks to women like you who provide positive leadership?

There is no doubt that we have a great opportunity, and perhaps a need, to redefine many of the work models and vision that we have developed for society and the world. We, as *homo sapiens*, as a species, are facing immense challenges: the climate crisis, an ageing population, the prevalence of chronic diseases, the environmental impact, pandemics. We need the best minds to take on these challenges and develop the technology that we have yet to invent. We are moreover convinced that we will not be able to address these challenges if we are not inclusive, if we do not have diverse teams and if we are incapable of giving a voice to the millions of women and minority groups; brilliant minds that often work behind the scenes and are invisible. I believe that this is something that we owe ourselves as a species and that we also owe the future generations.

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