Computer technology: robotic milking and interactive mirrors
Why milking and mirrors?

Hello. My name's Bernie Clark. I lecture in the Department of Communication Systems in the Facility of Maths, Computing and Technology at the Open University. My background is actually as an Electronics Engineer. And I was given the task of creating a new course called 'Computers and Processors'. That course actually is the interesting bridge between electronics and computing.   It doesn't actually go down into the detail of electronics. But it shows all the electronic components that reside within a computer. What you need and what those components do, to actually create a computer system.   Sometimes the interesting things happen between divides. And this course sits between the divides of electronics and computing.

When I chose the two examples that you can in the clips, one of the things I wanted to do was to be able to show the electronics. The insides of the devices, and how they were working.

Now in the robotic cow milking system you could see the mechanics of the system. You could see the robotic arm moving about, and you can see the sensors.   You could see the flashing lights. So you could see that there was a sort of mechanical system being driven by electronics.

The wooden mirror actually served quite a different purpose. Which was that we could actually get up very close to the electronics inside the device and we also saw him creating the code that was making it happen.

I was a bit concerned when we were creating the course, that one of the thing we hadn't done was show examples which would be very engaging and very surprising for the students. I felt that a lot of the case studies we had were built around quite conventional products. And I really wanted to do something which showed the creativity of computers and the surprising things that you could do with them.

The first thing I found actually was the wooden mirror. And that was really very clearly centred around the ideas of creativity. And the idea that somebody who actually perhaps didn't have a very high level of technical knowledge. Didn't have a degree in electronics. Didn't have a degree in computing. Could use computers to create something which was very visually exciting.

On the other hand when I found the robotic cow example, I thought that was something which people would find very intriguing and it would actually show computing in a very different light. In terms of the effects it could have on people's everyday lives. And the running of the farm.

I think really an awful lot of people's idea of a computer as a personal computer, it's very based around the PC and Microsoft software. And very traditional software packages. And you can see that when you talk to people about ICT they might mention Excel spreadsheets, word processing, databases. All those things which are just very traditionally software packages.

I wanted the students to realise what a powerful tool computers could be. The fact that they could be used in really quite different domains. I must admit when I found the robot cow milking, what I expected to show students was actually a very technical product. I thought I was going to show students something which was very technically robust. Something that could exist in a very harsh environment. And I thought that was going to be the surprise. That you could actually have a piece of kit which a cow could use 24 hour a day. And the whole story of the whole idea of how it had changed the farmers lives. How it had kind of affected the existence of the cows. How they had much happier existence was really a total

surprise to me. And I actually thought that was really rather charming in the piece that we show. The fact that there was this really robust technology on one hand. With this really rather lovely story of the husbandry of the cows and the farmers relationship with the cows. And how he felt about the technology, and what contribution it had made to the kind of working life of his farm.

Talking to the farmer, it was really quite clear that before the cows had been herded, the cows were actually being forced every morning. Herded together, waiting for milking. And they were in that perhaps quite uncomfortable situation where they were standing waiting for long periods of time, waiting to go in to be milked. What the farmer then said, was because he wasn't having to do that. He was actually going up and looking at the cows on an individual basis. Just checking their health just wandering around the field. So the time that he would normally have spent with cows in a group herding them, was actually spend in the field on a sort of almost individual basis with the cows. Which was really quite interesting, and the cows had names. There was one cow called 'Friendly'. And so the farmer and his son recognised each of the cows as individuals. So I thought that was really interesting.

He did talk about the vet. If he was coming along to do any inoculations. Didn't have to use the crusher anymore, to get the cows in a position to accept the vaccination. That they could actually sort of go up and take the cows as individuals and treat them as individuals.

I think in the use of any technology, how it's adopted is really really important. And I think one of the things that was really obvious with Neil. Was that he was one of these early adopters of an interesting technology. He'd found this technology and got really really interested in how it could be used. And he got really involved in it. And even when the equipment who perhaps stood a little bit further back from the technology, it might not have worked quite so well. So I think Neil was a big part in the running of that farm. I think probably the word is integration. It was the way he integrated the technology into the working life of the farm. I think that was really important.

There is a risk if the equipment breaks down, that the farmer has then got really quite an extreme problem. In terms of getting the cows milked. Because obviously they just can't wait. But there is an agreement with the providers of the equipment, that the equipment will be up and running within a certain time if it breaks down.

I do think that if a product like that is coming on the market, and actually it's very critical to something like the daily working life of the farm. It is important that tried and trusted technologies are used. Something which isn't going to be fragile. Something which can be mended easily.

And one of the things in addition to having perhaps used very tried and tested materials, electronics within the product. One of the things which also must be quite clever about the cow milking system is the accessibility and ease of maintenance of the equipment as well. The fact that you can perhaps change the server motor or an arm, or an item of pneumatic equipment very easily and quickly. Without having to totally disassemble the whole robotic cow milking machine.

So I think as well as using tried and tested technologies, it's probably assembled in a very clever way to actually make it very accessible and easy to fix.

Neil the farmer did say that he had got to such a level of familiarity with the equipment, that if it did break down, he could probably run through his head a list of maybe four of five things which were actually likely to have happened. He could go and make a very quick assessment of whether he could fix the problem himself, or whether he needed to phone the engineer. And again that's part of Neil's relationship with the technology. That he was interested in doing that. And interested in having that knowledge about the equipment he was using.

I think it was obvious that before he started to use the robotic cow milking Neil did feel that he was under an awful lot of pressure as a farmer. The daily grind did seem to be pretty gruelling. And I think the interesting thing was how much he talked about it in relation not only

to himself, but also to his family. And how it had changed the sort of daily lives of his family as well.

Any time he talked there seemed to be always sort of three parts of the picture. There was himself as the family. There was his family. But there was also the cows. And this piece of equipment seemed to have made life better for all of them.

I think it's really important that we do start to get people thinking about technology. I think the positive aspects and perhaps the negative aspects as well. I think I'd like to start to think that students who had perhaps studied T224 with CSCTV camera in the street, and actually start to make conclusions about what was happening there. The positives, the negatives.

We would look at perhaps reading an article about robotic cow milking perhaps. Or hear a Radio 4 programme which was where I heard about Neil and his farm. And actually make judgment about the quality of that technology. What effect it was having on society. And what it actually meant to them as an individual. Whether it was a positive thing or whether it was a negative thing.

When I first was choosing my two examples, I chose the robotic cow milking machine as a very technical example of the use of computer. With the mirror I was trying to look for a very creative example. And one of the things I was keen to do, was to try and take computers away from this very techy view. I was actually trying to show students that they didn't have to have this very techy head on their shoulders, when they were thinking about computers. That they were actually very creative people out there who were using computers. And actually they could also be very creative themselves, in how they were choosing to use them. So I was just trying to show them that in studying computers and processors, that didn't mean that they were very techy, very pigeon holed engineering type student. That actually they could be a very creative one as well.

I was getting a little bit concerned when we were creating the course, that the example we were using were quite traditional. And actually really quite unsurprising. And I went to the library with colleague actually. And we started to look through copies of literature in the library. It was Spectrum magazine. And we were just looking around for something which was different. And Daniel Rozin was on the front cover of one magazine. And we almost immediately picked that up, as a good example. I came back and I did a Google search on his name. Picked up where he was, and then I think the next day I phoned him up. He's at Tisch School of the Arts in New York.

I went along with a film crew to New York to film Daniel and the mirror's work. And I remember phoning him from the hotel the night before and arranging to meet. We met down in the foyer, and he took us up in the lift. And it was just such an amazing thing when the lift doors opened, and I hadn't expected the mirror to be hanging there, just in front of us. And we stepped out of the lift, and the first thing we heard was just the noise of it. But of course when we'd seen the photographs we hadn't realised that it made any sound at all. It's the fluttering of the tiles. And I think that immediately makes you look. And then you're just wondering what this thing is.

And then the other thing that really surprised me, was the quality of the light. And the difference between the dark and shape in the wooden mirror. Because obviously it's the differences between the light and the shade, which are allowing you to see the image.

I knew that the mirror was made of wood. But actually it seemed to be highly reflective. It seemed to be flowing back at me. And so I actually saw this kind of very attractive almost golden image in the mirror. And it actually took me a little while to realise that it was me. Because I was so intrigued. And actually I was intrigued by the noise rather than the image initially.

And then your next stage was just to play with it, and to actually discover that if you moved, the tiles actually did move. So most of the time even though the people who would be walking through the hallway would be really quite familiar with the work of at. What surprised

me was that quite often they would spend a bit of time in front of it. It's not a work of art that you just kind of would walk past, drift past and say 'Oh that's good'.

It really drew people into it. And people really did interact with it. Even people who were very familiar with it. And I thought that was one of the very intriguing parts of it. And it was just there in front of us. And it was amazing that we kind of made this journey from Milton Keynes and a picture on the front of a magazine to actually just be standing in front of the wooden mirror itself. It was just such a lovely moment. It was tremendous.

I think Daniel was quite intrigued that we'd made the journey to film him. Because I think perhaps sometimes people are surprised, to extent to which the Open University will do to create content for its courses. But he was really pleased. He really valued that. And I think he gave us an awful lot of his time. And he also showed us in really quite detail quite a lot of the work that he was doing. So it actually felt like a real privilege. It was really lovely to be able to talk to him in detail about what he was doing.

I think Daniel is a really clever link between technological aspects of that type of work, and the aesthetics. And I think that's one of the great things about his work. And one of the things that we have to make sure we don't take for granted. Because what he's done is he's taken a technology and managed to integrate into something which is very creative. But with such a balance, even looking at how did he choose the size of the mirror? How did he choose the size of the tiles? How did he work out the resolution?

So there's this interesting balance between how did he get the technologies right, how did he get the scale of it. and how did he make sure that actually in the fusing together of all those pieces, yet manage to create something which was appealing. Not only in the way it reacted. But also in the timescales, and the look. And the way that people interacted with it, was really amazing. I think a lot of that was actually due to the size of it, and his interpretation of what a mirror was. It wasn't something that was the size of your face. It wasn't a shaving mirror size that he created. It was this huge thing, which was just wonderful.

When you look at the mirror you hardly see the camera at all. You have to get up really very very close. And I think that must be one of the intriguing things. If you perhaps in an art gallery and watching people's reaction to it. If they can get close enough to see that there's a camera there at all. It's one of the things that I was trying to make sure students on the course would pick up on. That if they walked past something like that, in an art gallery and start peering at it, to work out how it worked. They think there must be a camera here somewhere, where is it? They find it, and then they might make some decisions about how it is that it was created. And how it was working. How it all hung together.

I think on one level the mirror is quite simple. If you actually look at the back of the mirror. You can see that there is a pattern. Your eye can pick out that there's repetition, repetition, repetition, along the different tiles of the mirror.

I think the complexity in it's construction actually is you can't think of just the technical complexity, without thinking about the artistry of it as well. The complexity in the product was actually really the marrying of both of those. It's the artistry and the technical coming together here I think.

When the camera takes a picture of whatever's in front of it. It will turn that into pixels. So that picture will be represented as lots and lots and lots of small squares. But actually the picture that the camera takes will have many many more small squares. And it's representation of the imagine than Daniel used in the wooden mirror. So he's made a very clever decision about how many pixels were there, in the original image. And how many to use in his wooden mirror.

If Daniel had used more wooden tiles in the wooden mirror, there would have been trade offs in how the mirror behaved. If you've got many more wooden tiles, they would perhaps have to be much less responsive. It would have taken rather longer for the image to settle on the mirror. They might not even have realised it was themselves as they walked passed,

because the image would have taken too long to settle. So he's made a decision between how many pixels he would use in the wooden mirror and perhaps how responsive the mirror is. And I think that decision is quite clever and quite well judged in his implementation.

One of the thing that I was really pleased about, and one of the things I wasn't very sure if it was going to happen, was that Daniel let us see the back of the mirror. When I went in and I saw it, and it was actually in some sense, quite heavily secured to the wall, and I didn't know if it was going to be possible. But Daniel quite naturally after we had done some filming in front said 'Do you want to see the back'. So he then got a screwdriver and took out the screws that held it on the front. And it was hinged, so it just swung open. And I must admit when I just saw the work on the back, I just thought that was great. And my immediate reaction was, I think I would have hung it backwards. But I think that's perhaps the sort of reaction of somebody that's an engineer, electronics engineer rather than somebody that's an artist.

I think one of the really interesting reactions you get from the mirror is that people feel that they really could do something like that themselves. I think one of the things that was very good about Daniel and how generous he was to us in making the DVD. Was he made it all seem really very accessible. And actually students I think can see 'well if I get a camera. If I get a PC. If I get a server motor. I can actually start to construct things like that'. And that's actually one of the most common comments I get from people when they've seen the DVD. Is 'Ah, I really wish I could have a go at making something like that myself'. It just seems very accessible.

Now that I've made the two videos, the wooden mirror and the robotic cow, I feel that I'm always on the look out for an opportunity. And I just say I've never found anything that's made me think I would have rather have done this, than done those two examples. Because I really do love having made them. And I think they do give a lot to the student. And I think they're a very important part of the course.

What I would really like to do is to make a third one. And I would like it to have a kind of slightly different focus. What I'd like to do is to find a third example. Which shows two experts together. So somebody who's very expert in a creative craft and somebody who's very expert in the technical domain, actually working together to create something.

And if I got a chance to look now. I think I might look around the performance arts. To see if I could find perhaps a dancer. Somebody who's very creative, a choreographer, who might want to do something about the physicality of their movement, might want to put sensors on their bodies, might want to work with somebody who's very technically capable to generate some sort of image or sound or whatever, which is based on that movement.

So instead of say the cow milking, where we've got Neil who's this kind of very ready adopter of technology, very interested in using technology. And Daniel who's very creative. And has used his knowledge, his own knowledge of the technical capabilities of a computer to create his own work. If I could find something where I've got two people who are technical experts in two separate domains, and see them coming together, to create something different, would be another lovely thing to film. An alchemy of the creative talent and the technical talent, that would be lovely.