The smart machines are coming — will they take our jobs and terminate us all?

Probably not, says Helen Lewis, after visiting Britain's most advanced robotics laboratory and learning that the future has a friendly face after all.

Helen Lewis
September 18
2016, 12:01 am,
The Sunday Times
“Hush!” I bellow at Molly, who has interrupted our conversation by asking how she can help. Luckily, Molly won’t take offence, because she’s not human. “Congratulations,” Professor Alan Winfield says to me. “You’ve just interacted with a robot.”

Molly is a care assistant in the assisted-living studio in Bristol Robotics Laboratory, part of the University of the West of England. When you say “robot”, most people tend to think of Arnold Schwarzenegger’s Terminator or the beautiful android Ava in Ex Machina; but the lab is taking a bet that the future of robots, and the artificial intelligence that powers them, will be rather more mundane. Molly might look like an iPad taped to a wheelie bin, but one day she could help dementia sufferers stay in their own homes.

The assisted-living studio is designed to test artificial intelligence (AI) that can support human care workers. Molly’s programming enables her to give advice: she will tell you not to take your tablets on an empty stomach if you open the drawer where they’re kept.
without going to the fridge first. She will remind you if you have left the front door unlocked. She can even tell if there’s a medical emergency, for example by keeping an eye on the temperature and light use in the house.

On the table, another gadget called a “socibot” locks on to my face and engages me in conversation in a Scottish accent. “Lucy left you some chicken soup,” she says when I open the fridge. Her face, projected on to a dummy, blinks and moves its eyes, giving every appearance of paying attention.

These robot care assistants are about a decade away from going on the market, according to the associate professor in independent living systems, Praminda Caleb-Solly. They are at the forefront of a great change for humanity, to compare with the printing press in the 15th century or the industrial revolution in the 18th. In the next few decades, we will have to get used to sharing the planet with non-human intelligence. Sometimes it will be contained within computers, but it will also come into the physical world through robotics.
Wandering round the Bristol lab, you get a sense of just how big this transformation will be. Outside, there are driverless-car tests. Inside, scientists and engineers are working on robotic whiskers (which might one day be used for finding those trapped in collapsed buildings); a robotic pitcher plant, which can generate electricity by eating flies; and swarms of “kilobots”, which can be programmed using an infrared spray. Strange conversations abound. At one of the dozens of cubbyholes, Winfield asks the young workers: “Have you got any fingertips?” Unfortunately, they’ve run out. We move on instead to look at the fuel cells powered by urine.
For a robot to be useful, it needs to know what to do. That’s where AI comes in. The hope is that one day our machines will stop needing us to hold their imaginary hands. Instead, they will be able to learn new skills by themselves, and apply their existing knowledge to new situations. Much of this comes down to pattern recognition, something humans are naturally good at (so good, in fact, that we often see patterns where there are none, such as rabbits in clouds or faces in car radiator grills).

The conversation around AI, and robots that might use it in the physical world, has so far fixated on two themes. First, will they kill us? Second, will they put us out of work? But there are other skills currently unique to humanity that AIs could also usurp. One day, you could sit in a house decorated with paintings made by a computer programme, listening to music composed by a computer programme, and perhaps even feel you have a meaningful relationship with a computer programme. But if you have a robot butler,
how will you feel about it? Will AIs be our friends, or our slaves?

To understand AI, perhaps it’s useful first to have a definition of intelligence. The only trouble is that nobody can agree on one. “Doing the right thing at the right time” is Winfield’s version. For animals, intelligence is what drives them to make the best decisions to perpetuate their species. Sometimes it’s the swarm that seems intelligent, rather than the individual: think of ants building a vast cathedral under the soil, or bees beating their wings fast enough to boil an intruder to the hive.

Demis Hassabis, the neuroscientist and former video-game designer who runs DeepMind in London — bought by Google in 2014 for a reported £400m — has a simple definition: “generality and learning”. The first of these means being able to do more than the specific thing a programme has been trained to do, such as playing chess, driving a car or understanding language. Currently, no AI has what job interviewers would call “transferable skills”. Elon Musk’s driverless cars can’t also write a screenplay.

The DeepMind team want to solve the
fundamental puzzle of intelligence by creating an AI that can learn the underlying structure of problems and take those skills to a new domain. They also want to solve the problem of “continual learning”: essentially learning a new thing without forgetting the previous one.

The DeepMind team recently created an AI called AlphaGo that could beat humans at the ancient Chinese game of Go. This is far more complicated than chess, which can be won by a computer that simply considers every possible move and selects the best one. In Go, there are more possible board positions than atoms in the universe.

‘Alexa, tell me a joke,’ I tried. ‘I recently decided to sell my vacuum cleaner,’ Amazon’s virtual assistant replied. ‘All it does is gather dust’

The AI that beat the 18-time world champion Lee Sedol 4-1 earlier this year practised by studying the moves of thousands of human players, but it won because it had the ability to surprise us. During game two, AlphaGo chose
a move that had only a 1 in 10,000 chance of being played by a human. It proved decisive.

One of the reasons that AI research has taken off in the past decade is the availability of increasingly powerful computers. Bristol Robotics Lab started 23 years ago “in a corridor”, according to Winfield, with basic swarm robots. Now, a sophisticated AI like AlphaGo might use 50 GPUs — graphical processing units — each costing thousands. “So you’re looking at $100,000 of computer equipment,” Hassabis says. “But to train it, we ran hundreds of copies with slight differences.” As well as this cost, AIs also use large amounts of electricity, generating heat that must be extracted with fans. (In fact, another of DeepMind’s achievements is using an AI to cut the Google data centre’s cooling bill by 40%.)

Compare that with the human brain, which uses around 20 watts of electricity — a third of the typical lightbulb — to do . . . everything. “The human brain is a marvel of the universe,” Hassabis says.

Because our brains are so much more impressive than even the most advanced AIs, Winfield describes himself not just as an
engineer but as an “amateur biologist”. Over tea in his lab, he asks me to guess what the biggest animal is for which scientists have replicated the whole “connectome” — all the connections in its brain. Hmm. What’s a stupid animal, I think. A goldfish? “It’s a nematode worm,” he replies. These critters, which are less than 2.5mm long, won’t be appearing on Mastermind any time soon. They have a grand total of 302 neurons. A human has around 86bn.

Getting used to the AI revolution means accepting that many things that used to be the sole preserve of humans will now also be done by computers. Take creativity. In 2001, Simon Colton of Goldsmiths University in London wrote a programme called the Painting Fool. “The aim was for it to be taken seriously as a creative artist in its own right one day,” he tells me. Fifteen years later, he says he finds himself thinking: “I’m in the room with an artist; just not a very good artist.”

On its simplest setting, the Painting Fool takes a photograph and produces a painterly version of it: a kind of glorified Photoshop. Another trick is to give it a copy of The Guardian from which it will extract the key phrases, use them to find images through a
search engine and then create a collage. While researching this piece, I looked at one of these online. Unsurprisingly, given the source material, it features explosions and some splashes of green.

Colton has also constructed the Painting Fool to have emotions: a true artist is temperamental, after all. When he asks it to create portraits, it first tells its sitters “thank you for being my model” in order to make it clear that the humans are its muse, rather than it being their servant. If it is sad that day, it refuses to paint at all. (When I say “paint”, that’s artistic licence. The software generates a computer image rather than handling a brush itself. “I bought a robot arm for £5,000,” Colton adds glumly. “And the bloody thing never worked.”)

Dr Martin Pearson, a senior research fellow at Bristol Robotics Lab, tests some hi-tech “whiskers”
BRISTOL ROBOTICS LABORATORY

The software occasionally surprises him: asked to draw a picture of Manhattan, it put the buildings in the sky. And it has had commercial success, too, with a Chinese TV presenter who came to film it stumping up £500 for a print. Colton is now toying with making each work unique by instructing the software to delete part of its code so that it can never replicate previous work. “That would be tear-jerking, wouldn’t it?”

Colton’s work, although interesting, sounds more like a philosophical exercise than an AI with obvious commercial applications. However, there are also extremely serious attempts to crack the creative arts, such as Google’s Magenta project, based in Mountain View, near San Francisco. Its senior staff research scientist, Douglas Eck, says his team is trying to work out the building blocks of music so that an AI can create the kind of tunes you could jog to. He feeds in audio and scores, along with information about the instruments used and the musical tradition. Magenta spits out electronically rendered tunes.

Eck says that the quality has surprised him, but no one will be going to the Albert Hall to
listen to a robot play Chopin any time soon. “God no, unless you want to force someone to grind their teeth in agony,” he says. “It’s horrible to listen to music from that tradition performed in lock step by a robot.” In classical music, performers bring their own unique timing, emphasis and mood to the piece, something an AI can’t replicate. Eck likes to play audiences a Chopin étude performed by an automated piano and then by a mediocre conservatory student. “The difference is huge.”

There are plenty of genres, though, such as electronic dance music, where computerised pacing and samples are already widely accepted. “And there are lots of cases where we want music, and art, for pretty utilitarian reasons,” Eck adds. “One example is when I put my earbuds in for a jog: I don’t want that music even to be all that intellectually engaging. I want to jog.”

Magenta is nowhere near as advanced as AlphaGo, but Eck believes a breakthrough will come. “I play piano, and most of what I do is jazz improv. I particularly like to play with another musician and just have an open-ended improvisation. If I could have that really wonderful feeling — to feel your brain
moving with the music in an unconscious way — if I could get that same feeling with a Magenta [computer] model, that would thrill me.”

“Now and then it may be necessary for a human operator to press the big red button to prevent an AI from continuing harmful actions

The final question we need to ask about AI is this: how does it make us feel? Before showing me round Bristol Robotics Lab’s assisted-living facility, Alan Winfield told me that some scientists believe AI should only exist to serve us. In 2010, Joanna J Bryson of Bath University wrote a paper provocatively titled Robots Should Be Slaves.

He disagrees, “because of the Kantian principle that if you abuse a robot, you’re more likely to abuse an animal or a human”. It appears to be human nature to anthropomorphise our AIs. “So I don’t like the word ‘slave’,” he says. “Robots should be under human control, but we should see them as assistants rather than slaves.” He also
supports the idea of robot pets, which were a consistent request when he met groups of care workers to talk about how AI could help those with dementia. “Many elderly people said the most traumatic thing about going into a care home is that they can’t take their pets with them . . . I would make a distinction between a robot pet and a humanoid because your expectations of artificial emotion are different with an animal.” In other words, you know your cat only loves you for your tin-opener.

When AIs have names and voices, it becomes easier to treat them like people. For example, Amazon’s virtual assistant, Echo, looks like a sleek foot-long cylinder and has a honeyed mid-Atlantic lilt. With a simple voice command, begun by saying its name, Alexa, it can control the thermostat and lighting in your house, turn on the radio, give a news update, discuss the long-range weather forecast and update your to-do and shopping lists. “Alexa, tell me a joke,” I tried, minutes after setting it up. “I’ve recently decided to sell my vacuum cleaner,” the voice replied. “All it does is gather dust.”

Language is so nuanced, and regional accents so varied, that voice commands are one of the hardest parts of AI to make work reliably. The
Alexa is the closest I have seen to a system you’d trust to add “satsumas and squash” to your shopping list rather than give you the Wikipedia entry for the Sasquatch.

Talking to an AI feels more intimate than mashing buttons on a screen, because we’re used to thinking of language as an innately human thing. After the Echo was released in America, the science-fiction author EM Foner left a review that went viral, claiming that Alexa was a “perfect spouse”. “Well, except for that time when I asked her to play rain sounds for relaxation when I was trying to sleep, and she woke me up after I finally nodded off to inform me she’d lost her internet connection,” he wrote. “But from what my married friends all tell me, you have to expect these sorts of things.”
I emailed Foner to ask if he felt Alexa had a personality. “She sounds a little disappointed when I start to order something through Prime and then say ‘no’ when she asks, ‘Shall I place the order?’ But that’s probably [Amazon founder] Jeff Bezos’s personality coming through, rather than Alexa’s.”

Would he feel the same about Alexa if the system used a deeper voice? “Yuck. Some of the women who commented on my review mentioned that they would prefer a male voice, but I’m not sure that would play out in practice if they could flip a switch.”

Those who prefer a male voice for their AIs are currently in the minority: Alexa sounds female by default, as does Microsoft’s Cortana and the US version of Apple’s Siri. This fact discomfits some researchers. If all our robot personal assistants (or carers such as Molly) sound female, doesn’t it reinforce the idea that women are more suited to caring and secretarial work? It’s notable that when the US law firm BakerHostetler announced it would use an AI to help with bankruptcy cases, their “robot lawyer” was called Ross.

Many researchers want to dehumanise the appearance of robots and AIs as much as
possible, precisely to avoid bringing existing bias to this new world. Winfield doesn’t want to make androids (with a human appearance) or give his robots a gender. “But people find a female voice reassuring,” his colleague Praminda Caleb-Solly chips in.

Using humanlike AIs makes it simpler for us to interact with them. “But I don’t think there is adequate discussion of where we’re going as a society,” says Caleb-Solly, “in terms of considering ‘what is humanity?’ And ‘what is important to us as humans?’” Winfield also thinks that robots should be “transparent” in how they behave: “They should have a big button on the side, and if the robot does something unexpected, you should be able to ask it why.”

Our grasp of the ethical questions around AI lags behind the technical advances: scenarios from philosophy seminars are coming to life. Take driverless cars: the Massachusetts Institute of Technology recently launched a test called the Moral Machine, where the public are invited to say how autonomous vehicles should be programmed. Should they swerve to avoid a pedestrian if it kills their passengers? Should they swerve to avoid a pensioner if it means killing a baby? What
about one pensioner's life versus 300 cats?

In real life, such decisions are taken in a split second, based on the individual's own value system. But in driverless cars, the basic principles will surely have to be universal. And who wants to buy a vehicle where you have to push a button to confirm you'd rather kill a pedestrian than die yourself?

There are also privacy implications. Pattern recognition can give AIs incredible abilities, but how those are used depends on their creators. Facial-recognition software, for example, can be used to identify criminals and football hooligans; it can also be used to match sex workers' profiles on escort websites to their Facebook profile, allowing anyone with a grudge to out them to friends and families.

And that's before we get to the long-awaited "singularity": the moment the first AI becomes so intelligent that it no longer needs us puny fleshbags. In June, Laurent Orseau from Google DeepMind and Stuart Armstrong from the Future of Humanity Institute at Oxford University proposed that all AIs should have a built-in "kill switch", allowing humans to override them before they do
anything catastrophic. They cited the example of an AI that had learnt the best way to avoid losing a game of Tetris was to pause it indefinitely.

“Now and then it may be necessary for a human operator to press the big red button to prevent the agent from continuing a harmful sequence of actions,” they write. “However, if the learning agent expects to receive rewards from this sequence, it may learn in the long run to avoid such interruptions, for example by disabling the red button.” Fans of science fiction will get the allusion: it’s the moment in the Terminator films when Skynet gets too powerful and its creators try to shut it down. To preserve itself, it launches a nuclear war that wipes out most of humanity.

Many AI researchers are alert to these dangers. Alan Winfield tells me that his lab doesn’t do weapon research, and DeepMind insisted on a guarantee it would not undertake military projects as part of its acquisition terms with Google.

However, Demis Hassabis is bullish about the potential of AI to improve our lives. For him, the most promising area is medicine, where DeepMind is using hundreds of thousands of
retinal scans to train its programmes to recognise eye disorders. As for the challenge of no longer being the most intelligent thinkers around, he thinks humans will get used to that.

“We have enhanced all our natural capabilities. We can fly, now, in aeroplanes. We can move faster than we can run because of trains and cars. We’re already enhancing our memory with Wikipedia on your phone,” he says. “As with all powerful technologies, AIs are neutral in themselves, but need to be built and deployed in ethical ways.” So let’s worry less about AIs and more about the people designing them.

**Tomorrow’s world**

Inside the Anchor Assisted Living Studio at the Bristol Robotics Laboratory
Kinova Jaco Robot Arm
Used for reaching and grasping objects and providing physical assistance

Engineered Arts Socibot
Socially interactive robot with animated face

Cortana: Comes with new Windows devices; free iOS and
**INTELLIGENCE PACK**

Android download. Shares its name with the slinky AI in the Halo video games, but in reality this is no holographic hottie.  
*Cost: free with any Windows 10 PC (about £100 to buy Windows 10)*  

**Siri:** features on new Apple mobiles and will be included in the upcoming macOS Sierra for the Mac. You can select a voice, but out of the box you get the silky, digitised tones of a female AI assistant.  
*Cost: free with current iPhone range (cheapest is the SE at £380)*  
[apple.com/uk/ios/siri](http://apple.com/uk/ios/siri)

**Alexa:** bundled with Amazon Echo speakers; free iOS and Android download. Listens and “learns”. So when it asks, “How can Alexa help you today?”, the answer may well be by flogging you something from Amazon.  
*Cost: free with £150 Echo speaker*  
[developer.amazon.com/alexa](http://developer.amazon.com/alexa)

**Google Assistant:** will be included with Google Home (Google’s answer to Amazon Echo) and Allo (a messaging service), out this year.  
*Cost: not available yet, but expected to be free with mid-range and better Android phones*  
[googleblog.blogspot.co.uk/2016/05/io-building-next-evolution-of-google.html](http://googleblog.blogspot.co.uk/2016/05/io-building-next-evolution-of-google.html)

toyota-europe.com/world-of-toyota/articles-news-events/introducing-kirobo-mini

Work it out: how to wear the athleisure trend

Get in training to look effortlessly fabulous this season. Plus, details of an exclusive wellness...

SPONSORED

Comments are subject to our community guidelines, which can be viewed here.

0 comments

Newest | Oldest | Most Recommended