

The Sunday Telegraph

This is what will happen when robots take over the world

Few will be spared in the robot revolution as millions of jobs are destroyed. But can humans fight back?



Handover of power? David Cameron, UK prime minister, and German Chancellor Angela Merkel hold the hand of a humanoid robot during a tour of Germany Photo: EPA



By [Szu Ping Chan](#)

10:00AM GMT 15 Nov 2015

 86 Comments

It's another early start for workers at the Premier Foods factory in Carlton, Barnsley.

A dozen arms flank the factory's newest machine, ready to pack hundreds of Mr Kipling cakes into boxes.

Today it's Angel slices. Tomorrow it could be caramel. But the action is always the same. Pick, place, move. Pick, place, move.

Darren Raine, operations manager, has the job of surveying it all. “Some of them work harder than others,” he shouts across the factory floor. “It’s mainly those on the beginning and middle of the production line. They don’t get any more money, though.”

In fact they don’t get paid any money at all. Mr Raine isn’t talking about his human workers. These arms belong to a robot.



Premier Foods' newest machine can pack up to 1,000 Angel slices a minute. The robots "eyes" sense the position of the cake and any imperfections before deciding whether to pack them for consumption. Photo: Premier Foods

Up to one thousand Angel slices roll off the production line every minute. It is mesmerising to watch. Each arm decides which slice to take, the tray to put it in and where to move next, all faster than you can say “exceedingly good cakes”.

Humans are only needed to feed the machine and clean up, supplying new packaging, clearing away excess plastic wrap and removing any less than perfect cakes, to be sold in the staff shop.

Automation has become an increasingly common sight at Britain’s factories. But does this mean **humans are destined for the scrap heap?**

Robots are taking over

Earlier this month, **Bank of America Merrill Lynch warned that 45pc of all manufacturing tasks would be automated within a decade**, up from 10pc today.

The International Federation of Robotics says the number of robots in factories across the world rose by 225,000 last year, and will rise even further in the coming years – and it is not just in manufacturing.

The Henn-na hotel, which opened in Nagasaki, Japan, this summer, is the world's first to be staffed by humanoid robots.



Hideo Sawada, chairman and president of Huis Ten Bosch Co, demonstrates the check-in process at the reception of the company's Henn-na Hotel during a media preview this July Photo: Bloomberg

Even the great and good are paying attention. “Mastering the Fourth Industrial Revolution” will be the **theme of the World Economic Forum in Davos, Switzerland**, next year.

Of course, there were fears about the consequences of the previous three industrial revolutions. Lord Byron argued that “nothing but absolute want” would have driven the Luddites to smash the new machines in the factories of the 1800s.

John Maynard Keynes predicted that leaps in technology would bring abundance and leisure, but also the threat of a “new disease” of what he called “technological unemployment”.

But it is not just mindless, **repetitive jobs that are under threat from robots**. Computers are demonstrating their ability to perform complex tasks.

IBM’s Watson supercomputer has beaten the brightest minds at the quiz show game Jeopardy!, and has now teamed up with oncologists to develop a system that could diagnose cancer.

Human advantage

Andy Haldane, the Bank of England's chief economist, **warned this week that 15 million UK jobs could become automated within a couple of decades.**

Inside the Bank, it seems he is planning his tactical response.

On one side of his brightly lit office is a massive whiteboard of the kind found in a football dressing room.

But there is no half-time talk here. Instead, the scrawlings come with a message that robots will "fundamentally reshape the nature of work".

"Things that enhance productivity [including robots] are what cause economies to grow and for us all to get wealthier on average," he says.

"But this is a world where the average may not mean what it used to, because it's a world in which there will be wider gaps between skilled and unskilled, between those with and without jobs.

"They don't sound the death knell for jobs. It just means that we need to rethink carefully how best we make the best use of the resources we have."

Optimists say that humans have always been resourceful.

At the same time, while robots can effortlessly perform tasks humans struggled with for centuries, the most simple jobs sometimes remain the most difficult.

Rich Walker, managing director of the Shadow Robot Company in London, makes human-like hands for concerns such as Nasa and Qualcomm, the iPhone chip designer.

The technology Mr Walker uses is cutting edge. But even he cannot get a robot to do a simple task like pick fruit.

"We have a project at the moment that is looking at strawberry harvesting," he says. "At the moment a lot of fruit is still picked manually by workers.

It's labour intensive and companies have told us that there's an opportunity for robots there. If the robot can hit a price point per punnet, they'll use them."

So far, they have not succeeded. "All kinds of crazy ideas have come out," he says. "We've had people trying to redefine the way berries are grown: robots find it difficult because fruit doesn't grow in a uniform way."



Rich Walker, the chief executive of the Shadow Robot Company is pictured alongside one of his robotic hands Photo: AFP

The feat is possible on a small scale, if the berries are grown in boxes, he says. “But if you can’t even generate enough strawberries to feed Wimbledon, what’s the point?”

The problem has a name: Moravec’s Paradox, named after Hans Moravec, of the Robotics Institute of Carnegie Mellon University. Put simply, high-level reasoning needs very little computer power, but low-level motor skills require huge resources. Back in Barnsley, this concept is, literally, the cherry on top of all the efforts to mechanise production.

“They don’t sound the death knell for jobs. It just means that we need to rethink carefully how best we make the best use of the resources we have.”

Andy Haldane

Despite Premier’s £20m investment in the latest technology, its brand new machine doesn’t know how to put a cherry on top of a bakewell tart – so that has to be done by hand, as does rolling every Swiss roll, another task still done by humans.

Ian Bowles, head of sustainability at Premier, says: “We’ve never been able to automate everything, because at the end of the day it’s people who make decisions and it’s people who make judgment calls. There may be machines that can do that, but if it costs £10m to install just to put a cherry on top of a bakewell tart, it’s not going to be worth it.”



Robotic arms assemble and weld the body shell of a Nissan car in Sunderland
Photo: Getty

At Nissan, robots have been a staple of production process for decades. But investment in machines has also led to more jobs, not less. “Car assembly has always been a mix of man and machine,” says Kevin Fitzpatrick, Nissan’s vice-president of UK manufacturing.

The carmaker has invested millions of pound into a new body shop that uses 100pc robot welding. However, the volume of cars it now produces means the Japanese firm has hired 300 new people to provide the finishing touches.

New challenges

For Stuart Russell, professor of computer science at the University of California, Berkeley, Moravec’s paradox is already outdated. He says:

“It is clear that we’re going to see more and more capable systems and, I think, self-driving cars, domestic robots, personal assistants – something that plays the role of [Apple’s] Siri but has its own intelligence – those things are going to become more feasible and more commonplace.”

In decades to come, teenagers could use Siri as their personal assistant. It could even answer calls, or, as Russell suggests, spurn potential suitors - but only if programmed in the right way.

“You could get Siri to tell a boy you didn’t want to talk to to go away – that’s a relatively easy one,” he says. “Determining whether you like the boy or not is a different matter.”

"If you set wrong, or unclear objectives then as King Midas found out, you don't exactly get what you want, you get what you say."

Stuart Russell

This problem was flagged by Norbert Wiener, dubbed the "father of control theory". Back in 1960, Wiener warned that as humans built more capable machines, it was vital they programmed them in the right way.

"If you set wrong, or unclear objectives then as King Midas found out, you don't exactly get what you want, you get what you say." Russell says it is vital that humans programme robots to understand the "full spectrum of human values", because the stakes are very high.

"If you buy a robot to look after the kids before you get home from work but there's no food in the fridge, it could decide that the cat would be a good source of food and put it in the oven for dinner.

"Get it wrong with robots and it could wipe out the domestic robot industry overnight."

There are also more serious issues. Two MIT academics, Erik Brynjolfsson and Andrew McAfee, **highlight in their book *The Second Machine Age*** several reasons why this time could be different.



A robot waiter serves fruit to customers at a restaurant in Xuchang, central China's Henan Province, China Photo: Rex

Advances in technology will push more and more companies to favour capital over labour, they argue. The brightest and best will continue to come up with the game changers in society, but they will leave the majority behind.

“Those with no assets would have only their labour to sell, and their labour would be worthless,” the pair say.

This paints a rather bleak picture of the future. Education and training is one way humans can fight back.

Massive online open courses - or MOOCs - provide a vast source of knowledge for anyone with access to an internet connection. Perhaps the only barrier to their success is recognition.

- **These are the jobs that are being taken over by robots**

Only when these courses are taken seriously by employers can they provide humans with an advantage.

But what if retraining takes too long? Advances in technology are moving at breakneck speed. Humans may not be able to keep up.

As some professions become obsolete, more knowledge may not lead to higher pay either, because everyone will be bidding for the same work, which could drive wages down.