

The Good Robot Report:

The robot revolution
is coming

Foreword

When we imagine what our lives will be like in the future with technology, many of us take our inspiration from sci-fi books, TV shows and movies. Nearly one hundred years ago HG Wells predicted we'd be communicating by messages rather than in person. As long ago as the 1960s, we saw the Jetsons using video phones and robot assistants.

With robotics and AI technology developing at pace, robots will no longer be confined to science fiction, they'll soon become a very real part of our lives. In fact, independent analysts, Juniper, predicts that the total installed base for consumer robotics will reach 40 million in West Europe by the end of 2022. In this report we share for the first time UK consumers' views about a life with robots which is encouraging; with two in three expecting a robot in every UK home within their lifetime.

But whilst most of the early depictions of robots on the screen helped us, entertained us and were part of the family, we are now more likely to see them threatening our very existence. So it's important we acknowledge that the majority of people aren't aware of the opportunity a future with robots presents, or even worse, are fearful of it.

And just like with the introduction of other transformational technologies, such as, radio and TV, mobile and the internet; if consumers and business are to realise its potential, it's important to understand the ground from which we are starting from. This is why we commissioned this independent report. It acts as a window through which we can view the world through the eyes of the consumer and offers a unique opportunity for us all to evolve the way we engage with each other about a future with robots.

It is clear it will take a huge effort and commitment from academics, technology companies, governments and consumers, whether that's through advancing education and perception of robotics and AI, the type of products we develop or the way we collaborate to ensure that the result is a future where humans and intelligent, general-purpose robots can live in a mutually beneficial way.

As experts in robotics and AI, we don't just get to imagine a future where we coexist happily with robots, we can help create it too. And whilst we can see the future clearly, we want to help everyone envision a future where the robots in homes are entertaining, helpful and friendly. Where personality and technology combine to create robots we want to live with. Where the robots will develop into the ones we've been waiting for all our lives. A future with entertaining and purposeful robots in every home, everywhere.



Boris Sofman
Co-founder and CEO
Anki



Executive Summary

For the last 100 years, we have been bombarded by a series of consistent messages about the rise and role of robots in our society; first they will arrive to help us and then they will take over the world.

It's easy to laugh but these are the very dystopian visions often propagated by pop culture and the media that risk derailing our ability to both understand and engage with the potential of home robots to help us to achieve more in everything that we do.

Thankfully, since the beginning of time, humans have longed for a better relationship with technology and this new research shows that despite this dystopian vision, many of us remain optimistic about a future where robots live as part of our families.

In fact, when we asked people in the UK what they thought about a future with robots, only 25% couldn't envision ever having a robot as part of the family. The overwhelming majority meanwhile are hoping robots can offer more help across all areas of our lives. People are hopeful that a home robot might give us an extra two hours every day that they could put to better use, either to give them more time to establish deeper and better connections with other humans (38%) or simply to give them more time to develop new and greater skills (38%).

Interestingly, 16% of the people we spoke to are also looking for something more than just a better kind of machine to help with the boring, repetitive parts of running a family. They are hopeful that a range of new technological developments in the world of artificial intelligence might be able to offer them a more emotional connection with

machines, providing companionship and advice as well as simple mechanical advantage.

Thanks to recent advancements in AI, we have been able to develop robots not just to think, but also to see, hear and even "feel". Of course, machines don't actually have feelings and probably won't have for a long time to come (if ever), but through these recent developments they are increasingly able to understand and use social cues and behaviours to provide a more meaningful and representative interaction with any human.

A new generation of roboticists and scientist have jumped on this opportunity, believing that we can create the ultimate human/computer interface by adding an "emotional" dimension to the already established cognitive functions. Finally, after over 500 years of dreaming, it seems that these might actually be the droids we were looking for...

The benefit of adding an emotional capability to robots should not to be underestimated. By making the interaction with humans far more effective, the gains and potential challenges are significantly greater. But it won't come easy. There are many barriers yet to overcome before we will be able to welcome the newest members of our family with open arms.

The technological issues are not insignificant, after all, our homes aren't all uniform but if the past 50 years has shown us anything, the pace of technological advancement means it's likely to assume these technological barriers will be overcome soon.

The barrier to the rise of robots in our homes is more likely to come from whether we humans can accept a new type of relationship with robots

rather than the technological challenges that might make such an opportunity possible. Our research brought some of these concerns to light, exposing that 36% of people fear that robots might be hacked and turned against us, 31% worry they would lose their jobs and 27% fear robots might rise up and take over. One in five are also fearful of the “uncanny valley” where robots look human, but not human enough for us to feel easy about interacting with them.

Whilst by no means a majority, these concerns are significant and the fact they are shared by many of us shows we need to address these barriers if we are to maximise the potential of this new set of technologies. This potential is understood more clearly than ever by the public as nearly two thirds (60%) believe we would see robots as part of our families within the next 50 years and one in ten (12%) think it will happen within the next 10 years. I believe it will happen a lot sooner and that we will see the ancient ancestors of some of our favourite fictional robots like R2D2, C3PO and Rosie arrive in our families within the next 5 years.

“Therefore, we must move forward, not just because the potential is simply far too great to miss out on, but because we know that for thousands of years we have been working towards this moment where humans and machines can work together as equals, harnessing the best of technological capability with the best of human ability.”

To maximise this opportunity:

- We need to ensure the integration of social robots complements human activity and relationships, rather than replaces them.

- We need to help people better understand the potential that social robots can bring, through education and through more balanced representation in culture and society
- We need to recognise that no single group holds the answers to how we unlock the potential of these robots in our lives.

Academics, technology companies, governments and consumers must work together to create a regulatory and ethical framework that can unleash the potential of this amazing technology whilst minimising the potential associated negative impact.

The rise of the robots may not be as many of us expected, but we understand that the real result on offer depends far more on how we choose to interact with them than just the capability of the technology on its own. If the robots really are going to be successful in helping us improve our quality of life, it's actually going to be down to us humans to help them help us to make it happen.

Part One

Setting the Scene: The Robots Are Coming...

For thousands of years, humanity has been obsessed with the potential of automated machines. They've soared in our imagination from the artificial servants in Homer's epic Iliad through to the slick computer-generated images of both utopian and dystopian futures projected onto today's silver screens. They have entertained, inspired and they have scared us. But far from being relegated to mere figments of our imagination, they've also been standing alongside us in real life too. For over 500 years, step by step, our futures have become entwined to a point where it is increasingly impossible to separate our lives from that of the machines.

"It's not hard to understand why. As humans, we have an instinctive drive to evolve, to do better, to achieve more than we could before and, unlike many of the other species that we share this planet with, we have realised that in order for us to be really successful, we're going to need some mechanical help."

At their most basic, robots are simply machines, mechanical objects that can be programmed to perform a series of tasks automatically. If you follow that definition, as you look around your home you might be surprised to note that the robots have already arrived and are doing their best to elevate your ability to do more in your domestic life.

Your washing machine is a great example of this. You may not see it as a robot, but this heavy white

rectangular box performs a complicated set of tasks that would have occupied a huge part of the domestic chores your great grandparents would have had to fulfil as part of their everyday lives. From coffee makers to cars, bread makers to microwaves our domestic lives would be almost untenable now if we weren't able to rely on the mechanical advantage our automated assistants bring us every single day. If you're comfortable with this definition of robot then you might be surprised to know that most UK homes already contain several robots: 93% of UK homes own a microwave and 46% of homes own a dishwasher. Even if you're not comfortable with that definition and prefer a more "intelligent" mechanical alternative, it's pretty easy to see it in the trajectory of home ownership of smart devices. 88% of UK homes have access to a computer, 85% of UK adults own a smart phone and earlier this year, ownership of smart speakers doubled from 5% to 11% .

The origin of robots.

Despite the fact we have had the concept of automated machines for thousands of years, the term "robot" is a relatively new concept having only been brought into common usage in the 1920s as sci-fi short hand for a new generation of humanoid looking machines that were created to be the slave labour required to free human workers from the drudgery and oppression of factory work offered by early 20th century Europe.

We owe much of our current perception of robots to two Czech brothers who witnessed the growing inhumanity being administered to workers in the industrialised nations of eastern Europe. In particular, a young writer named Karel Čapek was increasingly disturbed by the poor conditions of

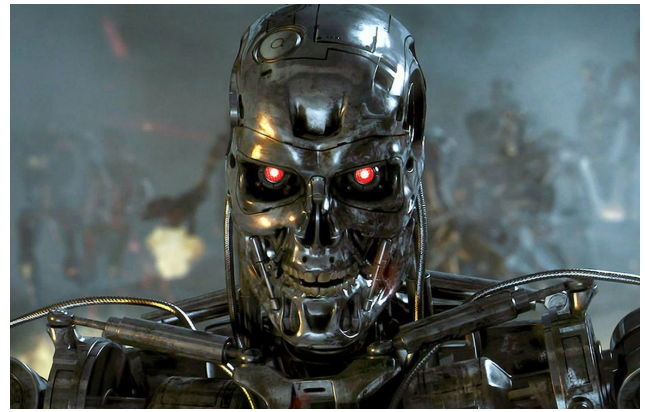
the factory workers and of the oppression being offered by the attitude of their hard line bosses. In successive works he sought to both bring attention to the problems but also to imagine a solution. Famously, his play “Rossum’s Universal Robots” presented a vision of a world where artificial factory workers could be manufactured and deployed to do the “dirty” work of human counterparts in order to set them free. Inevitably however, the over production of such machines ultimately leads to the demise of the human race.

While writing, Karel apparently struggled to find a word that he could use to accurately describe the machines that were at the centre of his play. He turned to the creativity of his brother for help, Josef, barely looking up from the easel at which he was painting, offered up the simple word “robots” as an extension of the Czech word “robota” meaning serf or forced labour.

And in that moment, the Čapeks seemingly both created the concept of modern robots and potentially sealed their fate, not just as the machines that were designed to serve humans but as the machines that would potentially destroy life as we know it.

Bad robots on the silver screen.

Since that play, the overwhelming majority of the depictions of robots in our lives show the dystopian potential of what may go wrong. In fact, looking back at the last 60 years of science fiction movies and television, you can almost count the number of “good” robots on one hand. By contrast, “bad” robots offer a far more attractive scenario to legions of science fiction writers and movie makers. With the notable exception of the Star Wars and Star Trek franchises - and even they had their moments, some of the most iconic science fiction movies of modern history all depict the role of technology as a force for evil.



From Cameron’s Terminator to Clarke’s HAL 9000, movie after movie, tv series after tv series, all seem to delight in coming up with new ways in which our new found relationship with robots may come to an untimely, dramatic end.

Whilst it may be OK to laugh this off as pop culture and good story telling, the danger is that the overwhelming proportion of negative role models being portrayed on screen can potentially have a damaging effect on how we perceive the value of robots in real life. Anecdotally we know this to be true because every time the topic of robots come up in our conversations, we all know it won’t be long before we start to discuss the disastrous fate that might befall us.

This hasn’t escaped the notice of the media either who seem almost to delight in bringing this dystopian vision to life. These days it seems like every day we are presented with headlines about “robots stealing our jobs” or how “artificial intelligence will destroy the human race”. With every new headline and every new movie, we risk switching a generation off from the potential of technology rather than helping them rise up to make the most of it.

¹ Family Spending Report; 2017; Office of National Statistics

² Feldman, Russel; “[Smart speaker ownership doubles in six months](#)”; April 2018; YouGov

³ Margolius, Ivan; “[The Robots of Prague](#)”; (July 2017)

⁴ Elliott, Larry; “[Robots will take our jobs, we’d better plan now before it’s too late.](#)”; (Feb 1st, 2018); The Guardian

⁵ Sulleyman, Aatif ; “[AI likely to destroy humans, Elon Musk warns.](#)”; (November 24th, 2017); The Independent

But somehow, from within all that dystopia, we have thankfully managed to hang on to a sense of wonder about what a world of well intentioned, useful machines might bring.

“The research commissioned for this report shows that only 1 in 4 people in the UK would rather not have a robot in their home with the resounding majority remaining hopeful that having a robot as part of the family would free them from domestic chores like cooking (25%), home security (25%) or simply just running errands such as accepting or delivering parcels (21%).”

Even with a relatively narrow view of what robots might do for us in the home, the majority of people we spoke with in the UK were hopeful of getting some time back from their busy lives that they could put to better use. In fact, on average, the UK public were hoping home robots might save them at least two hours a day to create the space for better outcomes.

Although much of the perceived opportunity for robots around the home seems restricted to scenarios where robots could do the jobs humans don't want to do, interestingly, a significant number of people are also looking for something on an entirely different level, they were looking for something that offers a fundamentally more human connection. Results from our own survey seemed to indicate this with 16% of people we spoke to, looking for companionship.

Perhaps we shouldn't be surprised by this. As robots and artificial intelligence technologies become more and more engrained into our



normal, everyday lives, it seems that our expectation of our relationship with them evolves accordingly. Increasingly it seems that what people are actually looking for is a very different connection with technology, one that feels fundamentally more human, a relationship that does not place the machine in the servitude of the master, but instead provides a sense of companionship intended to forge a deeper bond in order to help the human achieve more and be more fulfilled in everything they try to do.

In some ways, this new potential outcome for the relationship between humans and machines could not be further from the Čapek brothers understandable statement of dystopian enslavement. Unlike their grim, grey world of post first world war depression, this instead is a bright world of possibility, a world of potential, a world where empathy, character and personality have as much to offer as the ability to fulfil repetitive, dangerous or arduous tasks.

Part Two

The Opportunity: Putting the Emotion Back Into (Artificial) Intelligence

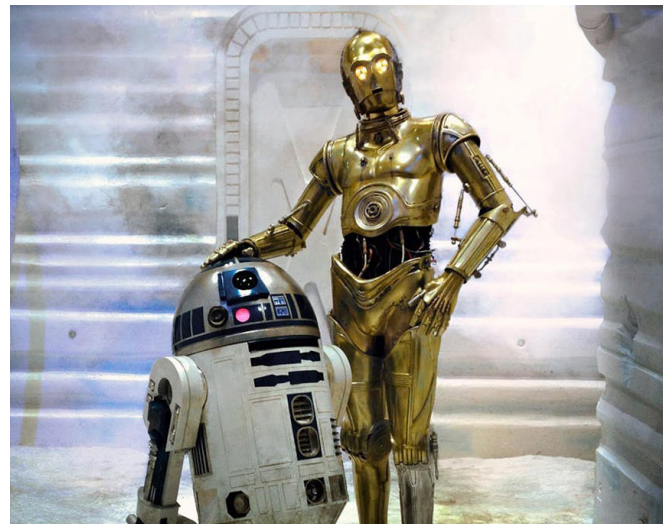
While the race to create more and more useful robots continued in hardware R&D facilities around the world, in 2006, in a university laboratory in Toronto, Canada, a leading computer scientist emerged with a development on an established way of helping computers think more like humans. This development in artificial intelligence technology was to prove as pivotal in the future of robotics as it was to the future of computing and it put a firm end to the “winter” that had been holding back all but the most determined of researchers looking for the next quantum leap in artificial intelligence.

The breakthrough from the work of academics like Geoffrey Hinton and his peers on deep learning and neural networks paved the way for us to bring more humanity to the cold, dark logic of robots and computers. It gave us a way to help machines see, hear and understand the world around them and for the first time we could give machines more than just code and instructions, we could help them begin to connect on a far more human level, we could help them both understand and communicate on an emotional level.

The opportunity of this was not lost on a generation of computer scientists and roboticists who were growing increasingly frustrated with the industrial, utilitarian application of robotics. These were people like Dr. Cynthia Breazeal, Associate Professor of Media Arts and Sciences at MIT’s Media Lab and Chris Atkeson, Professor at the Robotics Institute and Human Computer Interaction Institute at Carnegie Mellon University, who had grown up in the era of George Lucas’ debut of the fantastical Star Wars universe and as a result were inspired to want to create robots that

could become so much more than just a better factory worker.

Through Lucas’ window into another world, these young engineers saw a promise of a reality where humans and robots lived alongside each other, not as masters and servants but instead as friends and companions.



Emotion + Cognition = Intelligence.

What Breazeal, and her peers in universities and research labs around the world understood, is that the value of robots not just within the home, but more specifically within the family, could offer benefits far and beyond the simple productivity gains offered by the smarter automation of mundane tasks. They wanted robots with emotional intelligence as well as cognitive intelligence.

In Breazeal’s own words: “...robots complement our human abilities and relationships to promote quality of life and to empower us to be the people we aspire to be”. In short, these are not the droids we’re used to seeing.

Much of this new development in thinking pivoted

from some ground-breaking work in the field of neuroscience in the mid-nineties. In 1994, Antonio Damasio, a leading neuroscientist, published "Descartes' Error" a book that challenged our preconceptions of the role that emotions play in how we think and interact with the world around us. His work showed that not only were emotions crucial in decision making, they also fulfilled an essential role in how we perceive and interact with the world around us.

The ultimate human/ computer interface.

Building on Damasio's work, the roboticists realised that there was a far greater opportunity for society if we could improve the way in which we interact with the machines around us and, following decades of academic research, a huge amount of evidence started to emerge to show that the ultimate human computer interface is about how humans and machines can learn to relate to each other on an emotional common ground.

"What becomes obvious from



the results of this research is that if we are to have the best possible relationship with robots, we need to find a way of helping

them speak and understand the language of emotion, although to be clear, that does not necessarily mean they need to feel the emotion themselves."

This may also be the key to the next level of artificial intelligence, where we can transcend the basic pattern-based logic exhibited by today's deep learning algorithms and combine the power of cognition with the insight of emotion. Apparently, true intelligence needs both.

Helpful robots, helping humans live better lives.

In study after study, from one research lab to another, the experts all seem to come to the same conclusion, that only by equipping the machines around us with more effective communication skills and a sense of emotion, can we dramatically improve the outcomes of their interactions with other humans.

And it seems that we humans increasingly understand this. In our research, amongst the aspirations for robots with a higher degree of utility, many of the respondents were also looking for something greater, not just utility but a sense of human connection too. 16% of our UK respondents were looking for companionship, 11% just wanted something to listen to their problems and 12% felt that robots could help their pets be more fulfilled while they were away by keeping them company. Curiously the subject of pets comes up again, and whilst 42% of people could not imagine a robot as a replacement for a pet, 12% of respondents indicated that the companionship from a robotic pet would be better citing reasons such as not needing to be cleaned, fed or walked or having to be looked after while people were away.

In all of these examples, the humans were looking for a level of emotional attachment rather than just mechanical utility. Young people in particular, seem to be tuned in to the potential of having a robot sidekick with 19% of young people thinking that having a robot at home means they will never feel lonely again.

Using robots to create a more human future.

The optimism of these statistics seems to fly in the face of our reactionary dystopian perceptions of a future where humans and machines live side by side. One such cliché is the world where humans no longer need to work (or in fact do anything) in a world where the robots have taken over. Perhaps the best example of this was the wonderfully challenging "Wall-E" from Disney/Pixar. This was a world where humans have neglected the planet and themselves in a selfish pursuit of sloth enabled and to an extent justified, by the rise of the robots.



Although thought provoking, joyous and sad, it seems unlikely that this will become our fate. We have yet to see a time in our history where a technological development resulted in our ultimate redundancy. From fire to the wheel, through electricity to the internet, every single major technological development has served not to replace us, but to offer us a platform from which to reach further and at this point it looks like the rise of social robots will be no different.

When asked what people would do with the time saved by the arrival of robots in our families, a beautifully human range of responses came back: 38% of people would use that time to improve their connection with other humans (their friends and families), 38% wanted to use the opportunity to pursue their hobbies and interests. Self-improvement was high on the agenda too, with 28% of respondents wanting to take the opportunity to exercise more, learn new skills (24%) or even a new language (14%).

While it wouldn't make for a good Hollywood movie, it's incredibly heart-warming to see we humans still want to become more than we are and we want to use the potential of the machines to help take us there. Even with media and popular culture fearmongering of a dystopian robot enabled future.

So, given the research almost unanimously shows the potential and for the most part, we humans are willing, what then is preventing us from living up to all of the potential that robots have to offer us humans?

Part Three

The Challenges: Barriers Preventing Domestic Robot Adoption

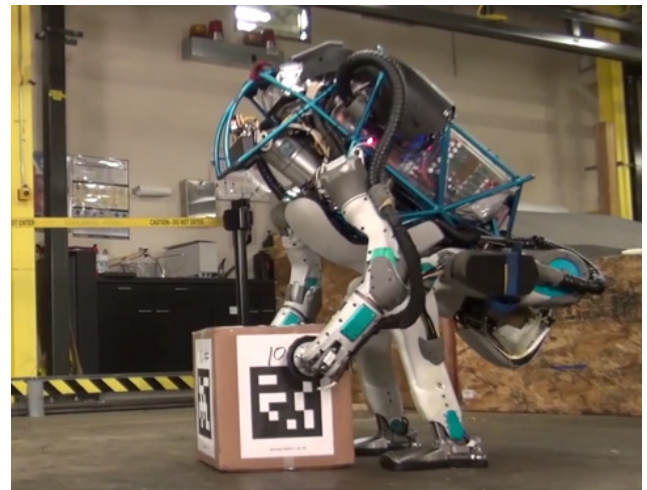
In the face of the incredible opportunities that lie in front of the potential of welcoming robots into our homes, it's hard to understand why it's been so difficult to make progress. But looking closer it's clear that there seem to be three major factors that are slowing the adoption and evolution of robots in our domestic lives. These factors are technical, social and ethical.

Technical challenges.

Part of the challenge of our domestic adoption of robots is that unlike the boring, predictable world of industrial robots, the home environment offers an altogether more chaotic environment. Not only is the layout of the home ambiguous and different from family to family and home to home, it is also in a state of constant flux as the inhabitants go about their day to day lives. The seemingly random nature with the flotsam and jetsam of everyday life being inevitably scattered across floors and surfaces means that for a robot to be able to navigate around that world it would need a lot of help from sensors and motors that are currently prohibitively expensive. Even owners of current robotic vacuum cleaners joke that the devices work so well because you have to clean up before they can operate.

And all of this before we even begin to consider Moravec's paradox. In the 1980's Hans Moravec, a research professor in the Robotics Institute at Carnegie Mellon University, established a principle which continues to govern and constrain the deployment of robots both inside and outside of the home. Simply stated, his work shows that everything that we think is difficult for a computer or a robot such as high level reasoning is actually

quite straightforward, especially now thanks to a world of deep learning and neural networks. Contrarily, everything that we think is simple and take for granted such as movement and fine motor control, the ability to navigate around our environment and pick things up continues to be frustratingly hard. There are some signs that Moravec's paradox may not hold true forever, especially as companies like the UK's Shadow Robot Company continue to use the power of AI to "brute force" the skill of picking up objects and replicating human dexterity but for now it's hardly something that's ready for the mass market, never mind the sanctity of our homes.



All of these shortcomings won't last forever though and along with better motors, batteries and further developments in artificial intelligence that will help robots see, hear and feel more than ever before, it's easy to think that the technological barriers may well soon be removed.

⁶ *Shadow Dextrous Hand*, Shadow Robot Company

Social challenges.

For most people however, it is not the difficulty in solving the engineering challenges of domesticated robots that hold up our adoption, it is our preconceptions and instinctive fears that make us feel uneasy about opening up our families to their potential. Our research clearly reflects some of these concerns.

“Of everyone we asked, the biggest fear is that the robots might be hacked and turned against us (36%), then we’re worried that they might take our jobs (31%) – a view that many headlines seem to reinforce and one that understandably seemed to be of significantly more concern to younger people than others.”

Visions of the Terminator come back again to haunt us with 27% of respondents fearing a world under the rule of our robot overlords.

Interestingly, then the concerns seem to shift to a more human level with a considerable group of people concerned about the emotional ramifications of sharing a home with a robot. From fearing a lack of understanding (20%), or that they might develop emotions (13%) or even the fear that their partner may fall in love with them (7%), it’s clear that we humans have a lot to learn about how we connect to robots on an emotional level.

And then there’s the issue of form factor. Science fiction, the media and in part, our own arrogance tells us to expect robots that are forged in our own image and yet the concept of near human

machines just feels weird to most of us.

The slight shudder you feel running down your spine when you see a humanoid robot that looks almost real, but not quite real enough is a well-documented phenomena, it’s called the “uncanny valley” – a place where we encounter an object that looks almost but not exactly like another human and instead of a connection, we feel revulsion.

Our research showed some evidence of an awareness of the problem of uncanny valley, with 1 in 5 of respondents preferring that robots didn’t look like us at all.

However, this is a concept that storytellers and artists have long understood. Most recently it’s been the bread and butter of the analogue and digital animators who for decades have helped us fall in love with inanimate objects imbued with humanised traits. From Mickey’s rogue magic brooms, to Pixar’s lovable trash compacting Wall-E, the talented individuals that brought these objects to life have figured out you don’t need to look like a human in order to invoke human emotions.

This power of this principle has not been lost on the roboticists seeking to bring the potential of robots inside our families with many of the companies now employing digital animators to help bring personality and human connection to their robots.

But as the technology gets better, and our social challenges are increasingly addressed by a different understanding of what robots might look like and how we might engage with them, we finally are faced with a series of ethical dilemmas that domesticated family robots might bring with them.

⁷ Mathur, Maya; Reichling, David; (2015); “*Navigating a social world with robot partners: A quantitative cartography of the Uncanny Valley*”;

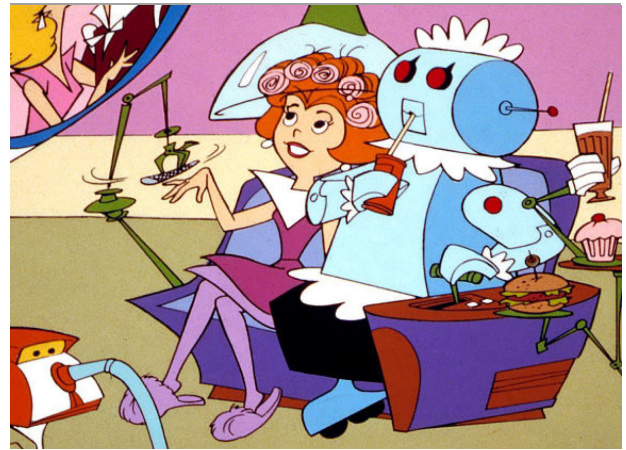
Ethical challenges.

As with most technologies, it's not until the capability comes that the ethical debates really start to take shape. Already we see concerns around the relationships that may form between humans and machines, especially in a domestic context.

The debate that most people seem to want to have first is whether robots experience the emotion, rather than simply interpret and mimic them, which leads directly to a discussion about the rights of robots in society. At this point it's really important to make the clear distinction between "feeling" and the "interpretation of" emotions. The current trajectory is for robots to be able to identify emotions based on verbal and non-verbal cues and to be able to use that insight to provide a response that is reflective of those cues in order to both be relevant and well received by the human involved. That's a world away from having the robot actually "feel" for itself.

The above debate is also somewhat of a distraction in the near term as the capability for robots to feel is unlikely to be possible for decades at least, even if it is possible at all. Instead, there are some other related, yet more pressing, concerns such as how we might interpret and internalise the relationship that might exist between today's robots and the humans they interact with.

Some of the concerns stem from the belief that given robots aren't human, how can the emotional experience of a relationship with one be valuable? Admittedly it's tough to quantify, but there is a broad precedent already set of the value of interactions with non-human objects. Scientists may laugh at the notion that I think my dog loves me, but the fact I think he does makes our relationship incredibly special and rewarding.



Others fear that human relationships might be replaced and that the relationships we have left might change how we interact with each other, much in the same way that social media and text messages have reduced many of our daily communications to less than 240 characters or a simple emoji or animated Gif.

Then there is the fear that if we do build close relationships with robots, could those relationships be exploited? This is especially prescient in a world where we already know that young people are far more trusting of robots than their adult peers. In a recent study by Plymouth University, researchers found that young people were significantly more likely to trust the input of robots without questioning them than adults, even when that input turned out to be wrong. This experiment highlights the duty of care that we all share, but in particular the roboticists, to ensure that our relationships with robots are both transparent and create a positive outcome in the lives of those that are engaged. Professor Noel Sharkey, chair of the Foundation for Responsible Robotics reacted to the research, adding "This study shores up concerns about the use of robots with children. If robots can convince children but not adults that false information is true, the implication for the planned commercial exploitation of robots for childminding and teaching is problematic." Dr Kate Darling, Research Specialist at MIT Media Labs puts it more succinctly – "robots + capitalism = questions...".

Perhaps most pressing, and underpinning almost all of the discussions above, is the way in which a domesticated robot may impact on our privacy. The smart robot of our future will inevitably be connected to the internet and the data it gains in order fulfil its role in the family will inherently be personal, simply by nature of the location in which the robot is being used. In order for humans to be able to trust the robot in an increasingly personal role in our families, they are going to have to be able to trust the robot and the organisation that created it. Just as we have seen in our relationship with social media, tech companies and governments, privacy will continue to be one of the major barriers to overcome if we are to truly unleash all of the potential social robots could bring our families.

Given the extent of all of these challenges in all of the domains, it's a wonder that anyone is seeking to move forward to build a world of engaging, domestic robots but in some senses, I think the rise of the family robot has already begun. Admittedly it's early days but already in most homes in the UK, you can begin to see their presence. From the simplicity of the domesticated appliances that lie in virtually every home in the UK through to the rapid growth of "smart devices" in over 10% of UK homes. Step by step, device by device, you can see the stage being set for the arrival of domestic robots that help to give us emotional as well as physical advantage in all that we do.

But we still have work to do, not just to address the challenges outlined above, but also to help our society get ready to make the best of all of the potential that these incredible machines might bring to our lives. If the robots are finally coming, we need to make sure we're ready for them.

⁸ Belton, Padraig; (August 2018); "[Children 'at risk of robot influence'](#)"; BBC News

⁹ Darling, Kate; (September 2018); "[Why we have an emotional connection to robots](#)"; TED.com

Part Four

Conclusion: Opening Up the Potential of Social Robots

Fundamentally it is my view that as the technology matures, so too will our social acceptance of robots into our families.

“Once we see and experience the benefit that an emotional connection with robots can bring, I think we will all quickly reach the same conclusion that all of the roboticists working in the space already know – that by working in partnership with the machines, we can extend our reach to help us achieve more in almost everything we do.”

The results from our research seems to concur with that conclusion. Despite all of the concerns that we’ve discussed in this paper, 60% of people still think we will see a robot as part of the family within the next 50 years with that number much higher – 73% in younger people, with 12% thinking it could even be within the next 10 years. Alongside a dramatic change in the capability and price of domestic robots it is likely we will see a plethora of new domestic companions within our homes within the next 5 years. For many, the future is actually already here, we just have to open our eyes and our minds to be able to see it.

But it’s clear that for many a lot needs to be done if they are to see beyond the negative headlines into the future potential of life with a robot and so open the doors to welcome robots into our homes and be part of our families.

We need to focus on areas where the robots can



partner with us rather than replace us, we need to create better role models and we need to establish a discussion where everybody has a voice that enables us to maximise the potential of this new technology in our society while minimising the risk.

“The biggest opportunity for social robots is not to replace us or simply to live in servitude to us, but is instead to help extend our reach, to make us more effective in everything we do by working with us not for us. They should not make us less human, but should instead make us better, enriching our human experiences by facilitating, complimenting and extending existing relationships in a new way.”

Creating better role models.

Although our research shows that people in general continue to be optimistic about the potential of robots at home, it's clear that we need to help them think about other ways in which they may bring value to our lives. We will also have to go a long way to help people become more comfortable with the value and opportunity a more "emotional" connection with technology can bring. And that's where we need to rethink our approach to how we help people engage with the potential of domestic robots. We need society and culture to do a much better job in creating better role models, and to seek to inspire and enthuse and to help balance out the criticism and scaremongering. Don't misunderstand, I think it's important to be critical and to help people engage with flaws and limitations, but not at the expense of helping them see the potential for good. In a world full of reflections from society's "black mirror" we need to take some time to show the equivalent reflections from our "white mirror" – which is in fact more reflective of our actual relationship with technology.

In addition to better role models, increasingly we are going to need real life examples of the technology that are accessible and affordable for people to start their own relationship with this new kind of human-computer interaction. It's only when people have first hand evidence of a new technology that we can start to fine tune both how we maximise the opportunities as well as manage the challenges. We need real examples to be able to get the chance to explore our relationship, to choose the experiences we like best and least, and to work with researchers and roboticists to help define what the right approach should be to bring the power and potential of robots into our families.

Involving everyone in the discussion.

In order to make all of this happen, we will need a clear set of guidelines to help this development, a regulatory and ethical framework that can put the focus on the benefits it could bring society and not

simply the commercial value they offer companies and governments.

And we all need to have a voice in this conversation. In a world of technology companies, academics, governments and citizens, no one group has the answer, but collectively we can come together to figure out how we can maximise the potential of the role of robots within our families while minimising the risks.

We have to find the right forum for us all to be able to have an open-minded pragmatic conversation about how we can navigate our way through both the challenging times that lie ahead whilst remaining open minded about how new technology might help us be successful across all our endeavours.

As citizens we also have a role to play, we should increasingly be active and vocal about our concerns but also be helpful and rational about areas where the technology genuinely may offer us value. We should not be shy in being heard or in challenging the assumptions and developments of those creating, reporting on or regulating the technology, it is only when we can work together that we can ensure that we reach the right result for all of us.

Final words.

The roboticists I've focused on in this report are not chasing the technology blindly, seduced by the machinery at the expense of the practicality or value of its implementation. They view emotion as the next big technological disruption, a means of helping us get the best of human experiences with the power and scalability offered by technology to deliver the value of a humanised service to the global population, not just the privileged few.

But it's clear that the public will need to be guided on their journey to be able to see and understand for themselves, the potential that robots could bring to their families and their homes.

Our challenge therefore is not just how we govern and guide the development of the technology and those that create it, but is in equal measure about how we enthuse, inspire and engage the people that stand to benefit from its application.

If we are to deliver the incredible benefit that the adoption of robots into our families can bring, benefits that give tangible, positive educational and emotional outcomes to the people we care about most, we need to do our very best to ensure that every member of our society is best placed and empowered to live up to that potential. Just as it has been for thousands of years, the future belongs to neither human or machine alone, but instead to those that can combine the best of technological capability with the best of human ability.

“The rise of the machines may well have already started but it is entirely down to us humans to decide whether this story ends in a Hollywood cliché or the emancipation of the human race.”

I for one welcome the robots into our lives, not as our overlords or our slaves, but as our companions, working not in competition but in partnership combining the best of both worlds to create a better future for all of us.

End Page

About the author

Dave Coplin is an established thought leader on the role of technology in our personal and professional lives and author of two books focused on a single goal - helping humans to get the most from all of the potential that modern technology has to offer. With over 25 years of technology industry experience, he has worked across a wide range of industries and organisations, providing strategic advice and guidance around the intersection of a modern society and technology both inside and outside of the world of work.

About Anki

Anki brings objects to life through robotics and artificial intelligence, allowing people to build relationships with technology that feel a little more human. For more information, visit www.anki.com

About Vector

[Vector](#) is Anki's first home robot with personality. Fully autonomous, cloud-connected and always-on, Vector represents a major leap forward for consumer robotics by bringing accessibly-priced, life-like robots to millions of homes.

Vector is available to order in the UK now on Anki.com Harrods, Argos, John Lewis, Amazon for £249.99.

Quantitative data from a survey of 2,020 UK adults carried out by Censuswide in August 2018.