

## 6. Internet - Looking forward

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” “Free expression is the base of human rights, the root of human nature and the mother of truth. To kill free speech is to insult human rights, to stifle human nature and to suppress truth”

*Liu Xiaobo, Nobel Peace Prize laureate of 2010 and human rights activist*

### CHECKLIST FACT SHEET 23 – INTERNET OF THINGS

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In the same manner that you already protect your computer and other devices from security intrusions, be sure to apply those measures to your “Internet of things” devices.

Be aware that it is difficult to protect every individual device, but that you can protect your network and reduce your areas of vulnerability.

Carefully consider any “Internet of toys” items that you plan on introducing into your home and to your child. Check the security and privacy parameters of the toy and ask yourself: “How necessary is this toy?”

### CHECKLIST FACT SHEET 24 – ARTIFICIAL INTELLIGENCE, AUTOMATION AND DISRUPTIVE TECHNOLOGIES

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Have you informed yourself about the latest developments in artificial intelligence and automation?

Have you invested in your interpersonal, social and emotional skills?

Have you set up your “smart” devices to ensure appropriate levels of security and user-protection?

### CHECKLIST FACT SHEET 25 – VIRTUAL AND AUGMENTED REALITY

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Have you talked with your child/student about key topics such as sexism, sexuality, racism, bullying, stereotypes and other forms of discrimination?

Have you made sure that the devices your child/student uses are set up correctly, with high privacy and security protection?

Have you checked that your child/student maintains a healthy life balance when using virtual or augmented technology?

### CHECKLIST FACT SHEET 26 – ARE YOU THE PRODUCT? BIG DATA, DATA MINING AND PRIVACY

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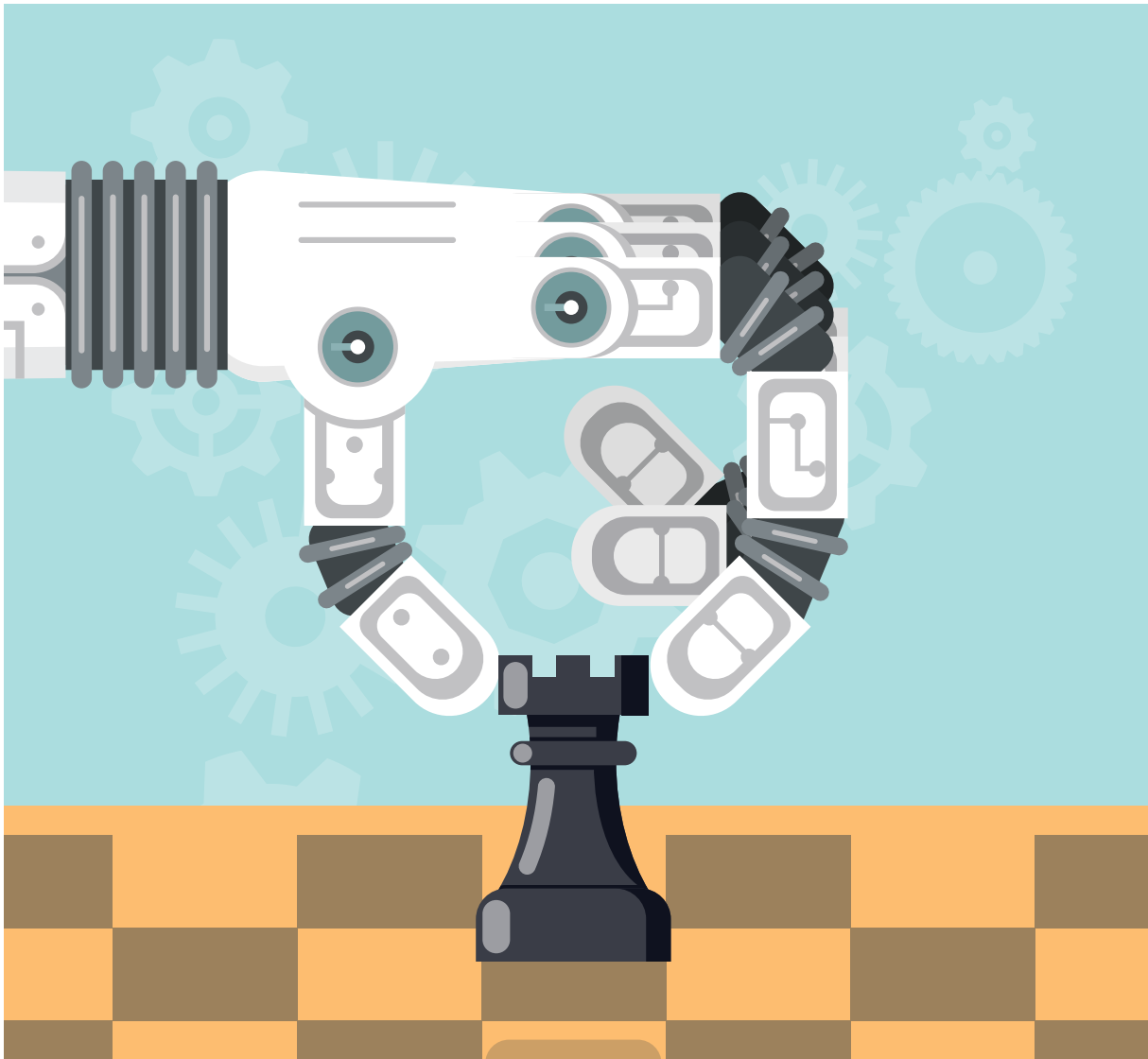
Have you taken the time to review the way your private data is treated by the online services you use, and to set up adequate privacy settings?

Have you recently reviewed the content you have posted online to make sure that it is still accurate and that you are still willing to share it?

Do you stay informed about the latest developments in “big data” to understand how these changes may affect you and what you can do about it?

## Artificial intelligence, automation and disruptive technologies

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■ “Automation”<sup>1</sup> is the process by which any action or function operated by a human is replaced by a machine and “artificial intelligence”<sup>2</sup> is the intelligence exhibited by machines or software.

■ At many points in history, technological leaps have destroyed jobs and created new ones. Take, for example, telephone operators, who disappeared completely as telecommunications technology evolved. Disruptions in the labour market caused by technological revolutions are not a new phenomenon, but each time society fears that there will not be enough new jobs to compensate for the lost ones.

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1. <https://en.wikipedia.org/wiki/Automation>

2. [https://en.wikipedia.org/wiki/Artificial\\_intelligence](https://en.wikipedia.org/wiki/Artificial_intelligence)

■ Thus far, such fears have been largely unjustified, as jobs that no one could imagine were created in sufficient numbers to compensate for the jobs lost. For instance, no one envisaged, two decades ago, that there would be such a job as a “social media manager” or a “search engine optimiser”.

■ At the same time, current technological developments in artificial intelligence, machine learning and automation are threatening a much larger proportion of the labour market, and not just the low skilled jobs.



## NEW DEVELOPMENTS

### Self-driving cars

■ Although there is a long road ahead before self-driving cars are available and ready for mass production, progress in this field has been undeniable. Tesla, for instance, already manufactures cars which can drive autonomously on a highway. The follow-up of the very first fatal accident due to a software error in a Tesla car in May 2016 will contribute to determining the future of self-driving technology. The biggest obstacle is not the technology itself but the problem of liability in the case of an accident and the necessary adaptation of the law to situations where machines make decisions in critical situations. But once these roadblocks are removed, taxi drivers, truckers and public transportation drivers (metro, bus, tram) will disappear. In the EU, the transport industry accounts for 4.5% of total employment.

### Automatically generated websites, apps, games

■ Web design is a recent profession but it may disappear even faster than telephone operators. Nowadays, with website builders, creating a website has become easier and easier, requiring the user to simply manipulate content by dragging and dropping it on the screen. Complex algorithms are now able to generate your website automatically based on your preferences. “The Grid”<sup>3</sup> is the first service to propose automatic website generation based on your preferences. It just needs pictures, content and some information regarding the purpose of your website and your preferences to generate a fully scalable website (compatible for all screens from computers to smartphones). This is just the beginning. As artificial intelligence, algorithms and machine learning advance, many jobs which required programming skills will be automated, leaving only jobs which require a lot of creativity, customisation or innovation.

### Randomly generated art

■ Thanks to advances in machine learning, computers are now able to produce artistic creations ranging from images and paintings to music. Google’s “Deep dream”<sup>4</sup> generator analyses your image and shows you imaginary objects inside, much like when you look at the clouds and see a dog or a flower. Other programmes are capable of emulating the style of a painter like Van Gogh or Picasso and applying it to any picture that you have taken<sup>5</sup>. In music, Emily Howell<sup>6</sup> is a programme that is capable of analysing musical scores, inferring the “rules” or “patterns” inside the music, and composing music in a similar genre. While this does not mean the end of artists, it certainly will have an impact on art.

### Robots and self-service

■ Huge online retailers such as Amazon invest heavily in robots to carry out tasks such as sorting and organising products or fetching products for delivery. The very first hotel managed entirely by robots has opened its doors in Japan. Self-scanning stations in supermarkets, self-service in restaurants, industrial assembly lines filled with robots, robot assistants in health care and elderly care, automated shipping processes for online shopping and services such as hotels are starting to be managed by robots. More and more examples of automation will be found around the world. Even construction work can be automated with the dawn of 3D printing!

3. <https://thegrid.io/>

4. <http://deepdreamgenerator.com/>

5. <http://web.archive.org/web/20160114142911/http://arxiv.org/pdf/1508.06576v2.pdf>

6. <http://artsites.ucsc.edu/faculty/cope/Emily-howell.htm>

## Predictive and accurate algorithms

■ Thanks to the combination of big data, super computers and powerful algorithms, many sectors such as health care will undergo a new revolution. With massive amounts of health-related data available, algorithms are becoming better than doctors at making a diagnosis based on symptoms, real time sensors and past medical record data.

## AI and machine learning

■ With advanced software and computers, it is possible, nowadays, for machines to learn either by observing human actions and deriving certain “rules” or “patterns”, and emulating these, or simply learning by doing and inferring “rules” by examining the results of certain actions. For instance, computer programmes have successfully been able to finish video games by “learning” how to beat enemies, jump over obstacles and so forth. There is no telling how much machines will be able to “learn” in the future, but at present it is already clear that repetitive tasks are well within their reach.



## EDUCATIONAL BENEFITS

- Learning how to code opens the door to a deeper understanding of robotics and software, including basic AI and automation. This is of utmost importance to identify and sharpen skills that are still outside the reach of computers and machines, and to develop skills that will be needed to push these technologies even further. With low skill and repetitive jobs taken over by machines, there is nothing left but to get more educated.
- At the same time, learning about automation and AI will help shape opinions on policies that will ensure that their impact will benefit society as a whole. For instance, many authors writing about automation and AI advocate a universal salary and lower working hours. A number of scientists, researchers and prominent figures such as Stephen Hawking have signed an open letter calling for a clear direction for the development of AI to avoid being one day enslaved by machines<sup>7</sup>.



## ETHICAL CONSIDERATIONS AND RISKS

### Joblessness

■ The most evident risk of AI and automation is the creation of fewer jobs than they replace. Even though it is impossible to foresee the jobs that might be created as these technologies advance, these new jobs will require highly skilled labour and there will be little opportunity for employment of people with just secondary education.

### Growing inequalities

■ As low-skilled jobs get scarcer, there will be a growing inequality between those who have marketable skills and those whose skills are gradually replaced by machines. Another form of inequality will also hit countries with some countries having the technological know-how to make the transition to automation and AI innovations whilst others rely on manual labour. Without proper social, employment and education and training policies, inequalities may stir social unrest.

### Over-reliance on machines

■ Automation and AI are no silver bullets. At present, they still require human supervision and only help to complete a more complex task. For instance, while flying an aircraft in autopilot at cruising altitude poses no problems to software, landing and take-off still have to be done manually by humans. However, since human pilots get less and less training and practice, they may be less able to manage a “critical” situation which cannot be handled by an autopilot. The same can be said about self-driving cars. In a future where transportation is automatic, what will happen if the software fails

7. [http://futureoflife.org/AI/open\\_letter](http://futureoflife.org/AI/open_letter)

and no human is able to drive anymore? More importantly, if machines end up doing everything for us, and are even capable of creating and repairing themselves, what are we, as humans, supposed to do? This could trigger massive regression of a part of the population which would simply seek entertainment at the expense of sharpening their skills and knowledge which, in turn, would fuel further inequalities and social tensions.

### Slow or inappropriate adjustment and development of skills

■ What automation and AI will achieve in the future is anyone's guess and thus imagining which skills should be promoted because they are "future proof" is a very difficult task. For instance, the world of education is slowly waking up to the idea of teaching programming and coding in schools, but the latest developments in AI show that it is possible to automate programming itself, since it is based on logic and clear rules. The automatic generation of web design is just one example.

### Security

■ As with any device connected to the Internet or relying on software, AI and automation are also vulnerable to hacking. But the consequences could be much more serious than stealing or destroying your personal data. A team of security specialists have demonstrated that it is possible to hack and take over a connected car and carry out actions, such as turning off the engine, or even taking over the steering wheel at slow speeds. Imagine the consequences if a "self-driving" car without a steering wheel was hacked.

### The end of dull work, the start of a dull world

■ Perhaps the greatest challenges posed by AI and automation are philosophical in nature. What makes our world interesting? Can humans be happy in a world which is fully understood, predictable and optimised, with everything running "according to plan"? What about human spontaneity, the deliberate choice to make a mistake and learn from it, or even the right to make an unreasonable decision simply because we can? Introducing "automated" decisions is the logical follow up to our societies driven by science, facts and reason, but is it healthy for humans? Although a century ago, many scientists and intellectuals predicted the end of religion thanks to enlightenment by science, we see now a return of interest in spirituality and religion. Perhaps it is a symptom of a world which is unable to provide humans with a meaning to their lives and is at war with what makes us human: emotions, feelings, impulsiveness and irrationality.



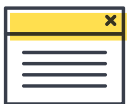
## IDEAS FOR CLASSROOM WORK

- A good introductory classroom activity for presenting artificial intelligence, is the so-called "intelligent piece of paper" activity. It consists in presenting a piece of paper with printed instructions on it that can beat any child or young person at the game of noughts-and-crosses (tic-tac-toe). See the detailed instructions here: <http://web.archive.org/web/20160326100226/http://csunplugged.org/artificial-intelligence/>.
- As a follow-up to that basic activity, ask your children or students if they are aware of any artificial intelligence they use in their daily lives.
- Your students will probably have a smartphone and most smartphones come with their own "personal assistants", namely Siri for iOS/Apple, Google Now for Android/Google and Cortana for Windows/Microsoft. All three present characteristics of artificial intelligence: they have a voice recognition feature which gets better as it listens to millions of human voices, they have an algorithm for answering questions you ask and they personalise information they display to you based on the data you feed them (search data, contact details, location data, etc.). The same applies to basic features like predictive typing. This is also AI technology.



## GOOD PRACTICE

- Artificial intelligence, automation and machine learning can be very useful, but never forget to maintain certain manual skills in case they fail. For instance, even if GPS applications are now common on smartphones, it is never a lost exercise to learn how to read a map and develop your sense of orientation.
- Keep everything under control. There are many levels of automation, the most extreme being a machine taking decisions with no input or validation by humans. Just as in predictive typing where the user always has the choice to accept or reject the proposal made by the software, so too should you configure any automated or AI-powered device or software to require your validation.
- Be prepared for change and be versatile in developing many different skills. As these disruptive technologies enter the market, it is the most versatile and flexible workers that will be able to adapt. In the future, it is very likely that workers will have to “retrain” or return to education frequently to develop new sets of skills. Lifelong learning will be the norm.
- Boost your interpersonal, social and emotional skills, as these are safe from any form of automation. While robots and algorithms will be able to replace many low-skilled jobs, they will never be able to replace quality and human interaction.
- AI and automation rely on software. Make sure that any “smart” device that you own runs the very latest software version by regularly checking for updates, and adjust to high security settings. If your device does not require permanent connection to the Internet to function, make sure it is disconnected to lower the probability of hacking.
- In order to connect the dots and have a global overview of what the future may bring, make sure that you read the Fact sheets on big data, augmented and virtual reality and the Internet of things. Understand that big data is what fuels artificial intelligence and automation, that augmented and virtual reality are new ways of interacting with AI and machines, that the Internet of things will be not only another way of interacting with AI and machines, but also a means of feeding them valuable data which will further fuel their development. Only by understanding the big picture will citizens be able to make conscious and informed decisions about harnessing these changes for a better society.



## FURTHER INFORMATION

- This is an article about artificial intelligence from the BBC: <http://web.archive.org/web/20160509115227/http://www.bbc.com/news/technology-34224406>.
- Google offers a research page about artificial intelligence and machine learning: <http://research.google.com/pubs/ArtificialIntelligenceandMachineLearning.html>.
- News about automation is available here: <http://www.automationworld.com/>.
- This is the official web page of the Consumer Electronics Show which often showcases the latest innovations in the fields of technology: <https://www.cesweb.org/>.
- News about the latest research and innovation in the field of ICT is available from the EU Commission Research and Innovation Magazine: <http://horizon-magazine.eu/topics/ict>.