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KA220-HED-000029536 – Cooperation partnership in the higher education.

HEDY
Life in the AI Era

BOOKLET

An essay on life in the AI era

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BOOKLET - An essay on the life in the AI era

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2022

https://lifeintheaiera.eu/

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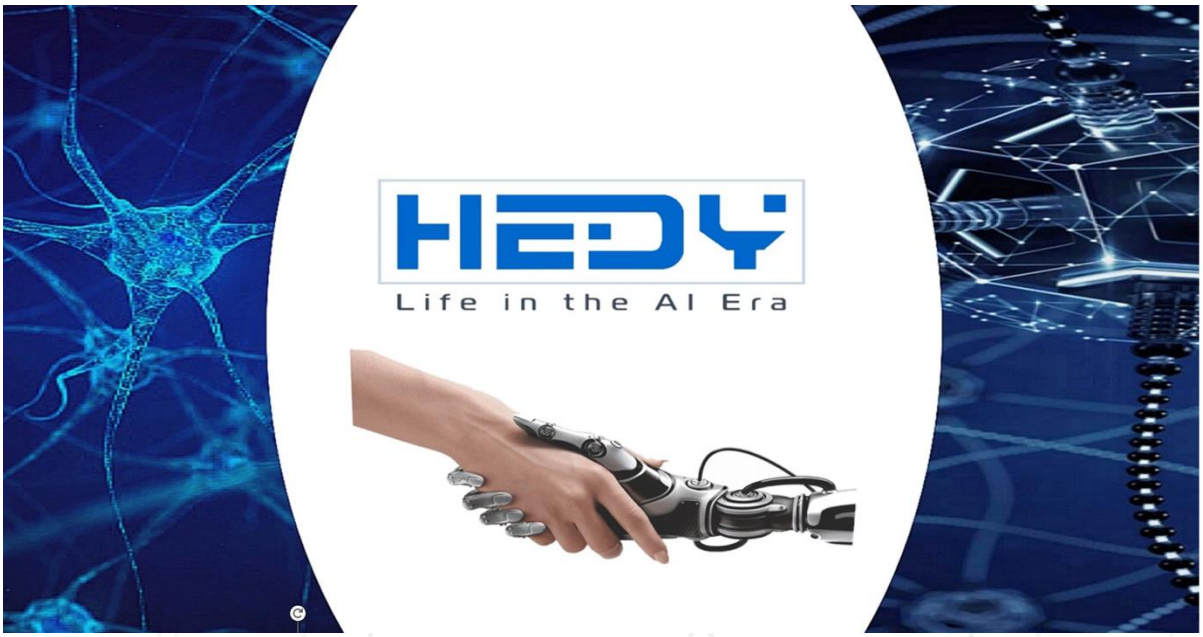

The HEDY project

HEDY - Life in the AI era is a 2-year Erasmus+ project started in November 2021. In its own title, it provides tribute to Hedy Lamarr, an Austrian actress and inventor (1914-2000), co-creator of wireless communications technology, adopted to control torpedoes during World War II and currently still used in mobile networks, Bluetooth devices and Wi-Fi. HEDY project stands for being a free and accessible source of information regarding the digital technologies of the 4th industrial revolution (Industry 4.0), namely AI, by enlightening its possible positive future applications, whilst clarifying the possible impacts. HEDY's goal is to offer a comprehensive and shared view of how AI is affecting our lives and reshaping our socioeconomic, cultural, and human environments by promoting critical reflection, self-based learning and debate on these issues. The main target (but not exclusive) of this project is higher education audience.

Abstract

The Booklet is an essay defining the HEDY position on life in the AI era and the rational for that position. In this work, we describe and present the results of our two-fold approach to build our rational about the challenges, opportunities and expected impact of AI on four areas: business, governance, skill & competencies, and people & lifestyle. This two-fold approach consists of collecting information from two sources: i) Literature survey, and ii) Interaction with people. Clearly, the first source consists of collecting the current state of knowledge about the impact of AI. The second source was a mixed approach consisting of both questionnaires and focus groups conducted in five different European countries with either experts or non-experts in AI. These two sources provide a unique contribution on AI panorama by combining state of the art research with different social actors' opinions and debated questions, concerns, and ideas.

Authors

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October 2022

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1. Introduction

The digital is invading our world, with technology being used in all dimensions of life, from education to work, health or governance. Knowledge and skills development is now a lifelong process, demanding growing digital literacy. But for some members of society, such as 'digital natives', using technology is natural, but this is not necessarily the case for the non-native digital persons (the so-called digital immigrants). How do we ensure that every citizen develops the necessary skills to remain included in an increasingly digital society? And how achieving fairness rather than amplifying inequalities? Assuming that Artificial Intelligence (AI) will transform the labour market, it is relevant to imagine the education system in a world where work is not a central factor in life or where jobs, as we knew them, do not exist. What would be the role of education? How could we organize it? What would be its aims and what needs would it address? And nothing better than proposing the use of technologies to raise awareness of life in the digital age and to develop skills to enjoy the benefits but also face the challenges that this new age offers.

This is the leitmotiv of HEDY – Life in the AI era [1.1]. HEDY project stands for being a free and accessible source of information regarding the digital technologies of the 4th industrial revolution (Industry 4.0), namely AI, by enlightening its possible positive future applications, whilst clarifying the possible impacts.

Four specific objectives will be produced to reach this goal:

A **Booklet** – an essay defining the HEDY position on Life in the AI Era and the rationale for that position. It organizes the AI features and positive impacts, risks associated with certain uses and identifies challenges, opportunities and expected impacts with paradigmatic examples, offered in an engaging way to stimulate reflection and debate on knowledge society topics.

A **Toolkit** – a collection of influential audio-visual tools, showing how AI could tackle some of the world's most challenging societal issues, as well as the risks to be mitigated if AI realizes its full potential, to be used flexibly to support learning and debate activities. It includes fictional and factual films & documentaries and expert speeches, of which five to be produced under Hedy;

A **Massive Open Online Course** (MOOC) – a course to promote extensive knowledge, critical reflection and debate on AI and its key impact on society. It will be free and open access for participants, with interactive forums. The course will be structured in 5 modules and authored by experts. Participants can share ideas and get deeply involved in AI subjects via a variety of online activities.

A **Guideline** – a concise and easy-to-read documentation explaining the nature of the HEDY learning resources, the best use of the assets produced and a glossary with key terms on AI related topics. It will help to create a solid foundation for ensuring the usability of the HEDY results by a wider community of practice network, even after the end of the project.

In this document, we present the Booklet. It plans to be a contribution to the challenge launched by the European Commission to build a solid European approach to AI, based on the 2018 strategy [1.2] and reinforced by the 2020 White Paper on AI [1.3]. It also contributes to the ethical framework of UNESCO [1.4] which provides in its resolution the basis to make AI systems work for the good of humanity, individuals, societies and the environment and ecosystems, and to prevent harm.

As stated above, its scope is to organise the AI features, identify challenges, opportunities, risks associated with certain uses, and expected impacts on four different ambits of our society:

- **Business** - with the increasingly vast amount of data available today and the constantly evolving preferences and complexity of customers, businesses can no longer rely on traditional business methods to drive growth. These radical changes have opened up new realm of possibilities, with AI, to drive business growth through actionable insights generated from customer data.
- **Governance** – the word governance has become embedded in standard business vocabulary and it is something that includes all processes of governing. It is the way rules or actions are structured, maintained, and regulated – and often how accountability is assigned. AI governance should close the gap between them and makes sure that boundaries within technology are set (i.e., they are ethical).
- **Skills & competences** – it is a virtual certainty that AI is beginning to replace increasing numbers of labourers: outsourcing of labour to machines will alter the skills & competencies which are valuable in a competitive labour market. In response to the inevitable changes in the work force, education systems' priorities seem to need a shift to reflect the skills & competencies that will be valuable in an AI dominated era.
- **People & lifestyle** – AI came to stay in our daily lives. From making our day-to-day lives easier with online search recommendations, voice assistants and facial recognition logins, to facilitating advances in healthcare, identifying pandemics, and helping alleviate starvation, AI is a truly transformative technology with far-reaching effects.

Besides describing the current applications and expected impacts of AI, for each ambit, we also identify the 5/6 more concerning issues about AI. Nonetheless, we are not trying to provide general solutions of these concerns; on the contrary the idea is to offer an engaging way to stimulate reflection and debate on knowledge society topics, discuss the ethical effects of these emerging digital technologies and provide paradigmatic examples.

To reach this goal and build our rationales, we collected information from two different sources.: i) Literature review, and ii) Focus groups. The first source consisted of collecting the current state of knowledge about the applications and impacts of AI. The second source consisted of gathering information by interviewing people through focus groups conducted in five different European countries with either experts or non-experts in AI. These two sources provide a unique contribution on AI panorama by combining state of the art research with first-hand opinions and debated questions, concerns, and ideas of interacting individuals.

The rest of the paper is organised as follow. Section 2 describes the fourth industrial revolution, namely the digitization and automation of manufacturing by means of a fundamental shift in the way products are produced, and it is deeply tied to the large adoption of AI. Section 3 is dedicated to the definition of AI and the identification of the main challenges and opportunities in general terms. Section 4 overviews the current applications of AI and the expected impacts of AI in the four ambits discussed above. In Section 5, we summarise our findings and highlight the key ideas of the focus groups. Section 7 concludes the paper.

2. Industry 4.0/5.0

It is instructive to remember that this is not the first-time society has been disrupted by an industrial revolution, but the fourth. Before the 19th century, a large percentage of the workforce was concentrated in the agricultural sector and the use of mechanical machines were very limited. Throughout the last 2 centuries, humanity has experienced four industrial revolutions that radically changed our life and our society.

1760-1840

The First Industrial Revolution took place in Europe and the United States. The use of steam and water power marked the move from hand production methods to machines. The first sector where this transition happened was in the textile followed by iron industry, agriculture, and mining. It also marked a societal repercussion: the growing of the middle class.

1871-1914

The Second Industrial Revolution is also referred as Technological Revolution. It was triggered by the construction of vast railroad and telegraph networks and the large introduction of electricity. As factories became more electrified, they were able to construct the modern production line. It was a time of rapid economic expansion and increased productivity, but it was also a time of high unemployment as many manufacturing employees were replaced by machines.

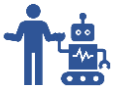
1969 -

The Third Industrial Revolution is the Digital Revolution and it occurred after the end of the Second World War. It consisted of the transition from mechanical and analogue to digital electronics, which began with the adoption and proliferation of digital computers and digital record-keeping. The mass production and widespread usage of integrated circuit (IC) chips, and related technologies, such as computers, microprocessors, digital cellular phones, and the Internet, are at the heart of this revolution.

2011 -

The Fourth Industrial Revolution, also known as Industry 4.0 was first introduced by a team of German scientists in a high-tech project, which promotes the computerization of production [2.1]. In essence, Industry 4.0 is the trend toward a union between physical assets and advanced digital technologies like Internet of Things (IoT), AI, robots, drones, autonomous vehicles, 3d printing, cloud computing and others, that are interconnected, having the possibility to communicate, analyse and act.

2011 -



Industry 5.0 is a new model, specially pushed by European Union, to redirect the focus of Industry 4.0. It is not considered another industrial revolution but a complement of the present one to bring the human, social, and environmental dimensions back into the equation.

There are three reasons why today's revolution is not just a continuation of the Digital Revolution, but rather the start of a new one: impact, speed, and scope. The present rate of breakthroughs is unprecedented in history. Emerging technological developments in disciplines including AI, IoT, autonomous cars, robots, quantum computing and networking, nanotechnology, etc. make Industry 4.0/5.0 progressing exponentially rather than linearly as in the precedent industrial revolutions. Furthermore, it is causing havoc in nearly every business in every country. And the breadth and complexity of these developments indicate a complete overhaul of production, management, and governance systems.

Industry 4.0/5.0, like the previous revolutions, has the potential to boost global income levels and enhance the quality of life for people all around the world [2.2]. To date, those who can afford and access the digital world have benefited the most from it; technology has enabled new products and services that improve the efficiency and enjoyment of our daily lives. In the future, technological advancements will result in a supply-side miracle, with long-term benefits in efficiency and production. Transportation and communication costs will fall, logistics and global supply chains will become more efficient, and trade costs will decrease, opening up new markets and driving economic development.

Nonetheless, there are not only positive impacts. The current revolution has the potential to disrupt employments. As automation replaces work across the economy, the net displacement of employees by machines may increase the gap between capital and work returns. This is still an open question as it is also possible that technological displacement of employees will result in a net increase in safe and satisfying occupations. Such uncertainty in the case of AI technology is analysed in Section 5.

Besides economy, inequality is the most significant societal worry related with Industry 4.0/5.0. The suppliers of intellectual and physical capital such as inventors, stockholders, and investors are the biggest benefactors of this revolution. This explains the growing wealth disparity between those who rely on capital and those who rely on work. This helps to explain why so many employees are disillusioned and concerned that their own and their children's actual salaries will remain stagnant. It also explains why the world's middle classes are becoming dissatisfied and unfairly treated. A winner-takes-all economy with restricted middle-class access is a prescription for democratic stagnation and dereliction.

The pervasiveness of digital technology and the dynamics of information sharing represented by social media may also foment discontent. In order to interact, study, and exchange knowledge, more than 30% of the world's population today uses social media platforms. These contacts, in an ideal world, would allow for cross-cultural understanding and integration. They may, however, foster and promote inaccurate expectations of what constitutes success for a person or a group, as well as provide platforms for the dissemination of extremist beliefs and ideologies.

In this context, AI is one of the key drivers of the fourth industrial revolution and is already all around us and affecting our life daily: from self-driving vehicles to virtual assistants, software that translates, invests, and suggests cultural preferences, are only few examples. The unprecedented computational and storage capacity, the access to massive quantities of data and the large adoption of AI in many different ambits are creating a symbiosis between digital and biological worlds that are changing the way we live and interact with the environment.

Referring again to the questions we raised in the introduction and in line with the potentials and risks mentioned above, in the following chapters we try to provide some more thoughts and arguments regarding AI and its impacts. Firstly, we present a survey of the challenges and opportunities of AI in a general context and then specialise them in four more target areas namely business, governance, education and lifestyle.

3. Brief history of AI

AI is a relative new discipline (born in the middle of the 20th century). Turing, often called the "father of AI", published in 1936 a mathematical description of what he named a "universal machine" [3.1] and he was the first to publish a method (Turing test) in "Computing Machinery and Intelligence" [3.2] to determine whether a machine thinks.

It is difficult to clearly define AI due to diversity of problems, solutions, distinction of what AI contains and what not. AI is a term coined by John McCarthy in 1955 and was defined by him in 2007 [3.3] as "the science and engineering of making intelligent machines especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable". Encyclopaedia Britannica [3.4] defines AI as "the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience". The Cambridge Dictionary [3.5] compresses it in a shorter version: "the use of computer programs that have some of the qualities of the human mind, such as the ability to understand language, recognize pictures, and learn from experience". The shortest and simplest definition is: "AI is not biological intelligence" [3.6].

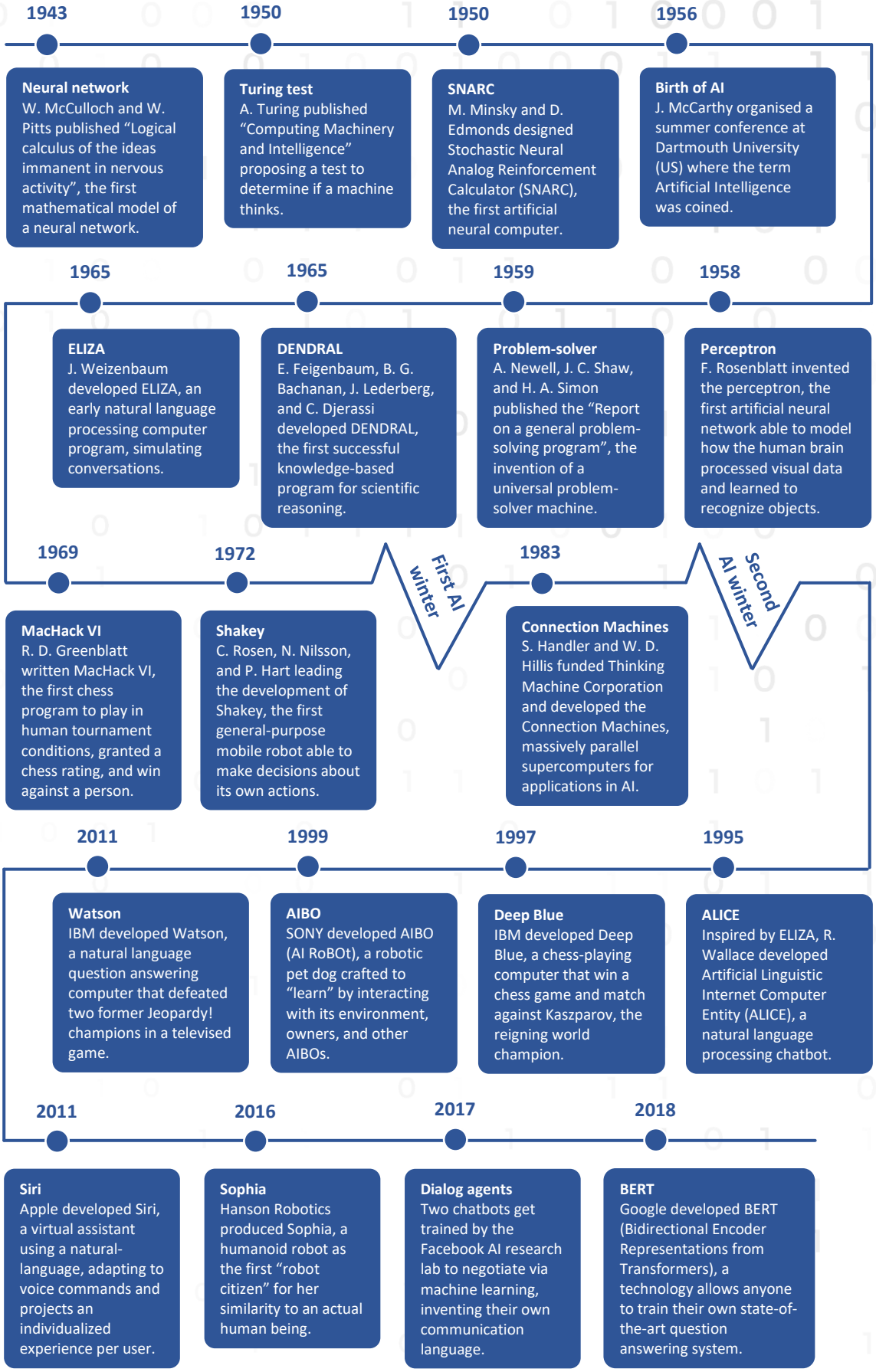
In summary, there is no universally accepted definition of AI. AI is an umbrella term that can refer to a broad field of science encompassing not only computer science. If we construe AI as studying how information is acquired, processed, stored, used, etc. in intelligent animals and machines then it obviously overlaps with several older disciplines [3.7]: philosophy, mathematics and statistics, economics, neuroscience, psychology, biology and medical science, linguistic, computer sciences, technical sciences and safety and security sciences.

Next figure provides a concise overview of the historical evolution of AI without claiming to be exhaustive given the size of the topic [3.8]-[3.10].

The first flowering phase was in the 50/60s. During these years, we experienced great advancements in many aspects that placed the basis of AI. For example, the first neural net machine, SNARC, was created in 1950. The first digital assistant, ELIZA, was developed in 1965, although his creator's (Joseph Weizenbaum) intention was to show the superficiality of communication between man and machine, but was surprised by the number of individuals who attributed human-like feelings to his computer program. The first general-purpose autonomous mobile robot was created in 1972.

This first phase was replaced in the 1970s by the so-called AI winter when development slowed down. Forecasts proved to be excessive, the approaches used so far did not live up to expectations, and the capacity of the machines limited the possibilities. In the 1980s, expert systems brought a brief boom, but then came the second AI winter. In recent years, AI began a new wave of progress and enthusiasm mainly due to three factors: 1) the capabilities more powerful computers; 2) the availability of big data from sources including e-commerce, businesses, social media, science, and government; 3) improved machine learning approaches and algorithms.

In the next chapters, we present the current status of AI, identifying the main applications, challenges and opportunities, and analyse its impacts on our society in general terms as well as in four different ambits, namely business, governance, skills & competences, and people & lifestyle.


1943
Neural network
W. McCulloch and W. Pitts published "Logical calculus of the ideas immanent in nervous activity", the first mathematical model of a neural network.
1950
Turing test
A. Turing published "Computing Machinery and Intelligence" proposing a test to determine if a machine thinks.
1950
SNARC
M. Minsky and D. Edmonds designed Stochastic Neural Analog Reinforcement Calculator (SNARC), the first artificial neural computer.
1956
Birth of AI
J. McCarthy organised a summer conference at Dartmouth University (US) where the term Artificial Intelligence was coined.
1965
ELIZA
J. Weizenbaum developed ELIZA, an early natural language processing computer program, simulating conversations.
1965
DENDRAL
E. Feigenbaum, B. G. Bachanan, J. Lederberg, and C. Djerassi developed DENDRAL, the first successful knowledge-based program for scientific reasoning.
1959
Problem-solver
A. Newell, J. C. Shaw, and H. A. Simon published the "Report on a general problem-solving program", the invention of a universal problem-solver machine.
1958
Perceptron
F. Rosenblatt invented the perceptron, the first artificial neural network able to model how the human brain processed visual data and learned to recognize objects.
1969
MacHack VI
R. D. Greenblatt written MacHack VI, the first chess program to play in human tournament conditions, granted a chess rating, and win against a person.
1972
Shakey
C. Rosen, N. Nilsson, and P. Hart leading the development of Shakey, the first general-purpose mobile robot able to make decisions about its own actions.
First AI winter
1983
Connection Machines
S. Handler and W. D. Hillis funded Thinking Machine Corporation and developed the Connection Machines, massively parallel supercomputers for applications in AI.
Second AI winter
2011
Watson
IBM developed Watson, a natural language question answering computer that defeated two former Jeopardy! champions in a televised game.
1999
AIBO
SONY developed AIBO (AI RoBOt), a robotic pet dog crafted to "learn" by interacting with its environment, owners, and other AIBOs.
1997
Deep Blue
IBM developed Deep Blue, a chess-playing computer that win a chess game and match against Kaszparov, the reigning world champion.
1995
ALICE
Inspired by ELIZA, R. Wallace developed Artificial Linguistic Internet Computer Entity (ALICE), a natural language processing chatbot.
2011
Siri
Apple developed Siri, a virtual assistant using a natural-language, adapting to voice commands and projects an individualized experience per user.
2016
Sophia
Hanson Robotics produced Sophia, a humanoid robot as the first "robot citizen" for her similarity to an actual human being.
2017
Dialog agents
Two chatbots get trained by the Facebook AI research lab to negotiate via machine learning, inventing their own communication language.
2018
BERT
Google developed BERT (Bidirectional Encoder Representations from Transformers), a technology allows anyone to train their own state-of-the-art question answering system.

4. Artificial Intelligence

AI has already appeared in all areas of life and is spreading rapidly. Below are some examples of some of the uses of AI, without claiming to be exhaustive.

- **Economy**, **finance**: AI based systems provide customer support, detect anomalies and credit card frauds by pattern recognition, enhance security across a number of business sectors, including retail and finance. Organisations rely on AI to trace those steps by analysing the behaviours of transactions. Ventures gives order to data scientists to determine future patterns in the market, improve their stock trading performance [4.1]. More details about AI in business are analysed in Section 5.
- **Agriculture**: Organisations are using automation and robotics to help farmers in farm management and free them up for other tasks. The AI systems promote find more efficient ways to protect their crops from weeds, combat animal and plant diseases, monitor the movement, temperature and feed consumption of the animals. AI systems enable analysis of satellite images to coordination of production at regional and national level for example identify drought-prone areas [4.1].
- **Health Care industry**: There are many examples of how AI in healthcare has helped patients, AI-based applications could improve health outcomes and quality of life for people all over the world. Personal or online consultations, personalised health guidance, virtual assistants reduce unnecessary hospital visits. AI uses the combination of historical data and medical intelligence for the discovery of new drugs, the detection of diseases and proposing diagnose [4.2].
- **Transportation**: A lot of advancement has been made in the autonomous vehicle segment (aviation in particular) [4.1] supported by AI: autonomous vehicles, unmanned drones. Today's cars now have AI-based driver-assist features such as self-parking and advanced cruise controls and natural language interfaces and virtual assistance technologies.
- **Smart cities, buildings** [3.7][4.1]: The expected growth of urbanisation need to manage environmental, economic and social sustainability: A smart /digital/intelligent city is an umbrella term, uses breadth of digital technologies to improve operational efficiency, share information with the public, the best possible use of resources, provide a high quality of services and improve citizen welfare. For example: traffic management, waste management, safety service (monitoring areas of high crime, an early warning system for incidents.
- **Education**: AI will fundamentally change education. The technology will revolutionise the way students learn and transform how teachers think about the educational practices [4.3]. More details are analysed in Section 7.
- **Robotics**: robots are often seen as both artificial intelligence because it is easier for the average user to imagine artificial intelligence in a mechatronic structure that also has a body, especially if it is body resembles a human/animal, for example social, therapeutic, educational robots. Machine-like robots are applied in industry and research, and other forms developed for military, medical use.
- **Personal tools:** Fingerprint recognition, built-in personal assistant, learning (maths) apps, automatic typing of spoken text, automatic language translators, virtual nanny talking to children are only example of the numerous of AI-enabled features available today to simplify our day life.

As highlighted in the previous few examples, AI has already appeared in all areas of life and is radically transforming the world. Humanity is facing an existential challenge whose awareness

and active struggle can bring about positive change, where cooperation between machines and people can result in a utopian world. In this direction, people of focus groups stressed the importance of the classics of science fiction and robotics literature to inspire the development of real-world solutions supported by AI to help humanity evolution.

> *"I think I know the difference between science and fantasy, but it is the interaction between these two fields that has led to the development of both"*
>
> *(expert)*

The OECD Recommendation [4.4] makes it clear that the role of AI can be key to shaping the future positively, promoting people's welfare and subjective well-being, and contributing to economic development and the achievement of sustainable goals. All this is accompanied by profound social changes.

The need for people to prepare themselves in time for these changes, because if they are not able to do so, they will lose out to AI. There is a wholeheartedly agreement that the debate should no longer be about whether AI is important or useful, but about how to or should prepare as many groups in society for change as soon as possible.

> *"Society is fundamentally unprepared for the rapid changes brought about by AI"*
>
> *(expert)*

Nonetheless, AI is also bringing unprecedented challenges and, as this new technology is rapidly spreading in the world, many ethical, moral and legal risks are also emerging. More specific details about ethical risks are provided in Section 6.

For instance, Elon Musk, Stephen Hawking, Steve Wozniak (and many others) signed an open letter for United Nation (UN) [4.5] asking to impose a ban on the development of weaponized AI with the capability to target and kill without meaningful human intervention. All the Member states of the UN Educational, Scientific and Cultural Organization (UNESCO) adopted in 2021 [1.4] a historic agreement that defines the common values and principles needed to ensure the healthy development of AI, a global agreement on the Ethics of Artificial Intelligence [4.6].

In this direction, in our debates, people highlight the possibility that AI will become so autonomous that it will become self-aware and unleash itself evolving in evolving in ways that can be both bad (machines turning against humans) and good (enhancing security). The optimal solution is seen by the participants to be that, as technology develops, our trust in AI-enabled devices increases, but that this trust can only go so far as it is still possible to take control of the AI safely at any time.

> *"What we don't know, we usually fear, and our fear often takes the form of rejection and hatred. And so it is with AI. There is only one way for humanity: get to know artificial intelligence so that you can consciously decide whether you love it or hate it"*
>
> *(expert)*

> *"I only believe in machine intelligence when it gives the same result as human intelligence"*
>
> *(non-expert)*

The vision is that in the future - what the world will look like in 10 years' time, in 2032 – the progress can be both good and bad, and that there are so many roadblocks that make it difficult to see the future based on realistic facts. Participants of focus groups would basically like to live in a happier, safer, more comfortable world thanks to AI, they would not want to be so spoiled that they are left with the experience of a boring life in every aspect of life.

> *"I would be much more relaxed if there was a positive world view in 10 years' time and I could say that thanks to AI my parents are safe in the smart home"*
>
> *(non-expert)*

It appears therefore urgent [4.7] the development of a new paradigm in which humanity will define its vision, the institutional systems of AI. It is important to keep in mind that it does not serve the interests of a narrow stratum (the profit-oriented, amoral, manipulative use of AI) but it should place the public good above individual interests. In fact, there is an increasing number of developments - not only in the military field - for which neither the ethical nor the humane adjectives are true.

> *"Recommendations, regulations and laws on artificial intelligence are only as good as the amount of them that are followed. While punishment may be a deterrent in some cases, unfortunately, it can be said that, in general, no punishment will deter those who develop AI with malicious intent and for their own ends"*
>
> *(expert)*

Individual awareness of AI-related changes is considered necessary. This includes making digital citizenship an integral part of everyday life, encouraging social dialogue about AI: they need to be agents of change, rather than victims of it. It is essential therefore to maintain authentic and quality media and to restore social trust by developing a new paradigm in which humanity will define its vision, the institutional systems of AI and the realisation of a human-centred AI [4.7].

> *"In the past it was man against man, then technology against technology, and now it seems that artificial intelligence against artificial intelligence. Maybe we would be better off if we chose cooperation instead of fighting"*
>
> *(expert)*

5. Business

Considered a key driver of future economic development and growth, AI has become a primary value proposition for an increasing number of new start-ups, particularly around Europe [5.1]. AI is conquering every industry worldwide and motivating businesses to compete to become AI-focused entities. The competitive business environment has been forcing corporate leaders, entrepreneurs, strategists, and investigators to employ AI to develop new strategies and generate new revenue streams [5.2]. European Commission [5.3] indicates that in 2017, 25% of large EU businesses and 10% of small and medium-sized enterprises utilised big data analytics. Only one out of every five small and medium-sized businesses was significantly digitised, and one-third of the workforce still lacks fundamental digital skills.

Meanwhile, the advantages of AI applications are widely acknowledged. Few examples are:

Businesses in the **commerce**, **agri-food** and **construction** sectors that have implemented AI report excellent outcomes in developing products or services, attracting new customers and entering new markets [5.3].

In **production**, AI helps improve the quality of production systems and, as a result, the quality of products. AI also enables the creation of highly personalised goods, matching customers' interests.

Marketing is one of the most advanced fields when it comes to AI. Applications in marketing include how AI methods can help forecast whether a new customer's future spending will reduce or grow after the initial purchase.

In **management**, AI is widely used in Human Resources to improve decision making processes integrating technical, human, and organizational systems to achieve an enterprise's strategic success.

AI has revolutionised online shopping, where major **e-commerce** companies, such as Amazon, Alibaba, eBay, have implemented AI to offer product recommendations that customers may be interested in, resulting in significant revenue growth [5.4].

AI is a crucial component of the popular **social media** platforms that have become to be used primarily for business purposes. LinkedIn uses artificial intelligence to provide job suggestions, suggest new network opportunities and diverse content [5.1].

Experts mostly agreed on the fact that AI speeds up the tasks, particularly the ones that do not require complex processes and that therefore it reduces simple mistakes while saving time

> *"We use AI to have sentiment analysis and these all are advantageous. The cost related to these activities can be disadvantageous, as well as finding people who can manage these processes is problematic."*
>
> *(expert)*

While there is a growing interest among businesses in investing in and incorporating AI into their operations, significant barriers exist at the organizational level that prevent businesses from achieving AI's full potential. Some of the main barriers worldwide preventing AI applications are lack of clear AI strategy, cultural resistance, lack of talent needed for AI solutions, enterprise size, and budget constraints [5.2].

Findings show that in Europe, a lack of government financing and venture capital are frequently reported as financial obstacles to AI development, particularly in SMEs and non-tech companies [5.5]. In this regard, Europe has raised its investment and the commitment to AI research to

increase Europe's technological growth potential and catch up with the countries leading the AI race. According to European Commission [1.3], innovative products and services can be boosted by AI in areas where Europe excels (machinery, cybersecurity, transportation, farming, the green and circular economy, healthcare, and high-value-added sectors such as fashion and tourism). The development of AI technologies in Europe also means reduced dependency on foreign technologies, which is vital for Europe's strategic autonomy and aligns AI technologies with European values. Such insights into business technology adoption decisions are essential to guide legislation and guarantee that AI technologies benefit both employers and employees by making the technology trustworthy, simple to use, and useful in day-to-day work [5.6].

Nonetheless, in this transformation process, he business world is rather sceptical about the rapid pace of technological change and its impacts [5.7]. Concerns about decision-making, privacy, ethics, and trust are also present and are expected to rise in the near future. Both experts and non-experts highlighted in our focus groups the importance of the ability of AI to enhance the capabilities and perspectives in business, however it was also stated that AI should not replace human capability and decision-making and human interaction will be still needed.

> *"Humans are the ones who can distinguish the things in fields like biomedicine. But we can still AI for simple detections. And in larger medical fields it is important to use AI but we should be sure that it is safe and will not cause big errors. Expert knowledge shouldn't be replaced by AI but rather enhanced. It should give recommendations but should not decide. I would prefer AI to enhance what humans can do. We are very far from that point where AI can replace the human knowledge anyway. Plus, it can be dangerous. Also, the responsibility (trolley problem) is another issue to consider when it comes to AI making decisions".*
>
> *(expert)*

> *AI cannot be fully implemented as we need interaction and we need to speak with real people.*
>
> *(non-expert)*

> *"Human interaction is important while having AI. We should also preserve some freedom and decision-making process as humans"*
>
> *(non-expert)*

The most common cause of privacy issues is the exposure of personal information; thus, companies strive to set out particular objectives to gain trust. For instance, Google stated that it would not pursue the AI applications that have caused, or are expected to cause, widespread harm and will proceed only if the benefits outweigh the risks, and will include appropriate safety limits if there is a material danger of harm [5.8]. While most nations have well-established data protection laws, AI has the potential to generate new data protection issues that are not addressed by legislation, raising additional ethical problems. AI could also use or generate sorts of personal data that are now neglected, such as emotional personal data, contributing to the problem [5.9]. More details on ethical aspects are reported in Section 6.

Studies predict that AI may transform the concept of the workforce by extinguishing some jobs. Research conducted in [5.10] on AI's potential impact on global economic activity underlines the highly potential development of as many new jobs as the number of ones that are being or will be replaced. It is estimated that there will be more available vacancies for engineers, software developers, and ICT professionals in Europe in the near future. According to Deloitte Human Capital Trends report [5.11], newly created jobs will be more service-oriented, interpretive, and

social, requiring creativity, empathy, communication, and complicated problem-solving skills. As for Accenture research [5.12], the AI-driven jobs that will be created are *trainers*, *explainers* and *sustainers*. These new jobs will include training AI systems, guaranteeing that they continue to perform as designed and do not learn the "wrong" thing, and closing the gap between business and technology. More details about new job and education system related to AI are reported in Section 7. Our participants also raised concerns about the cost optimization that follows the implementation of certain AI and that results in higher levels of unemployment for humans.

> *"Companies can benefit from AI to innovate their image and it leaves a good impression. Also cost optimization in human resources. It is good for business perspective. But as for CSR and human labour it can be problematic as AI replaces some jobs".*
>
> *(non-expert)*

The general opinion is that everything depends on the field of work.

> *"AI can open doors for new tasks but in some fields, it can just replace the human labor and reduce the complexity. So, it really depends".*
>
> *(non-expert)*

Finally, AI will be a market trend and a business opportunity during the next decade. It is predicted that it contributes $ 15.7 trillion to global GDP and that this index will be 14 percent higher by 2030 attributable to AI. Analysts predict a 6.6 trillion-dollar gain in production, with a 9.1 trillion dollar increase in consumption. If Europe develops and disseminates AI in accordance with its current assets and digital position in relation to the rest of the world, it may contribute €2.7 trillion, or 20%, to its combined economy output by 2030, resulting in 1.4 percent compound annual growth. This impact would be nearly double that of previous general-purpose technologies which developed countries have adopted in the past [5.10].

6. Governance

At this point, we already know that AI is today part of our lives. We can be aware of its presence and interact with it for instance when we ask Siri to find a restaurant for us according to our food preferences. But, in many other aspects, we are not fully conscious that AI is also there: for example, financial institutes leverage AI to identify potentially fraudulent activities in our accounts; AIs are used to track and predict environmental impacts in farm fields using data from satellite scanning and monitoring of crop and soil health. Those are only few examples and, according to several studies, the Covid-19 epidemic has expedited the adoption of AI throughout all sectors of the economy [6.1].

Nonetheless, AI is not all puppy dogs and rainbows. Many academics point out that the way AI tools are produced must change due to limitations in collaboration and inaccurate data assumptions, such as the unreasonable expectations that drive the usage of AI systems not robust enough. For example, inaction on AI prejudice has resulted in many injustices against entire groups of people, racial profiling, and other disturbing incidents. Deepfakes and the ability to create realistic videos, pictures, text, speech and other form of (social) communication have raised many ethical and legal concerns lately about the use of AI to manipulate human perceptions. In cybersecurity, bad actors have also access to AI tools, so the cat-and-mouse game continues. Video surveillance based on AI to recognise persons through their face, speech, walk or movement have also raised some privacy concerns. The Amazon Alexa has recently suggested to a 10-year-olf girl to touch live plug with penny after the girl asked for a challenge to do [6.2].

In this scenario of pros and cons when dealing with AI, the implementation of a governance becomes fundamental. Governance refers to the formation, maintenance, and regulation of rules or activities, as well as the assignment of accountability [6.3].

When AI is included in the term governance, two different interpretations can be found: i) The use of systems based on AI in the governance, meaning the adoption of AI in service provision, policy-making, and enforcement in public-sector ecosystems [6.4]; ii) The governance of the AI, meaning the promotion of a proper institutional and legal framework for the development and use of AI [6.5]. Despite both are considering different topics, it is not possible to maintain a discussion about AI in governance without considering AI governance, because they work as communicating vessels. Thus, governance is understood here in reference to what is known as "AI governance", an idea composed of three components related to: a) the infrastructure - obtaining, storing and processing data; b) the application - the management of data; c) the utilisation – the decision-making and evaluation processes based on data.

Many other definitions can be found in the literature [6.6]-[6.8]. Probably, the most complete definition is available in [6.9], standing that "AI governance is a system of rules, practices, processes, and technological tools that are employed to ensure an organization's use of AI technologies aligns with the organization's strategies, objectives, and values; fulfils legal requirements; and meets principles of ethical AI followed by the organization". In a nutshell, AI governance should close the gap that exists between accountability and ethics in technological advancement [6.10] and make sure that reliable boundaries within technology are set, so it does no harm and further aggravate inequalities incidentally while it operates.

> *"A research [project] to recognize a person based on the iris was financed through tax haven funds, to identify women with burqa and to know whether or not they were with their husband. I was very surprised [...]. How should it be done? Get here, yes? Get this far, right? What limits?"*
>
> *(non-expert)*

There is a widespread consensus on the need to discuss these reliable boundaries in the development of AI systems, because their use can have very important negative consequences for people's lives, or reproduce social models that are considered morally reprehensible.

The limits, however, are not clear, and it is difficult to establish or agree on an ethical, political or regulatory framework that can regulate the development of forms of AI that can then have a high impact on social decisions. One of the difficulties that emerges in this regard is the tension between a series of guarantees for the citizens and, at the same time, competitiveness in research and innovation.

Participants from both groups highlighted important issues related to these specific fields:

- **Data bias**. The emphasis is on the need to ensure that the data collected is not biased by gender, socio-economic level, ethnicity, etc. Guarantee of data diversity and its composition refers to the use of AI in all stages of the process, data collection, the decision itself or the evaluation. The use of machines for decision-making is not exempt from the ideology underlying any decision. These ideologies can represent interests of various actors, being them of a political, technical or economic nature. This is an important issue to be solved in order to guarantee that collected data and their use respond to the objectives for which they are designed.

> *"Humans make many decisions based on an ideology (...) A machine will also make a biased decision. Biased by whom? Because of the data, because of the engineer who designed it or the company behind it, or the ideology of the state that financed it".*
>
> *(expert)*

- **Justice**. Using the ability to handle large volumes of data and make statistical predictions is seen as an important value of AI. If the decisions affect non-substantive issues for people's lives, a possible error in the AI's decisions can be considered a minor issue and therefore, the AI could be used to make decisions on that particular issue. On the other hand, whether decisions affect substantive issues of people's lives, a wrong decision could have terribly unfair effects that would condition the person's life and, therefore, in that matter the decisions should not be made by systems day.

> *"Over the years we have built an important judicial system, which we want to maintain. There are areas in which the impact [of decisions made by AI] on the person is very important. AI should not enter this area".*
>
> *(non-expert)*

- **Privatization**. Certain companies or corporations are accumulating a lot of algorithmic knowledge and about the behaviour of the population, which implies a lack of guarantees that these data or this knowledge is carried out respecting principles or agreed ethical values. In this sense, the accumulation of data and knowledge in AI by entities outside the scope of government supervision means the privatization of governance, an issue that should be corrected.

> *"I believe that regulatory institutions should be created, in the same way that there are institutions that regulate banks and audit them to see what they do with the money. You should audit these companies like Google, Netflix and such, to see what their algorithms are really doing."*
>
> *(expert)*

- **Automation of decisions**. The debate about limiting the automation of decision-making processes cannot be bounded to AI, in the same way that AI cannot be considered solely responsible for the automation of decisions. The problem with AI is when those who design an algorithm are not able to explain its decisions, as well as when users do not know criteria that AI designer has implemented into the algorithm. We may fall in what is called the "computer says yes syndrome" [6.11], where employees who have spent a long time dealing with a system where errors are infrequent (as should be the case for AI systems) grow naturally less likely to challenge the system's correctness over time.

> *"There are algorithms which are not properly regulated, which can be an issue. I'm also skeptical that AI would not do human errors. But what if the algorithm was trained falsely or with some bias(racism)? In this case AI can do mistakes. So, who is to make the last decision - AI or the human? we don't know how AI comes to a decision. Why whatever decision was made, we don't know. Thus, there needs to be made with effort to make AI systems more explicable to understand why it decides for or against things".*
>
> *(expert)*

- **Freedom**. The threat to freedom posed by the use of AI systems in decision-making processes can be understood from two different levels. The first dimension refers to the strategies that use AI to achieve greater advertising or visualization, based on algorithms that make users enter loop-type processes, which are used by Meta or Twitter-type companies. The second dimension is related to the ability of AI to control emotions and regulate feelings. Taking into account the digital trail that all citizens leave in all their daily movements, obtaining and using these data for commercial or authoritarian purposes can be very dangerous.

> *"I have teenage children, who believe what they see: the fake news, the bleach they drank to cure themselves of covid. I have a 12 years old daughter. I see that the information they see is a brutal danger. People are impressionable and this is very complicated. When you start to see a content, when we are young, we look for news that is what you expect, we are more influenceable. If you see a video that comes out... Well, you say 'I want to go to Malibu', 'I want a Prada bag'. The algorithm moves you".*
>
> *(non-expert)*

Proactive governance measures are becoming more widely recognized as a differentiating feature for firms seeking to establish a reputation for trustworthiness. There are a number of worldwide frameworks on AI governance and ethics concepts. European Union issued the General Data Protection Regulation (GDPR) which includes a special set of rules that relate to a consumer's right to explanation when corporations employ algorithms to make automated choices. Nonetheless, it attracted also some controversial as does not afford a right to explanation of automated decision-making [6.12]. In this regard, the EU is likely to be the first to enact AI regulatory legislation [6.13]. The Algorithmic Accountability Act [6.14] in the US requires major companies with access to large amounts of data to audit AI-powered systems for fairness, privacy, accuracy, and security risks. A notable initiative is the Singapore AI Governance Framework. It is the first model developed in Asia and its strength is that it translates principles into a practical, operational framework for immediate action, decreasing the entry barriers to AI adoption. This framework is based on two factors: i) AI solutions should be human-centric, and ii) decisions made or assisted by AI should be transparent, explainable and fair.

In summary, to be effective and provide the correct trade-off between company's strategies and objectives, legal requirements and ethics, many actors work on identify the main principles. For

instance, Harvard University [6.15] created a visualisation map of 32 sets of AI principles. KPMG [6.16] provides four guideposts to help organizations ensure the proper governance of algorithms. Google [6.5] highlights five specific areas where precise, context-specific guidance from governments and civil society would help to advance the legal and ethical development of AI. In our work, a set of six AI principles are considered for AI in governance which are functionally algorithm-agnostic, technology-agnostic and sector-agnostic:

Accountability requires a clear identification of who hold responsibility for decisions and actions when designing, developing, operating, and/or deploying AI system. It must be people or organizations that are ultimately accountable for the acts of AI systems, no matter how complex the AI system is.

Transparency regards the ability to explain why an AI system behaves in a certain way in order to boost people's confidence and trust in the accuracy and appropriateness of its predictions. Definitely, the more the users feel they understand the overall AI system, the more inclined they will be to use it.

Fairness must ensure that AI systems are ethical, free from bias, free from prejudice and that protected attributes are not being used. There are so many different viewpoints to defining fairness and they may directly contradict one another. This can be mitigated if the exact fairness technique to use is decided up front and make it transparent.

Safety regards taking measures against both inadvertent and intentional abuse of AI that poses a threat to humans. However, this must be done in a reasonable manner, taking into account the potential for harm and the practicality of the suggested preventative measures in terms of technological, legal, economic, and cultural factors.

Human control means that people need to be in one or more points in the decision-making process of an otherwise automated system. Definitely, regardless of how precise an AI system is, society wants a human to make the ultimate judgment.

Universality principle recommends the definition and application of technical, ethical and regulatory standards during algorithm development, evaluation and deployment in order to have interoperability, cooperation and given level of quality, safety and trust.

7. Skills & competences

Despite its youth, AI is impacting the job market. Firstly, due to automation some intermediate skill jobs are disappearing. Secondly, people are now more likely to use AI in their everyday lives including at their job as about 50% of organisations report using AI [7.1]. Focusing on jobs that are disappearing due to AI, participants in focus groups agreed on three categories of jobs that are replaced by AI: repetitive/routinary jobs where AI can replace humans, decrease the risk of errors and increase the productivity (such as warehouse/factory jobs, drivers, pilots, toll employees); office/white-collar jobs (like secretaries, recruiters, lawyers, tax consultants, assistance, translators, paralegals); and finally physically demanding jobs (as truck (un)loading, box (de)palletizing).

> *"For example, a warehouse worker who currently uses a forklift to move pallets around may soon be managing a small fleet of autonomous moving robots (AMRs)"*
>
> *(expert)*

Because of this, education and training institutions must adapt towards equipping learners with skills & competencies that are needed in this rapidly changing world. This is particularly necessary as a way to combat people's distrust and fear over automation and digitalization replacing humans [7.2]-[7.4]. Indeed, a majority of Europeans are in favour of governments limiting the implementation of automation and digitalization by workplaces as a way to protect jobs and keeping people employed [7.2], [7.4]. However, the changing nature of work and the implementation of new technologies is unavoidable and 37% of respondents of the Gartner 2019 CIO survey stated they already deployed AI and/or would do so in the near future to try to stay ahead of their competition or at the very least not get left behind [7.5]. Additionally, earlier reports on AI focused and implied people would be abandoned and replaced by technology, which contributed/served to corroborate people's misconceptions and fears regarding AI. Nonetheless, newer reports have instead concentrated on how AI creates jobs and/or allows workers to have more fulfilling roles by being freed from menial and/or dangerous work [7.6] – [7.8].

While much attention has been paid to the fear of jobs being replaced by machines, less focus is put on the perspective that it is not the jobs themselves that will become inherently obsolete, but rather that the way of working will shift and that certain skills & competencies will gain importance whilst others will be discarded [7.9]. In fact, the benefits of using AI systems highly depend on the competencies and skills of those operating them, with the lack of AI skills being the number one problem for enterprises within AI projects [7.9]. Therefore, implementing an AI consciousness and related challenges in the educational curriculum has been identified as crucial to tackle the change of working experiences and businesses [7.10].

Moreover, AI can help increase workers' skills & competencies [7.8], [7.11]. One need only look at the example of KONE, which has installed the Internet of Things (IoT) in their elevators and used AI to analyse the data, allowing technicians to be informed about potential issues and perform preventative maintenance [7.11]. Additionally, whilst not necessarily AI in itself, hybrid simulation training has shown great potential in nursing and health professions [7.12].

According to a recent adaptation of typology [7.11], AI as a driver of innovation within companies can work both competence-enhancing or competence-destroying. While the first promoting existing skills and knowledge and the latter obsoleting them. This typology can be specifically useful for managers to identify and predict the impact of implementing AI in their company's competencies. Whereas at the moment, as the authors observe, most applications of AI foster

competence-enhancing innovations, in the future an increase of competence-destroying innovations is predicted due to the amelioration of machine-learning, problem-solving and reasoning.

One significant promise in AI lies herein: the valorisation of those skills & competencies that are impossible to be replicated by robots. In [7.13], the authors state that "complex social interaction and creativity are the most difficult things to automate." Indeed, due to this fact, educators are unlikely to be replaced by AI despite its increased implementation in education, partially due to the pandemic, which made it of the utmost necessity [7.14]. Indeed, AI started to be more widely used in education, and is likely to be the way of the future in education.

> *"I think we need more technical people, more knowledge about the evolution of society [...]. And also on the other hand, to the people who are more in the field of governance [...] who also understand this new partner who has a way everywhere ... At the educational level we must try to make an effort to integrate this AI into the whole existing knowledge base".*
>
> *(expert)*

The working paper [7.14] highlights the opportunity of AI to enhance personalisation and better learning outcomes. More specifically, AI enables (marginalised) people to benefit from learning despite not being able to be there in presence. It facilitates the possibility of adjusting and personalising the working progress to the individual by offering ways to create learning plans, preferences and trajectories. experts agreed that AI has already changed the higher education environment as now everybody can learn new skills individually.

> *"AI is expected to create flexible and personalized education by analysing and detecting students' weak or different points"*
>
> *(expert)*

This can for instance be through the help of a MOOC, through which not only a vast number of students can be reached, but which also includes a flexible learning approach for learners of all kinds. On the side of the teachers, AI technology can depict a tool for assessment of grades, as well as an aid for the implementation of the lesson and the monitoring of discussion groups. Due to the socio-emotional and creative components of effective teaching, [7.14] rates the replacement of teachers by AI technologies as rather unlikely. Nonetheless, they underline the importance of teachers to adapt to the new digital era by developing new methodologies and enhance the adequate skills.

> *"It could be useful to give some AI classes for younger students so they know how to deal with it and know the risks/challenges. We already use it but it is still tricky and we don't reflect on it a lot. Maybe it can be useful to have these courses at school to learn about it more."*
>
> *(non-expert)*

One pertinent skill that has gained relevance in the age of AI has been critical thinking. In this age where fake news can be easily dispersed through social media, critical thinking skills and validating sources are paramount [7.15]. Critical thinking allows people not only to reach conclusions based on the currently available evidence, but also to have their beliefs challenged in regards to accuracy and relevance due to newer or different sources and modify them accordingly [7.16]. Additionally, social skills remain particularly relevant due to their difficulty in being automated. Other pertinent skills are the ability to adapt to change, teamwork, problem-solving, communication, and helping customers in project management and using IT [7.16]. Scholars widely agree that the integration of such contents is essential to ensure a beneficial

transition into the AI era [7.10][7.17].

In this regard, a recent large-scale study [7.17] concluded that the need for physical, basic cognitive and manual skills will reduce due to the taking over through AI. Hence, the authors have identified 56 DELTAS (distinct elements of talent, attitudes and skills) split across 13 skill groups which themselves are split under four main categories - Cognitive, Interpersonal, Self-leadership, and Digital. These include the aforementioned critical thinking, teamwork, etc., but also others like Digital Fluency and Citizenship, Software Use and Development, and Understanding Digital Systems. These findings are in line with other recent research, such as [7.1], [7.9], [7.18], highlighting the necessity for data, technological and digital knowledge as much as competencies in problem solving, empathy, communication, innovation, critical thinking, and teamwork. Nonetheless, participants in our focus groups also pointed out that these skills would not necessarily become more widespread:

> *"There is a difference between what is important and what would be promoted. And I don't truly know what competencies... aside from the obvious like, OK, digital competencies and stuff... that would actually be promoted by an AI world in itself".*
>
> *(non-expert)*

Additionally, there is the perception that the education system is (too) slow to change and teach the skills & competencies needed for an AI world.

> *"The education system is still based on the logic that lots of knowledge must be learned by heart while it now is at the fingertips of everybody at all times. While there has been a small shift towards a competency-based education, this is by far not sufficient. More focus on technological education as well as complex problem solving e.g. through project work should take a bigger chunk in the educational strategy",".*
>
> *(expert)*

While the implementation of AI in an educational context provides a great number of benefits, the downsides of this process should not be neglected. According to [7.14], the development of a comprehensive public policy for the implementation of AI to foster sustainable development is essential. Even though AI itself can depict an opportunity for inclusion for example through the possibility of distant learning, challenges such as electrical, hardware and Internet availability, data costs, basic ICT skills, the language as well as the cultural appropriateness of content are only some aspects that need to be taken into consideration. This is specifically the case for "less developed" countries, which are in danger of being left behind even more if those challenges are not recognized and tackled in a thorough manner. Similarly, AI consists of the data which it is fed, therefore the quality and inclusiveness of such should be one of the main priorities when developing AI technologies. Through transparency and a clear ethical code, it can be prevented that AI perpetuates inequalities [7.14].

As a final consideration of current changes caused by AI, one also must consider the new jobs created by it as there is a need for people to train AI (i.e., train the AI to do the intended work), explain outcomes to AI (i.e., explain how AI reached a particular conclusion to the layperson), and sustain responsible use of AI (i.e., ensure that AI systems are working correctly, safely, and being used responsibly) [7.8]. These new jobs create a need for new skills and education; thus, some places like the ProgeTigerProgramme - which started in 2012 in Estonia - are beginning to promote the implementation of programming and robotics into the educational curricula for pre-school and primary school students but also at the vocational level to prepare people for the labour market of the future [7.1].

8. People & lifestyle

The fact that the majority of the population has an individual smartphone and/or computer can now be considered a prerequisite for the consumption of certain apps, software and more AI applications [8.1], [8.2]. In their normal life, people and in particular consumers (ordinary people's lifestyle or professionals) can interact with the current main types of AI and AI applications, depending on their focus [8.3]:

- **AI crucial tasks**. AI is related to the predominance of intellectual analysis such as Machine translation, automatic forwarding and retrieval of information, speech communication, computer vision and data mining.
- **AI based on specific tools**. The difference between this direction and the above is that here AI is designed to be able to solve a larger class of problems such as evolutionary calculation, pattern recognition, heuristic programming and multi-agent approach.
- **AI according to the developed model of thinking**. AI is characterized according to the developed model of thinking such as search in online space for solution(s), presentation of knowledge and machine learning.

Aimed at the daily activities of the majority of people, namely consumers (and partially also professional developers) using AI is associated with certain priority applications [8.3]. Some of the popular implementations of AI (popular in people & lifestyle) are related to activities such as:

- **Computer vision**. This technology processes visual information to extract useful knowledge. It includes many tasks [8.4]: site discovery; tracking of objects; pattern recognition; segmentation; estimation of the depth of the distance.
- **Biometric identification**. They are many and are varied, such as: face recognition system, iris identification, analysis of the chemical composition of sweat or body odour, analysis of microvibration of the fingers and micromovements of the hands, analysis of heart rate and heart size, fingerprints, user action analysis, keyboard handwriting, author's individual handwriting, posture analysis, lip identification, DNA test, etc. [8.5].
- **Natural language processing, searching and extracting information from texts**. They are used to generate texts that are almost indistinguishable from human ones in style [8.6].
- **Voice recognition**. It is widely used in call centres as well as in education and in the process of learning foreign languages.
- **Speech synthesis**. It can be used to change the style of speech, generate several voices from one model, generate previously unknown voices, transmit the intonation by model, adapt to the speaker's voice and many others.
- **Machine vision**. It is the application of computer vision in industry and manufacturing, for example to count objects on a conveyor belt, read serial numbers or search for surface defects. Modern machines already recognize over 90% of objects, that is not only fix the presence, but also determine exactly what they see [8.7]. An example is IBM's PowerAI Vision [8.8].
- **Machine translation**. Depending on the language pair, the subject area and, in fact, how similar the data used to train machine translation models is, the quality of the results of the different systems can vary considerably [8.9].
- **Generating text**. Allows the measure the quality of language models, for example, by the probability of guessing the next word from the previous context (Perplexity Per Word). For example, Google Brain allows many remote correlations to be effectively taken into account due to the original word position coding scheme using Fourier transform [8.9].

- **Dialog systems (chatbots)**. They are related to the interaction between man and vehicle (e.g., cars, buses, trucks, ships, etc.). By purpose, these systems are divided into three groups of chatbots: general purpose, targeted and those capable of dialogue [8.10].
- **Tonality analysis**. Through this activity, users can determine the speaker's attitude or emotional reaction. Example of popular applications are IBM Watson, Meaning Cloud and Salesforce Einstein.

Prospects for the development of AI are directly related to the development of computer technology, ICT, electronics, automation and others [8.11] [8.12]. Their application will become more tangible and will be a permanent part of online shopping and commerce (especially during epidemics), healthcare, transport, cybersecurity and others [8.13]. AI will turn from a service into a permanent part of people's lives. There is also a negative effect.

> *"The majority of society has focused entirely on AI, other major trends and fundamentals in people's lives are ignored."*
>
> *(expert)*

The change in actual and future people's lifestyle become more and more true, globally the presence of AI is associated to [8.13]:

- Exemption of people from routine activities, replacement or reduction of the intensity of intellectual work in certain professions until complete replacement of specialists from certain professions with intelligent devices;
- Building a digital interactive information technology space where people and thinking machines will collaborate;
- Fully integration of thinking machines such as robots into complex and dangerous places for work, rescue operations and others.
- Making responsible decisions in complex situations and processes;
- Increasing the efficiency of information processing with large volumes of data;
- Improving the quality of assistance in a routine area of everyday life;
- Improving the quality of professional assistance;

When talking about AI related to people & lifestyle, we should also take into account the attitude of individuals and different societies on this issue. This refers not only to the purely technical and practical, but also psychological and social aspects, as well as the comfort zone of the individual and others [8.14]. Some people tend to be very conservative because they are not comfortable with technology that takes decisions out of their hands.

> *"It helps a person in everyday life, but facilitation would lead to habituation. If people use AI to more difficult situations and if one does not have AI, person can panic."*
>
> *(non-expert)*

It is clear that AI is a technology that is evolving along with digitization [8.15]. People use AI in their daily lives, but they realize that this process of intellectual digitization must be carefully monitored [8.16]. AI can make people addicted and make them lazier, relying on AI intellect rather than his natural intellect. This will make their lives easier, but also deprive them of social communications and closeness between people.

> *"Limited human thinking and lack of self-development can lead to human dependence on the presence of artificial intelligence, which leads to a decline in the development of the human being."*
>
> *(expert)*

Many see the impact of AI on humans and lifestyle in increasing human capabilities, but some predict that the growing dependence of people on automated systems will undermine their ability to think independently, take action and communicate effectively with others. People can lose their sense of true values in life. AI attracts and directs the attention of people in areas where someone blames them, rather than pointing their attention to personal self-development. Makes people more dependent on advertising and external influences. This separates them from the tranquillity of life with nature.

AI has great potential to change a person's life and make it more productive, efficient and easier. Life will continue to change rapidly and one must be able to adapt to new conditions. Advances in AI will affect what it really means to be human in the 21st century, but these changes can be unequal.

> *"Younger people will adapt more easily and quickly to automated systems, and older people will find it increasingly difficult to keep their skills and knowledge of working with them up to date."*
>
> *(non-expert)*

The changes that AI will bring to life will have positive and negative effects on people's daily lives. In summary, we can identify the risk and opportunities as follow:

Positive

Improve the efficiency of human work and increase people's free time, happiness and satisfaction.
New opportunities and abilities to improve lifestyle, developing natural interests and talents.
Better monitoring and diagnostic capabilities, providing personalized treatment plans.
Gain time and productivity with autonomous transport.
More secure with crimes detection.
Virtual assistants to understand and perform tasks given by people.
Automated systems to change games and home life.
Higher family connection to reduce the mental strain of household management.
Greater individualisation, such as training based on human needs and abilities.
Infrastructure improvements (traffic relief, supply chain improvements, etc.).

Negative

Workforce reorientation and loss of jobs.
Economic, legal, political and regulatory implications that will affect lifestyle.
AI can be restricted from crossing ethical or legal boundaries.
Data collection can violate confidentiality of personal information.
Limiting personal space and destruction of digital privacy.
Socio-economic inequality with the disappearance of millions of low to medium-skilled jobs.

AI raises the question of man's understanding of himself and freedom. The hope is that AI will have a more positive than negative impact on humans. Human beings will and consciousness remain the source of intentions and the judge of all results. Machines are created to provide ease and efficiency in the journey from intention to outcome. AI needs to work to improve human activities and experiences, save time and increase people's life satisfaction. It is expected that in the future AI will affect people's daily lives even more and it will strongly depend on the control of the people who run these systems, as well as their permissible application in society.

> *"Dangerous is human stupidity, which limits the functions of the brain, as well as inaction"*
>
> *(expert)*

9. Conclusions

AI came to stay in our daily lives. This is an obvious conclusion and we need to deal with it. So, how can we do that?

In this document we have reviewed many literature sources and talked directly with experts and non-experts to have a better understanding of the problem, the concerns, the opportunities AI can bring to the humanity and its impacts to our society. Thus, we can now provide a set of conclusions and guidelines.

In a nutshell, we can firstly summarise our findings in the four ambits as follows:

Business: AI is seen as a great potential especially when it comes to saving time, facilitating faster decisions, bringing innovative solutions, increasing customer satisfaction, productivity and cost efficiency and maximising sales while reducing human error probability.
Major risks are related to finding a balance between the economic interests of companies and the non-violation of citizens' rights in matters related to privacy and individual freedom.

Governance: there is global agreement on a fundamental set of six AI principles that are functionally algorithm-agnostic, technology-agnostic and sector-agnostic to provide a trade-off between company's strategies and objectives, legal requirements, and ethics: accountability, transparency, fairness, safety, human control, and universality.
Major risks are related with the non-compliance of one or more of these principles, leading to incorrect output, bias, lack of freedom, inequities, etc.

Skills & competences: the need for physical, basic cognitive and manual skills will be reduced due to the taking over through AI while digital competencies, critical thinking, teamwork, empathy, higher cognitive skills, technological as well as social and emotional skills will be more demanded. Education systems' priorities need a shift to reflect this to better develop students' abilities.
Major risk is related to "less developed" countries which are in danger of being left behind even more.

People & lifestyle: AI should contribute to make person's life more productive, efficient, secure and easier. We may have personalised monitoring and diagnostic capabilities, an increased free time, the possibility to develop our natural interests and talents, a better and faster infrastructure, a gain in time and productivity, a more secure life and a greater individualisation.
Major risk is related to the fact that AI can be biased and perpetuate or even increase the gender and racial disparity and inequity.

Secondly, our research in AI allows us to identify that AI is conceived in two different ways. These two views appear alternately throughout all our sources, allowing the focus to be on different issues and proposals. Although these two views may be understood as contradictory, they are in fact complementary views that make it possible to grasp the complexity of opinions, concerns and proposals around the use of AI systems.

Restrictive view: AI as one more technology and therefore needs to be treated like any other technology.

Disruptive view: AI as a different technology, which marks a before and after in human society and the relationship with technologies.

From a restrictive point of view, AI tends to be seen as a chance: it can create new, very qualify and remunerated jobs, open new market and business opportunities, make life easier and heathy, bureaucracy faster. The common idea is that AI is useful in decision-making processes. The challenges that may be raised by these processes are considered restricted and possibly overcome by drawing a clear border between when AI may be employed and when it cannot. In this sense, AI is thought to be particularly effective for data management and analysis, as well as information assistance for decision making and assessment, but not for automated decision making. In this sense, it is thought that decisions that have a direct impact on people must be decided by people.

In contrast, from a disruptive view of AI, the impression is that in contemporary societies any ambit integrates or will integrate AI. It is thought that, while we do not want AI to participate in many aspects of our daily lives, it is vital to analyse the costs and benefits, based on assessing what would happen if AI systems made incorrect decisions. This may affect several areas of our environment and is in these specific areas that the risks of using AI systems need to be assessed. The justice, the people's privacy (i.e., freedom), the algorithms themselves (aka, the bias of the data), the biomedicine, the finance are only few examples of the areas identified.

A shared concern, which is mostly associated with a restrictive view of AI, and which appears both explicitly and implicitly throughout all sources, has to do with the relationship of AI systems with science fiction imaginaries or with the idea that AI can solve all problems of any kind. Numerous applications have been developed in the field of AI, and can be applied in many fields, but there is a significant gap between current functionalities and technical capabilities and the narrative of what AI could do in the future. This type of narrative around AI, which does not correspond to current developments, is considered to have two types of negative effects: i) The difficulty of articulating a proven public debate on accountability when using forms of AI in decision-making processes; ii) The emergence of a series of catastrophic imaginaries that generate reluctance towards AI between public opinion and citizens.

It is worth to mention also the topics not discussed in this document. One of them, probably the most important one, is the impact of AI to our environment and how it can help with the current crisis due to the climate change. In fact, we failed to introduce this issue in all our focus groups but it was also not raised by the participants, which may indicate that environment is still not felt as a major concern. Nonetheless, AI is a major energy consumer given the complexity of training and inferencing on big data, above the fact that all ICT ecosystem is already one of the major contributors to greenhouse gas emissions [9.1]. On the other hand, AI has also been presented as the solution of the climate change due to its multipurpose capabilities, which include tracking and cutting emissions, allowing creative economic models to aid the environment, and enhancing climate resilience. For instance, a study commissioned by Microsoft [9.2] concluded that using AI for environmental applications has the potential to boost global GDP by 3.1 – 4.4% while also reducing global GHG emissions by around 1.5 – 4.0% by 2030 relative in business, up to 2.2% in energy and up to 1.7% in transport.

One shared opinion is that humanity social and intellectual skills like creativity, empathy, teamwork, innovation are irreplaceable by AI. In short term, the vision is that we will face the emerge of more artists. Nonetheless, this vision seems too optimistic: AI is already able to compose symphonies, paint pictures, writes poems, songs, and stories and plays games. Some countries like Australia [9.3] already accepted that an AI machine can be registered as an inventor in a patent. In the future, it is likely that these capabilities will be even more explored.

A common opinion is also that AI should not replace human capability and human freedom to make decisions should be prevented from being influence by AI-driven tools. In particular, ethics is a recurrent problem raised in all our sources. Even the experts we have interviewed consider that they do not have enough knowledge to be able to decide on ethical and social issues, a

knowledge that should be integrated in an interdisciplinary way.

In order to avoid this type of narrative and its negative effects, actions related to information and citizen participation are needed:

Information: Ensuring that the media reports ethically and honestly when talking about AI systems, which allows for a clear distinction between speculative futuristic visions and current developments and possibilities. It is necessary to develop a pedagogical task that allows the public to know how AI works and what applications are being used. Such knowledge can boost people's confidence and trust in the accuracy and appropriateness of AI systems.

Participation: Involve the public in the establishment of priorities for the development of AI. This is considered to be the added value of the European AI development strategy, compared to other strategies that may be more technologically advanced, such as China or the United States. It is considered that the European strategy can incorporate as an added value to its AI the integration of citizens in the establishment of priority areas in which to develop or apply it.

In conclusion, AI is a technology that in its design and development is so far removed from everyday life that experts believe that the population is not trained enough to make decisions about how to use AI. Although, at the same time, it is considered necessary for citizens to make decisions and decide on the course of AI. For this reason, we point out the necessity to train citizens in the operation, potential and possible effects of AI. We need therefore to provide teachings, courses and trainings in schools and higher education institutes to facilitate the use and adoption of AI for young people and future generations. This is indeed the main goal of the HEDY project. Throughout the next two years, HEDY will provide a Massive Open Online Course with exactly the aim of reaching higher education audience and show them the capability of AI, the opportunity our society has in this moment to change our environment to a better one but also the risks we are facing from different point of views. This material will be complemented with the Rootkit: a set of supporting multimedia tools with the ability to have a more immediate and visual impact to the audience.

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B. Additional material

Methodology

We collected information from two different sources to build our rationales: 1) Literature survey, and 2) Focus groups.

Our first source of information came from the available literature on AI in general and on the four ambits described above in particular. The aim was to acquire an in-depth grasp of the subject and to understand current knowledge. This allowed us to: i) identify relevant theories, methods, and opinions in the existing state of the art and report them in the Booklet; and ii) organise and guide the participants through the focus groups with these bases already learned so to obtain the complementary information we needed.

Hence, we searched, read and evaluated more than 250 documents, between research papers, magazine articles, expert blogs, companies' reports, agencies' guidelines, etc. to get the proper knowledge on the challenges and opportunities of AI and the current applications and expected impacts in both short and long terms. These documents have been carefully selected as the best representation of the state of the art, according to their impact (e.g., number of citations, dissemination in news and social networks, etc.), the author/s, the publisher, and the year of publication.

The second source consisted of gathering information by interviewing people through focus groups with expert and non-experts in AI in 5 different European countries. A focus group is a type of qualitative technique of data collection, in which a group of people, guided by a moderator, have a conversation and discuss around a common topic. It normally consists of a group of 5-10 persons who do not know one another. These individuals are chosen because they have particular traits that are relevant to the focus group's subject. By fostering a tolerant and caring environment that fosters many perspectives and points of view, without pressing members to attain consensus, the moderator uses the group and its interaction to learn more about a particular subject [A.1].

During February 2022, we prepared and conducted two different focus groups with a common methodology and organisation in each of the project partners' countries: one focus group with only experts in AI and one focus group with only non-experts in AI. The project defines the term expert as a person with a university degree, working for at least 5 years in the area of AI, digital society, human-robotic interaction or Industry 4.0, and at least 3 published scientific or professional articles. The number of participants for each group was set to a minimum of 5. In all focus groups, we were assisted by one moderator and one assistant: the former directed and harmonised the discussions, while the latter took notes. Each focus groups lasted approximately one hour; sessions were recorded and later transcribed. In one case, the focus group was not possible to be organised due to conflicting schedules/COVID restriction; we substituted the focus group for a questionnaire. The questionnaire was created with similar questions used in the focus group. In summary, nine focus groups and one questionnaire were organised and the results analysed following the directives available in [A.2].

More details about all sessions are reported:

1) Two focus groups in Budapest (Hungary) about AI challenges and opportunities
    - 8 experts (7 males, 1 female) aged 28-61 years old;
    - 5 non-experts (2 males, 3 females), aged 20-28 years old, university students enrolled in a Master's degree

2) Two focus groups in Münster (Germany) about AI in business
   - 7 experts (7 males) aged 26-50 years old;
   - 7 non-experts (3 males, 4 females), aged 22-30 years old, university students enrolled in a Master's degree
3) Two focus groups in Barcelona (Spain) about AI in governance
   - 9 experts (7 males, 2 females) aged 35-70 years;
   - 10 non-experts (7 males, 3 females), aged 22-70 years old, from civil society with no previous knowledge on AI.
4) Mixed approach in Lisbon (Portugal) about AI in skills & competencies
   - 9 experts (6 males, 3 females) aged 26-67 through an online questionnaire;
   - 5 non-experts (3 males, 2 females) aged 23-55 master students or recent graduates through a focus group.
5) Two focus groups in Varna (Bulgaria) about AI in people & lifestyle
   - 6 experts (4 males, 2 females) aged 29-59 years;
   - 15 non-experts (4 males, 11 females), aged 20-24 years old, students enrolled in a university degree.

Limitations

It is clear that this methodology has some limitations. Firstly, it is an analysis whose conclusions make it possible to identify the different interpretations and arguments socially available on an issue, but unlike quantitative analysis, its conclusions are not representative, but significant. Moreover, there exists the limitation of the heterogeneity of the focus groups since most of the experts were academics and the non-experts had a university degree; hence the outcomes may not represent the general population's views on the topic. However, it is worth mentioning that we contrasted people's opinions with the available literature and vice versa, so our findings are valuable and other similar works are likely to reach the same conclusions.

Draft, longer version access

This Booklet is the final result of almost one-year work on investigating the impact of AI in our society. To reach this goal, we produced during this year many other intermediate works that have been finally harmonised and summarised in the present document. Interested readers may want to get access to the first, longer version of the document, which is available in the Zenodo repository (https://www.zenodo.org) with DOI: 10.5281/zenodo.7243312.

Acknowledgement

We would like to thank all persons who helps us in preparing this booklet and generously and openly participated in our activities.

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Funded by the Erasmus Union. Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither European Union nor EACEA can be held responsible for them.

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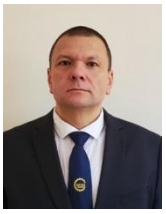

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