Artificial intelligence in everyday life

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Management summary

Artificial intelligence (AI) has affected every aspect of life as far as we can see. This research is exploratory research with qualitative data. The qualitative research in this paper is primary data as these are interviews with experts in artificial intelligence. Based on the interviews and the literature, a conclusion will be drawn on the research question.

Artificial intelligence is becoming increasingly advanced as it continues with the threat of fewer people understanding the technology (Puaschunder, 2019). With the threat of total job replacement (Huang, 2018) or at least a visual threat of jobs vanishing, many people are currently scared to adopt AI practices, which have many positive effects. Such as automation, more capabilities and efficiencies (Poola, 2017), reduced human errors and increased accuracy (Poola, 2017), and better insight through data analysis (Davenport, 2018). However, these researchers also mention bias, lack of reliability of data sets and transparency (Nikolskaia, 2021), and the law cannot cope with development (Buiten, 2019). Each side has its positive and negative regarding why society should or should not adopt AI.

Therefore the following research question has been developed for this study: *To what extent does AI influence the daily life around us regarding co-dependency in different segments of our lives (and how might this affect us in the future)?* For the different segments the following segments have been chosen: healthcare, education, work & retail, and home & online. This study examines the effect of artificial intelligence on everyday life. It looks as if society is becoming more or less dependent on this technology and if it is a good or bad thing that society is becoming dependent on this artificial intelligence technology.

The hypotheses are based on the literary review and are broken down for each segment from the research questions: *Is the co-dependency on artificial intelligence in daily life positive or negative in healthcare/education/work & retail/ home & online?* This study concludes that in most segments, healthcare, education, and work & retail, co-dependency has a slightly positive effect on artificial intelligence in daily life. The efficiency and reduced human effort in these sectors give an incredible boost to the performance of each sector with side notes such as artificial intelligence error and trust & privacy issues. Home & online, however, are (slightly) negatively affected by the co-dependency on artificial intelligence due to the social importance within the sector; many are unaware of artificial intelligence applications within this sector, which causes questions by researchers and experts.

Table of contents

List of Figures and Tables

Chapter 1 Introduction

Artificial intelligence (AI) is getting more traction in the business and private life of world citizens. AI can be found in mobile phones with programs like SIRI, Google Assistant, or television (Smart TVs). TVs and phones are not the only places AI can be found, however. Take, for example, order systems, which automatically fill in the orders after receiving the inventory, based on the recent sales of the past weeks/years, or a response system, where robots answer basic questions based on keywords of questions of customers on a website. AI can be found everywhere around a person, no matter how small of assistance it may be. Every day people are becoming increasingly reliant on these technologies, from finding the best route to letting AI take over tasks such as explaining issues through applications.

In this research, the main objective will be to look at artificial intelligence's past, current, and future to see what artificial intelligence applications already have influenced in the everyday environment. Moreover, what artificial intelligence might be capable of in the future when it comes to new developments of AI in different sectors. Previous research shows that investment in IT alone does not show improved organizational productivity (Ko, Osei-Bryson, 2004). However, the question is what gives artificial intelligence its efficiency boost in different environments? How does artificial intelligence slowly take over? To create a pilot or demo AI project, nowadays, only a little effort is needed with all AI already out there. However, deployment, on the other hand, requires a variety of tasks and capability to deploy such AI, and the group that can deploy is in short supply (Benbya, Davenport, Pachidi, 2020). With robotics being introduced into different industries, the entry of these demo products is more enabled yet limited as there are only a small number of good developers compared to the amount of theory researchers regarding new artificial intelligence. The lack of good developers gives artificial intelligence an opportunity as showing off such new products can get much attention. However, it also might fail as the application stage needs to be appropriately led. The black-box behavior of AI systems due to the lack of expertise could cause a variety of artificial intelligence to have disruptive, trust-eroding effects that are irresponsible for AI implementation (Asatiani et al., 2020). Without the proper knowledge of artificial intelligence, it can form a threat to people who assume their AI applications are safe to use and rely on the answers given by AI. Artificial intelligence is extensive and can be used in many different sectors across the market; hence it could be a problem and a solution when it grows exponentially in usage across industries.

1.1 Problem statement & research question

Artificial intelligence can positively and negatively impact the environment around it. From a positive perspective, like increased profits and higher efficiency, to a negative perspective, such as higher IT costs and the possibility of unpredictable decisions made by artificial intelligence systems (Mayer, Strich, Fiedler, 2020). In order to find the positives and negatives of artificial intelligence, this study will attempt to look at the literature on artificial intelligence and study both sides of the equation to make a proper analysis. The literature is followed by literary analysis to create interviews to see if experts in the field of artificial intelligence agree with the literature. The results should clarify the capability and threats of artificial intelligence and its possible effect on daily life.

Furthermore, it should show if it is a solution or a threat if becoming more reliant and thus dependent on this type of technology, where it takes the effort of humans and moves the reliance on robots. Now the problem is apparent leading to developing the research question for this study which has to involve dependence, different segments, and artificial intelligence.

To what extent does artificial intelligence influence the daily life around us regarding co-dependency in different segments of our lives (and how might this affect us in the future)?

The different segments in this paper are healthcare, education, work and retail, and home and online. The result of this paper will give an insight into how artificial intelligence can be used to advance human capabilities. Especially for business and other aspects of applied artificial intelligence, the positive side effects of artificial intelligence are helpful. However, this group must also be aware of the negative side effects artificial intelligence can bring to not fall into a hole already dug. Researchers can instead look at the negative side to study why these failures arise and how these can be prevented in the future regarding artificial intelligence.

1.2 Research method

This research aims to test hypotheses of a possible future take on artificial intelligence in daily life concerning co-dependency. The research will be done through an extensive literature review. For each segment, and all together. An analysis is made to give a possible answer to how it could affect the co-dependency on artificial intelligence in daily life—followed by interviews with experts in the field of artificial intelligence. With the

interview, experts will be asked to respond to questions in the artificial intelligence environment. Together the experts will be able to create a view of how artificial intelligence has developed over the years and how it will possibly develop over time and give their opinion on specific developments in AI, both positive and negative. As a prominent part of this interview, the experts will be asked to what degree humankind will be dependable on artificial intelligence and how this may affect society. These answers will form an expert opinion of all experts, which will be compared to the literature analysis. The data will be analyzed freely between the experts and compared to the literature to allow for free comparison of what the experts said and a comparison based on the literature and the experts' opinion.

1.3 Relevance

For a paper to be beneficial for its environment, it has to have particular scientific and managerial relevance to succeed. Currently, there needs to be less of a gap between research and application, which needs to be solved. Many articles write about theoretical improvements in the field, such as efficiency gain or accidents with artificial intelligence; however, more needs to be mentioned about the application in the daily life of success and failures of artificial intelligence. Artificial intelligence has been maturing for a long time in the research literature; however, it is starting to become more front-stage than back-stage. Many new artificial intelligence applications like ChatGPT, AI art generator, bots for customer support, speech recognition, and many more are showing their proper form with many people talking about them. Few people speak of invisible or back-end artificial intelligence as many applications have secretly already been adapted without knowledge of many such as automatic grading, spelling checkers, and social media algorithms. This paper will focus on four specific segments where artificial intelligence will play an essential role in the development of that sector.

First, the paper will go into a deep literature analysis which creates the hypothesis of this research. Followed by the literature, interviews will be created and taken by experts in the field of artificial intelligence. These interviews can be analyzed to form a professional opinion of artificial intelligence in the applied state. This analysis will, after that, be compared with the literature to conclude the hypotheses and research questions based on literature research and the application of artificial in daily life.

Chapter 2 Literary review

2.1 Definition Artificial intelligence

The fruits of artificial intelligence are all around us, from the phones used daily to assist in many forms, such as in cars or the thermostat. While it took 75 years for the telephone to be used by 50 million people worldwide, it only took four years for the internet (Dimitrieska, Stankovska, Efremova, 2018). Due to the fact that artificial intelligence is such a significant term, it is crucial to ensure the description and definition of artificial intelligence used in this paper are up to standard and defined well. *Artificial intelligence* is an overarching term used for a wide variety of topics, and therefore it is not easy to find one clear definition to state what artificial intelligence exactly is. For example, Dick (2019) describes artificial intelligence as an ever-changing definition as artificial intelligence today resembles the symbolic (postwar) traditions of systems engineering and cybernetics approach of the fifties and sixties in name only. Holzinger et al. (2019) describe it as mechanical intelligence compared to human intelligence, with AI now raising enormous interest due to the practical successes in machine learning. Minsky (1961) describes the basics of artificial intelligence as a computer can only do what it is told in repetitive steps with multiple searches, with the resulting process being relatively inefficient if repeated many times. More modern-day articles like Benbya et al. (2020) state that AI is the ability of machines to perform human-like cognitive tasks with feasible concepts yet low deployment rates due to the strong possibilities of artificial intelligence but the little utilization of AI around the world. Hua, Li, Wang, Dong, and Cao (2022) state that artificial intelligence, or rather more specifically, machine learning, utilizes massive amounts of data to compute and learn, with machine learning representing the future direction of artificial intelligence.

Therefore the definition of artificial intelligence, including the future of AI, machine intelligence which focuses instead on the learning side of machines than performing human tasks (Holzinger et al., 2019; Hua et al., 2022) is:

"An ever-changing definition of mechanical intelligence where a computer can only do told repetitive steps by feeding it massive data performing human-like cognitive tasks with a perspective of machine learning being the current best future approach."

By focusing on the computing steps within artificial intelligence, it is important that artificial intelligence can be applied within every segment in the following chapters, which are the following: healthcare, education, work & retail, and home & online. These are segments where artificial intelligence is commonly found in a few different ways. The AI can be subtle, like the back-end, but also the very visible front-end, like applications that can draw based on words.

As mentioned before, the primary usage of artificial intelligence nowadays is machine learning. By letting a machine automate business processes such as help services, those bots that usually talk and try to figure out the problem before being let to an employee can significantly reduce the need for workers in help services and get better customer satisfaction. Furthermore, someone can gain insight through data analysis and engaging with both customers and employees using artificial intelligence (Davenport, Ronanki, 2018). With computers getting stronger every day and the available internals for a computer allowing faster and faster computations, a lot more data can be fed in a shorter amount of time, allowing for more robustness, design time reduction, more optimization, and more (Zhao, Blaabjerg, Wang, 2020).

Nevertheless, computational analysis is one of many uses. It can also be used in a managerial role, decision-making processes, and its relationship with the organization (Feuerriegel, Shrestha, von Krogh, Zhang, 2022). Even though, at the current stage, it might be small; this can affect companies in the future more and more as artificial intelligence develops more prominently. Think, for example, about making a schedule. Many companies use software online based on everyone's schedule and create an automatically generated schedule that only needs to be looked over for a few issues. These issues are issues like late entries, possible mistakes made by its employees, or other miscellaneous reasons that cannot or are not put into the system.

2.2 The segments

As the definition of AI is now clearly outlined, to not steer off target, it is essential to look at different environments in which artificial intelligence comes up. In order to be more specific regarding the influences of artificial intelligence. The following environments will be explored: healthcare, education, work & retail, and home & online. These environments each form a vital setting for the daily life of an average person. Each has a different perspective on

why and how artificial intelligence is portrayed and used within its environment. Healthcare due to the willingness of automation yet insecurity, education as it is the future workers and environment. Work and retail due to most artificial intelligence being worked and performed there and at home and the online environment as that is what comes closest to human interaction daily.

2.2.1 Healthcare environment

Artificial intelligence within healthcare is a very touchy yet innovative subject due to the nature of the environment, which is highly catered to the patient's needs and desires, which an AI can only be programmed to do with previous experiences, thus learning from human data only. The AI can make the system more and less reliable as humans are prone to making mistakes, but the mistakes can also be more easily patched out as it compares old errors with new possible solutions.

There are many different applications of artificial intelligence within the field of healthcare. For example, the ambition of future medicine is to model the complexity of patients to tailor medical decisions, health practices, and therapies to individual patients (Holzinger et al., 2019). The applications are a massive step as currently; the data is missing or lacking on different fronts to ensure a safe environment for patients. Briganti and Le Moine (2020) give another example as it is pointed out several other research that have improved through artificial intelligence. Such as glucose monitoring paired with a mobile app and epilepsy seizure detection devices which, like dogs, can sense it. Both dogs and the machine can check for any irregularities notifying a person and their surroundings before the seizure has taken place, with the possibility of sending their location to the closest relative for help.

2.2.2 *Education environment*

Education is one of the segments which has more influence on the future and possibilities. By introducing both artificial intelligence and the application of AI within the education sector, it can automate and fit students on their learning level, as well as get more students involved within the field of artificial intelligence by creating more understanding and the possibility to explore new things. By introducing the topic of artificial intelligence at an early education level, further interest could be created for potential future coders and developers. The coders and developers can improve existing artificial intelligence, improve its effectiveness, or even create entirely new machine intelligence that could be unimaginable or are in the starting era.

When looking at education, it is clear that it can be split into three major streams: administration & management, instruction, and teaching and learning functions or areas (Chen, Chen & Lin, 2020). The article from Chen et al. (2020) describes numerous examples of artificial intelligence, such as person-tailored curriculums and content development based on previous works, help with grading, and offering feedback using special tools like Knewton with interaction on the platforms. Other research (Ouyang, Jiao, 2021) shows that artificial intelligence has the potential to assist significantly on different levels to enhance the learning ability of individuals. The enhanced learning can be done with low assistance, completely tailored needs, or a middle area of both. The paper mentions AI-supported, learner-as-collaborator, and AI-empowered, showing these are different entries. The levels are things such as extra exercises for their education to take over their education completely and steer them into education the students are good at or need to develop more on their level and beyond.

2.2.3 Work & retail environment

The work and retail environments have the most hidden artificial intelligence, as most artificial intelligence in work-related environments runs more on the back end than the front end. The back-end AI can be seen in, for example, the supplier side that can get automated by ordering based on projected sales and the current stock or marketing. The only thing a person gets to see is the banner or online advertisement, and nothing behind the scenes, such as research and development or targeting, as this is needed to fit the best needs of the customers. Workers have to deal with more and more automation which can make their jobs both less intensive and more complicated due to the complexity of machines.

Deep learning is a method within artificial intelligence that is more common nowadays, mostly in experimental departments and work environments. By feeding a machine large amounts of data it can start to form its result by repeating each result; an example of this is the verification checks everyone online has to do by recognizing pictures of a specific object. The machine is trained to recognize the object in many situations and how absurd the object may be. This deep learning could automate, for example, virtual assistants by answering questions customers have (Jarek, Mazurek, 2019). Another side of the work environment is the help managers can get in many ways and forms. Suppose this is through back-end ordering or helping automate the schedule. In that case, this, however, also comes with issues

as the help the managers get off artificial intelligence also has a darker side, such as privacy issues, prone to bias, cyber security issues, and more (Berente, Recker & Santhanam, 2021).

2.2.4 Home & Online environment

Nowadays, many people spend a significant amount of time online on their computers, phones, tablets, consoles, and other electronic devices and need to realize how many different types of artificial intelligence or results of AI are packed in these devices. Many more products nowadays carry electronic chips, such as cars, (smart-) fridges, laundry machines, alarms, watches, and many more, which can be used to connect and predict using other devices. These chips can be changed to be used for other or more practices. For example, people use smart fridges to play games or watches that predict or calculate the number of calories burnt or steps walked.

An example of this is the current hype on the internet: the AI that draws based on a few words creating an out-of-this-world picture based on everything learned about the words. More back-end artificial intelligence includes algorithms to improve or filter social awareness in social media applications (Lamsal, Harwood, Read, 2022). There are many examples of artificial intelligence in the online environment and inside and around the house. Such as autonomous driving (Holzinger et al., 2019) and smart homes where you can control your temperature, lamps, preset the oven, and more (Dunne, Morris, Harper, 2021). The newest artificial intelligence that is being developed most of the time ends up on the internet. Open AIs and pay-to-unlock have enabled both growth and diversity in artificial intelligence, as seen in an article by Hua et al. (2022). Cloud computing is becoming a bigger problem and is being solved through edge computing, allowing cloud tasks to be moved to the edge of the network, thus creating less pressure on network bandwidth with all artificial intelligence running big data around.

2.3 Co-dependency

As seen in the previous chapter, Artificial intelligence has evolved many times and has a big future ahead, according to multiple researchers. With these developments and progress also comes new responsibilities; as technology advances, fewer people will understand its complexity and become more dependent on others and artificial technology. That makes the problem of this chapter the general public becoming too co-dependent on artificial intelligence and how this will affect the future. According to the Oxford dictionary,

co-dependency is characterized by excessive emotional or psychological reliance on a partner, typically who requires support on account of an illness or addiction. For this paper, the definition will be slightly altered to fit the need for technology co-dependence:

"The excessive emotional or psychological reliance on technology, typically who requires support on account of an addiction and lack of understanding of the technology within."

By creating this definition, it is possible to find the most positive and negative forms of reliance on artificial intelligence and compare them to co-dependency. By weighing the literature, both their positive and negative sides, a temporary conclusion can be made on the possibilities of artificial intelligence based on the literature and be turned into hypotheses that can then get tested on reliability.

The best description comes from Makridakis (2017), whose research offers scenarios that cover a majority of different types of followers of artificial intelligence and the co-dependence on AI. First is "the Optimist", who believes that nanotech and robotics will revolutionize everything and that society will become partly robotic to enhance everything in society and become efficient artificial intelligence life. The second group is "the Pessimist" who think that machines effectively control all critical decisions because people are afraid to make their own choices; artificial intelligence and human life are conjoined. Examples of this could be a future possibility of forbidding to drive themselves and only be driven by AI and computers taking over. Thus, computers observe humans as people do in the game the Sims. The opposite is "the Pragmatist"; these people believe that through OpenAI and effective regulations, society can augment and improve their skills, but this artificial intelligence cannot take over people's lives as they are stubborn enough to make their own choices. The last group is the denial group, "the Doubters"; this group does not believe it is a real threat to society as only once computers are given data can they respond. These computers cannot replicate how the mind works, even humans do not understand this.

These four groups each form opinions on how artificial intelligence will develop over time, with each positive and negative co-dependency related to them. Only time will be able to tell which view is the closest. However, looking at the literature per segment and overall, it is possible to make a better picture of the possible future of artificial intelligence.

2.4 Positive co-dependency

Let us start with co-dependency on artificial intelligence and its positive effects on daily life. Before diving into every segment, it is essential to look at general improvements that can be noticed. As mentioned earlier in the paper, the definition of artificial intelligence is constantly changing due to technological changes every few years. This continuous learning also comes with continuous improvements to artificial intelligence making every system more advanced and capable of more and more as more time passes (Poola, 2017; Ågerfalk, 2020). These improvements create more advanced artificial intelligence units/robots/programs. This results in reduced human efforts and thus saves a lot of labor/human time as artificial intelligence takes over from the limitations of humans and pushes the boundaries of what is possible to create and produce(Khanzode, 2020; Poola, 2017).

2.4.1 Healthcare

Take, for example, healthcare; this segment can profit nicely from the fruits of artificial intelligence as it advances. There is already some artificial intelligence evident, such as physicians cooperating with AI to a point where it could be considered crucial as they help with predictive measures on vaccine developments and potential patients (Alansari, Gerwe, Razzaque, 2021). Another example of the development of multiple AI algorithms is that these AI can report on different regions of the human body to prioritize examinations with emergent findings (Tadavarthi et al., 2022). These AI-assisted reviews can also be used for silent assistance for junior residents with complex or high acuity cases. The AI-assisted reviews will result in more independent reviews while ensuring an attending physician is also aware of the case (Tadavarthi et al., 2022). As these improvements come around, it can result in a smaller load for the attending physician or senior resident taking on the case, which means these people can be used to doing other things given the already shortage of nurses and physicians in hospitals. Another big negative of hospitals is the giant piles of administrative work for both the hospital and client sides, such as insurance or bills. AI applications can be used to standardize, giving increased clarity, accuracy, quality of reporting, and decreased report variability in certain situations streamlining the process (Tadavarthi et al., 2022). These improvements, together with the light on the online environment becoming more and more important for clients of the hospital, makes it more critical than ever to use artificial intelligence to stay ahead of the possible time-consuming reports.

2.4.2 Education

The next segment for positive co-dependency on artificial intelligence is education. As the new generation starts to study, more electronic devices are being used. From using the phone to do a quiz like Kahoot or a laptop to write a report to alternate lesson plans such as extra or more advanced material. These materials can improve the learning experience significantly by tailoring programs to the student's needs and desires, resulting in higher grades and better learning abilities (Chen, Chen & Lin, 2020).

However, the student side is not the only side improving within education. Administrative tasks have improved through automation, such as grading, grades, personal details, and more (Popenici & Kerr, 2017). Reviewing assignments can now be done more automatically through, for example, multiple-choice answering or searching for keywords within a text (Chen et al., 2020). Furthermore, augmentation possibilities are used to extend human capabilities and possibilities of teaching, learning, and researching (Popenci et al., 2017). By introducing artificial intelligence to offload some pressure on teachers and lecturers, this group of people can work on creating a better lesson and focus on students that might need extra attention.

2.4.3 Work & retail

Within the work and retail environment, the positive co-dependency with artificial intelligence is more focused on the back than the front end. An example of this back-end artificial intelligence is managing and organizing statistical data, which results in more minor human errors, thus decreasing the number of overall errors thus increasing accuracy (Poola, 2017). Automating business processes and gaining insight through data analysis (Davenport et al., 2018). A company nowadays can get valuable insight into what may benefit the company in both the short and long run from the customers and finding places where the company can cut some expenses to become more profitable. Automation tasks based on characteristics can help companies attract customers by cross-referencing more clicked images (Tadavarthi et al., 2022). Another significant change is the introduction of bots on websites and other online platforms, which engage with customers and employees (Davenport et al., 2018). These bots can answer basic questions or help with specific issues making big call/help centers redundant and creating a more cost-efficient environment. Now, only a few members have to help with issues irresolvable by this bot.

2.4.4 Home & online

In and around the house, everyone is using particular artificial intelligence technology. As new AI systems get introduced every year, more and more houses are becoming dependent on technology, and the co-dependency on artificial intelligence increases too. From the thermostat automating hours every day of the week to the right temperature to the application on the smartphone controlling lights, sockets, and other objects within and around the house. Also artificial intelligence is becoming more evident outside the house. Self-driving and assisted-driving cars are spotted more on the roads and streets, which results in fewer accidents due to lane assist or accident avoidance using artificial technology (Poola, 2017). These help more tired or distracted drivers alert when making a mistake or even entirely prevent it by emergency braking or steering away from the danger.

Furthermore, online cybersecurity is becoming increasingly important as most things are now moved to the online environment. This movement means cybersecurity must keep improving to keep everything safe such as banking and insurance (Wirkuttis & Klein, 2017). Many internet security providers nowadays share certain security breaches or can be found in the public domain under prevention websites if the issue is across the board and should be prevented as soon as possible.

2.5 Negative co-dependency

As with anything in life, it is easier to find negatives than positives; this is the same for negative co-dependency on artificial intelligence. Critics say there are still many roadblocks before artificial intelligence can become an addition to society and not have opposing sides due to issues such as the reliability of data sets (Nikolskaia, 2021). Some of these challenges include trust (Rossia, 2018; Alansari, 2021), safety, security, privacy, justice, fairness, and an increased level of accountability (Hwang et al., 2020). Other issues like high error susceptibility create standard errors in which AI can cause mass-scale destruction (Khanzode, 2020). Data mining could draw the wrong conclusion based on patterns in data without verifying that the illocution (social context) of the data is understood (Ågerfalk, 2020; Yudkowsky, 2008). These negative co-dependency issues with artificial intelligence can lead to greater inequality, disruption of the labor market, cybersecurity issues, hacking risks, manipulations, and ethical issues (Dimitrieska et al., 2018). These issues are fundamental, if over time, society becomes more and more reliant and thus dependent on artificial

intelligence and its technological advancements. Creating artificial intelligence takes money and time (Khanzode, 2020), especially if the issues mentioned prior have to be revised and worked away to create a better environment. There is currently still a lack of transparency and learning ability (Nikolskaia, 2021) which causes this massive inequality and problems that make artificial intelligence untrustworthy. Furthermore, to come back to the issue of money, second and third-world countries are struggling as machines replace cheap labor creating no reason to outsource the firm to certain countries other than for their resources or laws. It results in less money for those countries already lacking due to lower-developed artificial intelligence technologies creating an even more significant gap (Makridakis, 2017).

2.5.1 Healthcare

When it comes to healthcare, doctors and nurses must act with the highest accuracy, as every mistake could cost human lives. The cost of human lives means negative co-dependency is a real issue within this sector. For example, at the current time, artificial intelligence is already outgrowing the human mind. Most case results cannot be easily questioned as the analysis is hardly scrutable due to recognizing patterns beyond current common knowledge and known human capabilities (Puaschunder, 2019). The physicians who check the scans might need help understanding or skipping specific issues, while artificial intelligence must be 100% accurate.

Furthermore, as transparency is still an issue, disconnected systems and fragmented data sources limit information flow and the development of scientific insights (Puaschunder, 2019). It does not stay only in the hospital as it could augment healthcare providers' capabilities in identifying high-risk patients (Lin et al., 2017). Insurers have insight into this information, and when a person might belong to a specific demographic or symptoms, this person will get a standard higher rate as they are more of a liability than an asset to the insurance companies and hospitals. It refers to the previously mentioned negative co-dependencies such as transparency, privacy, and fairness.

2.5.2 Education

As the education system is becoming more dependent on artificial intelligence the biased artificial intelligence system usually created due to an unfavorable dataset might affect students in a wrong way as these students are introduced through clean datasets in school. Their code on the internet or public datasets might be completely different. Take, for

example, Twitter-bot Tay, who was released and soon became very racist, bigoted, and started hate-spewing before being taken offline quickly by the development team (Popenci et al., 2017). The bot, in a theoretical atmosphere, as well as tests, performed well in the real world, and it soon got cluttered with the dark side of Twitter and started to adapt to those groups.

Furthermore, the more important AI becomes, the less work there is for people. People who studied artificial intelligence or more technical-related studies have a higher wealth creating more wealth inequality (Makridakis, 2017). At the same time, leaving other studies in shambles as artificial intelligence started to replace quite a few jobs. Current law cannot cope with the development and evolution of artificial intelligence (Buiten, 2019) as most governments are traditional and need to grasp the fast-changing technologies being created yearly. The fast-changing technology will result in a negative co-dependency as more people will become dependent on these technologies. Nevertheless, the human variant of it is becoming scarcer, thus creating a monopoly where AI takes over without much competition as AI can easily outperform humans.

2.5.3 Work & retail

Work and retail will be the most challenging segment affected by artificial intelligence and its co-dependency on artificial intelligence. As mentioned in the previous part, jobs will decrease as artificial intelligence takes over, resulting in higher prices for machines at first (entry cost) but reduced costs due to fewer workers on the floor and higher efficiency. In other words, the threat of total replacement in the future as demand for human labor turns into demand for mechanical skills to higher intellectual skills and those tasks to machines (Huang & Rust, 2018). An example is the introduction of bots that engage with customers and employees (Davenport et al., 2018). The majority of call center employees will be redundant and only issues the bot cannot solve will have to be dialed through to employees who have to have a better understanding of the topics and issues. As the majority starts to understand the theory behind the application, cybersecurity becomes a real issue (Nikolskaia et al., 2021) as the constantly changing environment will result in the expanding threat landscape and creating new threats that must be patched every time (Nikolskaia,2021).

2.5.4 Home & online

Home and online segments are the most vulnerable to co-dependency. Look at the current old generation, who needs help understanding technology and all the phishing emails, scammer calls, viruses, and other things these people deal with, resulting in loss of property, money, and time. It could happen to a more significant part of society if the co-dependency becomes too high and the majority does not understand what is going on with their artificial intelligence. As an example, cars, autonomous driving is becoming more and more present on the road, which is a great thing; as mentioned previously, it reduces accidents; however, it must be noted that some drivers are becoming too dependent on them. As other drivers on the road can be very unreliable with reactions, unclear decision-making of the AI vehicle can become a problem (Holzinger et al., 2019). A car could make mistakes and not see particular debris as it was not calibrated to do so (low-lying debris that could shoot up into the car) or fail in the code. Such as when an autonomous vehicle did not detect a semi-truck due to the wide body of the carrier resulting in the AI vehicle at full speed crashing into the semi (Popenci & Kerr, 2017). It is not the only place where AI is becoming more present. As the online threats become more significant, cybersecurity and online security also become trickier and trickier (Wirkuttis et al., 2017). The security system must continuously improve its safety by patching every possible entry into a computer. As this gets more complex new possible backdoors are opened for hackers and malicious intent. This shows that negative dependency indeed will cause many problems as the programs are becoming more sophisticated to extract information as the common eye might not be able to spot a fake from a real one anymore.

2.6 Co-dependent literary conclusion

In the following table, table 1, there will be a summary of all points mentioned prior from the many different issues and opportunities within artificial intelligence concerning co-dependency. Both positive and negative co-dependency will be displayed for all segments together as well as each segment separately.

	Positive co-dependency	Negative co-dependency
All segments	- More capable (Poola, 2017) - More advanced (Ågerfalk, 2020) - Reduced human efforts (Khanzode 2020) - More efficient (Poola, 2017)	- Trust issues (Rossia, 2018; Alansari ,2021) - Reliability of data sets (Nikolskaia, 2021) - Safety, security, privacy, fairness, accountability (Hwang, 2020) - Error susceptibility (Khanzode, 2020) - Wrong conclusion of data analysis (Ågerfalk, 2020; Yudkowsky, 2008) - Disruption of labor market, inequality, ethical issues (Dimitrieska, 2018) - Money and time investment (Khanzode,2020) - Lack of transparency (Nikolskaia, 2021) - Problems in second/third world countries (Makridakis, 2017)
Healthcare	- automatic examinations (Tadavarthi, 2022) - AI assisted review (Tadavarthi, 2022) - Potential patients (Alansari, 2021) - Decrease report variability (Tadavarthi, 2022)	- Knowledge beyond human capabilities (Puaschunder, 2019) - Fragmented data sources and limit flow of information (Lin, 2017)
Education	- tailoring programs (Chen, 2020) - improvement on administrative side (Popenici, 2017) - automatic review of assignments (Chen, 2020)	- Biased bots (Popenci, 2017) - Job and wealth inequality (Makridakis, 2017) - Law cannot cope with development (Buiten, 2019)
Work & Retail	- reduced human errors and increased accuracy (Poola, 2017) - automating business processes (Davenport, 2018) - insight through data analysis (Davenport,2018) - automation of tasks based of characteristics (Tadavarthi, 2022) - bots for engaging with customers (Davenport 2018)	- higher entry cost - threat of total job replacement (Huang, 2018) - bots to engage with customers (Davenport, 2018) - cybersecurity issues (Nikolskaia, 2021)

Home & Online	● Smart homes ● self/assisted driving (Poola, 2017) ● cybersecurity (Wirkuttis, 2017)	● Other road users and AI (Holzinger, 2019) ● Failure of detection with AI (Popenci, 2017) ● Security issues (Wirkittus, 2017)

Table 1 Positive and negative co-dependency on artificial intelligence

2.7 Hypotheses

As visible from this table, each segment has its fair share of good and bad outcomes of artificial intelligence with respect to co-dependency. Relying on technology is not bad per se as long as it does not lead to catastrophic outcomes that a few of these artificial intelligence applications could become. This table, table 1, also brings the hypotheses for this research along with it, which are the following:

H1. Overall co-dependency on artificial intelligence will affect a person in a semi-positive manner

Given the fact that there are still trust issues (Rossia, 2018), reliability issues (Nikolskaia, 2021), and other things that might affect the co-dependency, the main point of constant improvements (Ågerfalk, 2020), reduced human efforts (Khanzode, 2020) and increased efficiency (Poola, 2017) can outperform these issues and resolve them sooner or later. This means that at this point, given the literature, it is semi-positively affecting daily life as the issues have not been resolved yet.

H2. Co-dependency on artificial intelligence will affect Healthcare in a positive manner.

When it comes to healthcare, there are a lot of improvements like automatic examination (Tadavarthi, 2022) and the potential catching of patients' symptoms early (Alansari, 2021) with artificial intelligence becoming more present and younger generation of physicians, doctors, and nurses becoming more relying on this technology to improve efficiency and accuracy, smaller issues like knowledge beyond human capabilities (Puaschunder, 2019) and fragmented data sources with limited sharing (Lin et al., 2017) fall into the too small category to affect the co-dependency on artificial intelligence enough.

H3. Co-dependency on artificial intelligence will affect Education in a positive manner.

Just like the other segment, healthcare, education has had many improvements to improve artificial intelligence technology in schools, from student-tailored programs (Chen et al., 2020) to improvements on the administrative side of the school (Popenici, 2017). These changes help students and teachers significantly that the opposites like job and wealth inequality due to AI (Makridakis, 2017) and biased bots that students and researchers create (Popenci, 2017) do not have such a heavy negative as the heavy positive for co-dependency.

H4. Co-dependency on artificial intelligence will affect work & retail in a semi-positive manner.

When it comes to the work and retail environment, co-dependency is semi-positive. This is due to more pressing issues like high entry costs, the threat of total job replacement (Huang et al., 2018), and cybersecurity issues (Nikolskaia, 2021). These are not able to be patched quickly as these will be reoccurring issues while big positives like reduced human errors and increased accuracy (Poola, 2017), automation of tasks (Davenport, 2018), bots taking over basic work for engaging with customers (Davenport, 2018), are taking a more net positive co-dependency on artificial intelligence.

H5. Co-dependency on artificial intelligence will affect home & online in a neutral manner.

As last the home and online environment, the co-dependency is neutral. Both sides show significant influence on why the co-dependency on artificial intelligence could be good and bad. Good things like smart homes and self or assisted driving (Poola, 2017) offer a great look toward the future of artificial intelligence. However, the negative side, like the failure of detection with AI on the road (Popenci, 2017) and security issues (Wirkittus, 2017), remains in sight for now, which need heavy improvements to ensure no accidents happen.

Chapter 3 Methodology

This part of the paper will give an overview of the methodology of this research. First, the research method will be discussed, followed by data collection. The data used in this paper will be primary data, with focus interviews with experts in the field of artificial intelligence.

3.1 Research method

The aim, as mentioned prior, is exploratory research due to the nature of the environment of co-dependency with regard to artificial intelligence. Artificial intelligence is the most common way people usually will put things like AI art generators or the self-walking robot forward, which are the more visible ones on television and news but by far do not reach the extent of how much artificial intelligence is around them. Dickinger (2007) states that the main objective of qualitative research is to gain preliminary insights into decision problems and opportunities. Interviews with experts will allow an understanding of how future artificial intelligence might establish and develop more over time and how this could affect society's reliance on these artificial intelligence applications. Therefore this research will be a qualitative study where a number of people are questioned based on expertise in a lower amount than in a regular survey. However, the quality of the answers will go up significantly as these interviewees are specifically chosen for their knowledge of artificial intelligence. The structure of the interview will be semi-structured with open-ended questions, so the interviewee has the opportunity to answer however the interviewee wants to answer with a preferred length and detailed answer, as a result, allowing for a more in-depth analysis of the topic.

3.2 Data collection

For this research, there were several ways people were contacted to participate. First and most was through the help of an email. Next to email, there was also the usage of Whatsapp to contact an intermediary that could connect with experts in the field acquired through earlier job and internship applications. The interviews are done mainly through the Zoom application and by phone. Most experts were found through their shared interest in artificial intelligence and are experts in the field of AI in the Netherlands. The data collected in this paper are done through open-ended questions, which allow for more freely spoken conversations with the possibility of steering to follow-up questions to ensure staying on

topic and diving deeper into the topic. All participants of this research have to a certain extent, an involvement with artificial intelligence or know a great deal about this topic. The interview questions can be found in the appendix, appendix 2a, and 2b, for anyone that wants to replicate the study to test its reliability, validity, and replicability (Golafshani, 2003).

Furthermore, the interview shall be recorded and transcribed to allow researchers to read back the answers when needed. The transcription has two stages; the first stage is to run it through an artificial intelligence program that automatically transcribes text from audio, such as Descript, Trint, or Sonix. After this program is done, to ensure quality, everything will be listened to manually and checked for any mistakes made by the speakers or the program to ensure high accuracy of the transcribed text. Transcription is needed to allow for transparency, as mentioned earlier, allowing other researchers to redo the interview and confirm its reliability with replicability (Silverman, 2011).

After the data from the interviews is acquired, it will be turned into information, and the core values of each answer will be transferred to the results section of this paper. Due to the size of the interview, it is impossible to put every single word in the results. However, with all interviews, a general picture can be created of how well the artificial intelligence technology is developing and how dependent society could become on this technology, as well as answer the research question along with hypotheses. By adopting these interviews into results, the experts can form a clear answer if these experts agree or disagree with the development of artificial intelligence.

Prior to the interview, the experts were contacted through email with an introductory email which had the topic of the study and its aim but further than that, no information was given unless asked to extend on the topic so the experts would understand what was asked from them. The questions from the basic interview layout were not given to prevent experts from working out the answers prior to the interview and threatening the validity and reliability of the answer of experts with as a result a threat to validity and reliability of this study (Dörnyei, 2007; Nordhus, 2021).

3.3 Interview conduction process

The interviews should take between 30 to 45 minutes to allow a proper answer to each question and thinking time for each question for the experts. In order to ensure quality, each interviewee was contacted due to their nature of work within the AI field, such as being

mentioned in articles of upcoming/current AI experts, teaching specific courses, or writing books regarding AI. The relationship between the topic with the informant is a key indicator of the quality of the findings (Dickinger, 2007). Each expert will go through the exact same interview based on the same questions except for the possible follow-up questions, as these will be answered dependent. The answers the experts will give can change the way of asking the interview questions due to the nature of the questions, as examples are usually asked in follow-up questions that might be answered in the main question already. All interviews will either be done in their native language (Dutch) or English, depending on which language the expert prefers to do the interview in. The interview details can be found in appendix 2a and 2b. The interviews will be recorded in order to be later transcribed and entered under appendix 3a, 3b, 3c, 3d, and 3e. The interviews done in Dutch are translated by the researcher with a professional level of English.

3.4 Data processing

As mentioned earlier, the data will be acquired by recording the interviews given to all participants who are experts within the artificial intelligence field. The audio files will be run through a rudimentary artificial intelligence transcribe, followed by a full manual review to remove any impurities and errors within the text. In order to keep anonymity within the paper, all experts will only be called by general profession, expertise in years, association to paper by Makridakis, 2017, and segment. Next to this, their name shall be replaced to keep anonymity. These names will be replaced with the following names:

- Perdu
- Watson
- Uri
- Elena
- Veos

These names have an origin in the game Old School Runescape and have been randomly selected to replace the names of the experts. As seen above, five total experts were asked to do an interview. Each has expertise within the field of artificial intelligence and can bring in a helpful view concerning co-dependency on artificial intelligence and artificial intelligence.

3.5 Data analysis

The data will be examined in two different ways. First, the five interviews will be cross-examined to see what the experts put together as an answer. These interviews will create a view that creates a path that emerges from the interviews with similar or different views. After the path together, the research will be categorized; here, the segments and questions will be more deeply examined and put into categories to determine the differences as well as similarities between the experts and the research papers.

By allowing an unrestricted cross-examination apart from the literary review, the experts can make an independent point regarding the topic of AI. This can be, for example, a point that is not mentioned in research but might relate importantly to AI in general. Through this, an idea can be set on how these experts think about AI and its possible future regarding co-dependency.

After the cross-examination between each expert, the paper will focus on comparing the expert's view with the segments, research papers, and everything mentioned in the literary review. The comparison is then made to shape a better answer to the hypotheses of this paper and to get a clear conclusion based on everything said in the interviews with experts.

Chapter 4 Results

This chapter will take a look at the answers given by the experts. The information gathered from the data as mentioned prior will be viewed in two different ways. First, the interviews will be cross compared to each other to allow the data to make their conclusion based on the experts followed by comparing the segments mentioned in the paper and interview to allow the opinion of experts and researchers to flow to one conclusion. In order to get an understanding of the data it is essential to take a look first at the experts in the following table, table 2, each expert has been categorized into profession, segment(s), years of expertise within AI and their opinion on which group they belong from the paper of Makridakis (2017).

	Perdu	*Watson*	*Uri*	*Elena*	*Veos*
Profession	Investment manager	CTO	Professor + practor	Professor + researcher	Professor + practor
Segment(s)	Work and retail	Work and retail	Education & work and retail & home and online	Healthcare & education	Healthcare & education & work and retail
Years within AI	2 years +	11-12 years	20 years	5 years	1-2 years
Makridakis group	Pragmatist	Pragmatist	Pragmatist	Pragmatist	Pragmatist

Table 2 The experts

4.1 Expert definition

With this information in mind regarding their background and expertise of artificial intelligence, the focus can go towards what each expert said in the interviews. Each expert was asked their definition of artificial intelligence and co-dependency. Let's first look at artificial intelligence.

4.1.1 Artificial intelligence

Perdu stated that artificial intelligence is a self-learning system which means it is permanently restricted to what humans ask it to do by continuously learning from the data it

gathers. Watson said the same thing as Perdu, yet added that it is a tricky question as there is no real great definition of artificial intelligence. Furthermore, Watson states that it helps us advise with making a hard decision. Veos agrees that there are a lot of different definitions. Veos puts the definition instead in everyday speech as Veos describes it as Veos would to the parents as a computer system that acts as a second set of brains to help with complicated computations and to work faster/more efficiently. Veos' definition is interesting as both Perdu and Watson are field-related artificial intelligence by applying it to their jobs only. Veos comes with the same conclusion while using artificial intelligence rather than educating people on artificial intelligence and would still explain the same way.

On the other hand, Elena and Uri give a more detailed view of artificial intelligence as both work in the educational system, teaching the basics of artificial intelligence. Elena describes artificial intelligence as undefined. AI tries to mimic our human behavior, yet there are also things that only AI can do and no human can, such as the speed at which it computes data. Nevertheless, there are also things that AI cannot do, such as emotional things, as it attempts to fit a model. Elena compares this to a question where a picture is presented with an airplane, and the question is asked if it is a cat or a dog. A human would say it is an airplane, but AI would refer to it as more of one or the other as an attempt to force match the question. Uri, who has been in the field for the most time, has seen AI develop a lot and describes it as an automatic or semi-automatic system operating on data or for linking and joining and making systems interoperable with the final goal of supporting or taking decisions and gives examples of these such as the automation in the supply chain.

So together, the experts create the following definition based on at least two experts mentioning it in their definition of artificial intelligence:

Artificial intelligence is not definable (Watson, Elena, Veos, Perdu). However, in an attempt to make a current suggestion to the definition is that artificial intelligence is a machine system (4) that follows the tasks of humans and mimics them (2) in an attempt to gain efficiency and speed beyond human capability(2) in order to help make decisions and advice/support the humans (3).

4.1.2 Co-dependency

With this in mind, the focus goes toward co-dependency. Each expert was asked to voice their understanding of the co-dependency of artificial intelligence on daily life before being told

the definition in this paper to ensure that throughout the interview, no misunderstanding would arise regarding this definition of co-dependencies and create discrepancies.

Veos states that tools that humans have developed in the past have been integrated into society well, showing that technology integration is not necessarily bad but not necessarily good. Watson was initially unfamiliar with the term, but after being given the definition, Watson stated that reliance could also sometimes slowly take over, like system technology, where it is basically like electricity or having fresh water, which shows a follow-up on what Veos stated. Uri also agrees with Veos and Watson and reinforces this. Uri states that nowadays, much artificial intelligence gets used without knowledge, and going back without it is challenging as we usually do not recognize it as the presence of artificial intelligence. In other words, it describes what dependency is. Perdu takes a more global approach and states that because of artificial intelligence, humans are becoming more reliant on artificial intelligence due to innovation. Given the history, society always becomes dependent on innovation. It is simply how we work and how we do it. Elena takes the simple approach to the definition only and describes co-dependency as the need for something to be able to do your work.

4.1.3 Expert comparison

Even though all experts refer to themselves as pragmatists and think artificial intelligence will not surpass human capabilities, in the interview, several experts are still scared of the inevitable consequences of artificial intelligence with the possibility of out-reaching human efforts. Watson responds by stating that as long as society has effective regulations to protect people, it is possible to stay above technology. Things such as transparency are necessary for the success of artificial intelligence, and it is not good if we become too dependent on technology. It is crucial to understand the concept deeply and know what you are doing when it comes to AI. People are willing to share a lot of information with, for example, Facebook and Tiktok. Perdu compares it to China, where Perdu states that AI is used to visually check its citizens, and where AI could be used to control a bigger group. Perdu's statement is similar to what Veos said as Veos put the situation of the Roomba forward, where it maps the whole house to clean or Whatsapp, which has the rights to the pictures sent through Whatsapp. Product owners are slowly becoming more unaware of their usage of artificial intelligence (Elena), and people that use AI are less aware of how it works for them. It is just like a black box, something goes in, and something comes out, but they do not have the

realization of how (Elena). Furthermore, it is scary from the military perspective as these AI are getting more dangerous (Veos, Uri), and AI could take over and make the decision of war without human intervention as the cost of living might be lower than the achievement of killing someone (Uri). Last, the scariest part mentioned by multiple experts in the act of desocializing, their job getting more standardized and boring, less social interactions together (Perdu, Elena) as well as contaminated data (Veos, Elena) which could affect the results of artificial intelligence. As last, it must be mentioned that AI could be scary as Perdu mentions that outliers could be missed as artificial intelligence only defines a positive or negative, but data is never completely clean. New issues could be created without the suitable dataset trained.

Without looking at the segments and questions asked to the interviewees, the experts came up with their positive effects that have a positive effect on society or parts of society when it comes to co-dependency on artificial intelligence in daily life. Besides the previously managed advantages in the definition of artificial intelligence, such as efficiency, helping with complicated computations, helping to make difficult decisions, positive innovations, and other things, more things were mentioned by the experts regarding the positive effects artificial intelligence has brought to the world. Concrete examples mentioned by the experts were smart fridges, Google Alexa (Perdu), Roomba (Elena, Watson), smart lamps (Watson), and smart thermostats (Perdu, Watson). All experts agree that robots can take over the (dangerous) jobs of their human counterparts, such as self-driving forklift trucks (Perdu), or help with analyzing x-rays and detection in time (Veos, Elena, Watson). Watson also mentioned that it allows people to be more mobile traveling as it becomes easier to find the best routes making it less scary for certain people.

On the technical side, Elena states that federated learning allows faster and better improvements in areas such as privacy and security through artificial intelligence. Perdu and Uri add on top of that that AI could become more scalable and widely used. Just take a look at, for example, ring cameras or Roombas (Veos), which are very common nowadays and still rising in popularity. Job reduction also comes with cost reduction and efficiency for governments and companies, which could be better (Veos). Perdu states that the economy will do its work again over time. New people will be attracted to do that work if there is a scarcity of people. Innovation will push for new standards, just like how knights vanished in the past (Perdu, Veos, Alena). Watson agrees as each (technological) innovation decreases inequality as more people work nowadays and fewer people are poor compared to the past.

As last, Elena mentions that it is easier than ever to use artificial intelligence as there are a lot of different AIs commercially available to be bought.

4.2 Experts versus researchers

Now that the information from the interviews with experts has been independently compared with each other, it is now important to examine it together with the literary review and compare how this matches up with the view of the experts. In the interview each expert was asked to give their opinion on whether they thought co-dependency on artificial intelligence in the four segments, healthcare, education, work & retail, home & online, was positive or negative. Each segment was asked individually and based on those answers the overall opinion was created by averaging out every answer as seen in the following table, table 3, on the next page.

	Perdu	*Watson*	*Uri*	*Elena*	*Veos*	**Overall**
Healthcare	Positive	Positive	Negative	Slightly negative	Slightly positive	**Slightly positive**
Education	Positive	Slightly negative / neutral	Negative	Positive	Positive	**Slightly positive**
Work & retail	Slight positive / neutral	Positive	Negative	Slightly positive	Positive	**Slightly positive / positive**
Home & Online	Negative	Neutral	Negative	Negative	Positive	**Slightly negative / negative**
Overall	**Neutral / slightly positive**	**Slightly positive**	**Negative**	**Neutral**	**Positive**	<u>**Slightly positive**</u>

Table 3 Opinion on co-dependency on artificial intelligence in daily life per segment

As seen in the table, experts tend to differ, each has their own reasoning for why they agree or disagree with each segment regarding the co-dependency of artificial intelligence in daily life. In the following part, each segment will be carefully reviewed from both the side of the experts and the literature review to compare the view of researchers and experts in the field.

4.2.1 Healthcare

To start, let us take a look at healthcare. Healthcare is a complicated topic due to the sensitivity of its environment, as there are human lives at stake. This risk means that artificial intelligence must work on point before being used to minimize human risk. According to Elena, a major drawback of artificial intelligence is that there is no uncertainty output. AI might not see the outliers as artificial intelligence only tells what to do based on data and questions (Perdu).

Furthermore, with artificial intelligence currently being developed for error detection in radiotherapy treatment, the data available is low as the error rate is low (Elena). When looking at the literary study and comparing this to what the experts said, quite a few things popped up as comparisons confirming this research to real-life cases. Artificial intelligence applications like standardization of the patient journey give increased clarity, accuracy, quality of reporting and decrease report variability. AI might become dangerous when becoming too dependent on AI as the analysis is hardly scrutable due to it recognizing patterns beyond current common knowledge; both were mentioned by researchers (Tadavarthi et al., 2022) (Puaschunder, 2019) and an expert (Elena). Another statement supported by multiple experts (Veos, Elena, and Watson) and a researcher (Lin et al., 2017) is the improvement of artificial intelligence to help analyze x-rays and detect high-risk patients on time. Perdu also stated the same as Tadavarthi et al. (2022), stating that now, with AI, EKG readings can give much more information on what might be happening. Thus AI can report on different regions and prioritize examinations.

The experts, however, also mentioned other items that are of importance for artificial intelligence and the possibility of co-dependence on AI. Perdu mentions that it helps people live healthier by using, for example, wearables to monitor health. However, Perdu also mentions that AI cannot replace human/social interaction needed in healthcare, like nurses having contact with patients. Perdu states that Perdu always wants to have a doctor look at my data, meaning Perdu does not trust AI enough to do the job of a doctor. It becomes easier to compare patients all around the world using artificial intelligence (Watson). However, a side note must be posted as in the UK, an automated system by Atos, which has massive contracts about healthcare, automatically assesses clinical situations to provide support in terms of money and other things. It was completely biased and asked the wrong person, such

as the sad example where every year, a quad amputee, a person who lost both their arms and legs) was asked to check up on their arms and legs (Uri).

For healthcare, the co-dependence of artificial intelligence on daily life in the healthcare segment, the experts judged the sector, and with all experts together, all arguments and the spoken position as asked in the research indicate a slightly positive attitude of co-dependence on artificial intelligence in the healthcare segment.

4.2.2 Education

Following healthcare, the research will focus on the early stages of the line and go back to where the roots are nestled for artificial intelligence and education. Education, compared to healthcare, is judged differently as this is where artificial intelligence is taught. AI's values can be discussed to allow understanding and create future AI that could support the understanding.

Veos has been pleading for more talking about AI in education to create a better understanding of the topic and has even been working on getting high schools and universities to create a workgroup for future artificial intelligence and other future ICT. Many of Veos colleagues have been shaken awake especially seeing the ease of cheating with AI applications popping up like ChatGPT. Watson agrees and states it is easier to cheat than ever, "If a student can cheat the system, they will." Watson stated that nowadays, it is possible to answer questions without understanding the concept. In contrast, Uri states that education is important to ensure people are educated on the consequences of using AI in daily life. When it comes to the job market, there will be more of a job shift as there is different work to be done nowadays than in the past (Elena). New jobs will evolve, some old jobs will vanish, and new jobs will arise. It is the cycle for students. Nowadays, more and more people work, and fewer people are poor (Watson). Perdu reinforces this statement by stating that the economy will do its work again. When scarcity is created, it will attract new people.

When comparing research with what the experts said in the interviews, quite a few main points are said in both. For example, there should not be a one-size-fits-all. Everybody needs a different path (Perdu). Ouyang and Jiao (2021) mention that artificial intelligence has the potential to assist significantly on different levels to enhance the learning ability of individuals, thus showing that a tailored program would be good. This is backed up by Chen et al. (2020), who describe numerous examples of artificial intelligence, such as

person-tailored curriculums and content development, based on previous works. However, Elena said a tailored program could be good as long as the student can still make their own choice, and AI only should be a preference. AI, in that sense, should stay scalable so it can be applied in mass (Perdu), as this could show that artificial intelligence has the potential to assist significantly on different levels to enhance the learning ability of individuals and groups (Ouyang, Jiao, 2021). If not done correctly and people do not know what they are doing. AI can be applied for the wrong reasons, for example, seen in the Dutch tax system scandal (Perdu) or Twitter Tay that quickly turned into a biased bot spewing out racist and hate text (Poppenci et al., 2017). When not appropriately educated, artificial intelligence will massify people (Uri). Uri mentioned that less educated people when it comes to AI knowledge would create generations of lower interest and understanding of AI, which can cause a big gap with the group that does understand and can augment and improve with these AI applications. This advantage could lead to higher wealth and create more wealth inequality, as seen in an article by Makridakis (2017).

For education, the co-dependence of AI on daily life, educational segment, and the expert together each judged with a majority voting positive. Education was the most positive, receiving three positives and only one negative resulting in education receiving a slightly positive attitude of co-dependence on artificial intelligence from the experts.

4.2.3 Work & retail

After education, it is now time to look at the real-world applications of artificial intelligence. Within the work environment, most artificial intelligence that gets developed gets tested and applied for its efficiency increase and other improvements. Elena says that within the work and retail environment, it depends on what AI is used and if AI is a positive or negative dependency on daily life. There currently are a lot of commercially available artificial intelligence applications which are buyable, like software, and train it on its data and implement this (Elena). Sometimes this is important, especially in healthcare. It is vital that data is protected and most files are on-premise to ensure patient data privacy and security (Elena). Perdu states that many still want to have the social aspect in society, such as nurses who have contact with their patients regarding AI. Companies are getting larger and larger. Just look at how much server room Google uses and how many broadband/storage centers there are (Veos). According to Perdu, when companies get too big, the businesses will fall, and innovation will do its job and democratize it again.

On the other hand, Watson thinks that large tech companies are now building foundational models. These are hard to train as these foundational models cost a lot of resources, time, and money; however, if more businesses start to use this platform, it will become more embedded and harder to regulate. Uri agrees with this point and mentions that new companies that actually survive and are not bought up by bigger ones are companies that function in a niche market. When it comes to new artificial intelligence, there need to be more collaboration between scientist/researchers and the applicators, as an algorithm can have very high accuracy and perform very well, but if no one wants it, it is impossible to force it onto them, people will only really use AI if it helps them do their jobs faster or better (Elena)

Now moving onto the comparison between research and experts, Uri states that in the short term, AI is not replacing jobs; however, it is true for the long term, AI will replace, create and destroy working posts. Perdu adds that AI mainly takes away less valuable jobs. Huang and Rust (2018) agree with this by stating: *"the threat of total replacement in the future as demand for human labor turns into demand for mechanical skills to higher intelligent skills and those tasks to machines."* Watson also tunes in and is convinced that the cost of hiring is more expensive than buying a machine. It is not only the salary to pay but also the time looking for hires, and after that applicant changes jobs again, retrains, and rehires again. Our culture is based on work and the job. For example, the Italian constitution states: that Italy is a republic based on job/work (Uri). Uri then starts thinking out loud and states that if AI robots will replace so much work, there is a possibility that society has to rethink and find a different way to lead our life and get salaries. Over time jobs will become less and less and less as jobs get taken over, such as deep learning could automate virtual assistants answering questions customers have (Jarek & Mazurek, 2019). Watson thinks that a machine can do the job faster and with better accuracy and can help people become more creative instead of doing simple, standardized tasks. A paper by Poola (2017) backs up this claim by stating that AI is managing and organizing statistical data, which results in smaller human errors, thus decreasing the overall number of errors resulting in higher accuracy. However, artificial intelligence also has a darker side here with issues such as privacy, prone to bias, cybersecurity issues, and more (Berente, Becker & Santhanam, 2021). Confirming what Veos said, the more ICT we use, the bigger the chance of something terrible happening. There will always be a rat race. If higher walls are built using AI, hackers will still find a way under the wall or around the wall (Watson. The constantly changing environment will result in an

expanding threat landscape and create new threats that must be patched every time (Nikolskaia, 2021).

For work & retail, the co-dependence of artificial intelligence on daily life, the experts judged it slightly more positively than education, as four of the five experts were slightly positive or higher due to the significant impact AI has on the working environment. Together, the experts state that the overall co-dependency link will be slightly positive/positive when it comes to artificial intelligence in daily life.

4.2.4 Home & online

Regarding the home and online environment, experts and researchers start to be more negative towards co-dependency on artificial intelligence in every life. Many people are now addicted to their phones through algorithms that keep them busy (Watson & Elena), and there is much unawareness of what AI is being used (Elena). Researchers back this up (Lamsal, Harwood, Read, 2022) by stating that back-end artificial intelligence includes algorithms to improve or filter social awareness in social media applications. However, phones are not the only thing, from smart fridges to smart thermometers to Google Alexa (Perdu & Watson). Smart homes where it is possible to control the temperature, lamps, preset the oven, and more (Dunne, Morris & Harper, 2021) are becoming more common, just as Roombas are. A Roomba could map the house (Veos & Elena, and the given examples for this are in initial testing, the information of the Roomba was sent to labeling companies and somehow ended up on social media (Watson), clearly forming a privacy threat. The threat means cybersecurity and privacy must keep improving to keep everything safe, not only for the things like Roombas but also banking and insurance (Wirkuttis & Klein, 2017).

Another big topic within the home environment is self-driving or assisted driving cars with things such as lane assist or other driver-supporting systems. This gets both positive (Elena, Perdu) but also negative (Watson, Uri) support from experts. Research shows that self-driving and assisted-driving cars are spotted more on the roads and cause fewer accidents due to lane assist or accident avoidance using AI (Poola, 2017). However, this is in America. Watson believes that in Europe, there will not be self-driving cars to the extent as in the USA due to liability issues. Car companies do not want to give full liability if anything happens as the companies always put the driver as the main person who is liable for everything that can happen in the car. Other drivers can cause very unreliable reactions and unclear decisions

making the AI vehicle respond to impossible questions (Holzinger et al., 2019). However, another expert (Uri) says we will get there sooner or later, it might take some more time, but eventually, most people will ride in self-driving cars. Watson furthermore states that even companies like Waymo stopped their experiments in busy areas like San Francisco due to the complexity of the city and the unreliability of other road users. An AI vehicle could make mistakes and not see particular low-flying debris or things due to bad calibration or failure in the code. Such as when a semi-truck was not detected by an AI vehicle due to having a wide and high body of the carrier resulting in the vehicle crashing at full speed into the semi-truck (Popenci & Kerr, 2017). These issues can cause a lot of danger, and both experts as well as researchers question how safe such a system has to be before it can be implemented.

Besides what researchers mentioned, the experts also stated a few extra points which have not yet been discussed in this paper. Namely, applying too much artificial intelligence in the home environment, a social place will lead to desocialization (Perdu). Perdu furthermore states that this could be a scary pathway as desocialization could lead to a possibility of less creativity and troubles with social jobs, as well as fewer children could play and learn with each other as AI would take that task instead. Humans will always find a way to make life easier and embrace these efficiencies, says Veos. Only a small group in society is conscious about their privacy and how to deal with that (Veos, Watson). Veos adds that the water already started flowing as the dikes broke ages ago for issues in socialization. Take a look at Ring. In the Vinex district and two household incomes, maybe about 40% have these camera doorbells (Veos). Or how about the Roomba (Veos & Elena)? As mentioned in the previous chapter, these are potentially dangerous issues; for example, not many people know that when pictures are sent through Whatsapp, technically, Whatsapp is now the property owner of those pictures (Veos).

Moreover, next to that, it also brings positive effects to the tracking of a person. Navigating with a navigation system made a lot more people mobile; it is less scary to travel the road with navigation (Watson). However, AI systems still need to be fully optimized, as you could race your navigator, and sometimes you win, and sometimes your navigator does (Uri). It is best not to give away all the control when AI goes autonomously. It can start to make terrible decisions for humans, which can be dangerous such as the possibility of destroying certain things as they "have no added value" and are better off destroyed no matter the human lives lost (Uri). This, however, could be solved in the Netherlands, at least by an upcoming act, the

artificial intelligence act, which can bring more regulations, or in the United Kingdom, where they are thinking about giving certificates to data scientists to safely practice AI (Elena).

For the home & online environment, the co-dependence of artificial intelligence on daily life, both the experts and researchers are more negative. The experts judged the sector more negatively than any other sector, with 3 (Perdu, Uri & Elena) negative answers to the question of how the co-dependency on AI would affect daily life. With all the arguments mentioned by the experts and their opinion on the developments, they have a slightly negative/negative attitude toward co-dependence on artificial intelligence in the home and online environment.

Chapter 5 Discussion and conclusion

5.1 Discussion

Artificial intelligence is all around us in our daily life, and it is getting increasingly important. This research focused on four specific segments where artificial intelligence plays an important role: healthcare, education, work & retail, home & online. In order to find out how crucial artificial intelligence is in these segments, co-dependency was examined to determine if our daily life in the future was positively or negatively affected by artificial intelligence.

The first hypothesis expected that the overall co-dependency on artificial intelligence would affect a person's daily life in a semi-positive manner. According to different papers, there were still a lot of different issues, such as trust and reliability issues. However, it brought many advantages, such as reduced human efforts and increased efficiency. Based on the four segments in this paper and the positive and negative effects of overall artificial intelligence on the daily life of a person, the result came out slightly more on the positive side. The experts, one after the other, voiced their opinion of how they thought artificial intelligence could affect us as a society. Through examination of the experts' answers, as seen in table 3, hypothesis one (H1) can be confirmed by the experts as the combined answer of the experts was slightly positive.

The second hypothesis focused on one of the four segments, healthcare and the co-dependency on artificial intelligence would affect a person in their daily life in a positive manner. The literature was mainly concerned with knowledge beyond human capabilities and fragmented data sources. At the same time, automatic examination and filing are a huge plus to offload certain tasks of high-priority workers. This results in many more positive points than negative points. The experts, however, were more skeptical. While the experts still considered healthcare slightly positive, there were more issues, such as no room for AI errors. At the same time, there were errors still being made, and the chance of losing social interaction and distrust of artificial intelligence results. This results in hypothesis two (H2) to be rejected by the experts due to a slight difference, while still positive, only a slightly positive result.

Hypothesis three is centered around education and the co-dependency on artificial intelligence, and it would affect a person in their daily life in a positive manner. In this paper,

the researchers state that within education, a lot of educational programs can be tailored to the student's needs, and educational institutions can upgrade their back-end to improve overall efficiency. Only minor issues like biased bots, which need to be taken back to the drawing board, and a moving job and wealth inequality possibility can be solved instead in the short term, while the positive points can improve life in the long term. The experts agreed to an extent with the researchers by stating that tailored programs and voicing the need to talk about AI in education is of high importance yet also remained critical of new AIs such as ChatGPT and lack of understanding as reasons only to support the education co-dependency on artificial intelligence slightly positive. For this reason, hypothesis three (H3) has to be rejected as well. Even though still being positive and supported by three experts, not positive enough.

The second to last hypothesis, hypothesis four, focuses on work & retail when it comes to co-dependency on artificial intelligence in a person's everyday life. It was put at a lesser positive already compared to healthcare and education. While the papers stated that reduced human errors and increased accuracy alongside automation and insight through data analysis give the work environment a massive boost in efficiency when it comes to using artificial intelligence on and around the work floor, some negative effects came to light. Human fear of the loss of jobs, being replaced by robots, and the need for money and security are not issues easily solved and thus remain. Experts add that the group agreed to the boost in efficiency and also mentioned that the ease with which artificial intelligence is copied and applied could form a threat to security, privacy, and other issues. People should be careful with how AI is used. For these reasons, hypothesis four (H4) has to be accepted as both experts and researchers agree that in the work & retail environment, co-dependency on artificial intelligence is slightly positive.

As last, there is hypothesis five, which discusses the home and online environment concerning co-dependency on artificial intelligence in daily life. This relationship was put in a neutral outcome due to the positive implications smart homes, self/assisted driving vehicles, and cybersecurity can bring to the table. The negative implications, however, also play an essential role in AI not being able to be flawless with the detection failure with AI, and the upgrade on cybersecurity is also its weakness. These positive and negative points balance out on the scale for the researchers as both sides give reasonable answers if the co-dependency is good or bad. The experts, however, are more skeptical, with each expert being skeptical in their way, like with a Roomba tracking the rooms or desocialization of the upcoming

generation and liability issues for self-driving cars. These points given by the experts result in their final verdict that the home environment is too dangerous when it becomes dependent on artificial intelligence. Together the experts say it is slightly negative to negative. For this reason, hypothesis five (H5) is rejected as experts find it more negative regarding co-dependency on artificial intelligence.

In the following table, table 4, there will be a summary of each hypothesis stating the hypothesis itself, followed by the experts' opinion and final verdict. The last column shows if the hypothesis is accepted or rejected based on the answer of the experts.

H1	*Overall co-dependency on artificial intelligence will affect a person in a semi-positive manner*	*Slightly positive*	**Accepted**
H2	*Co-dependency on artificial intelligence will affect Healthcare in a positive manner*	*Slightly positive*	**Rejected**
H3	*Co-dependency on artificial intelligence will affect Education in a positive manner*	*Slightly positive*	**Rejected**
H4	*Co-dependency on artificial intelligence will affect work & retail in a semi-positive manner*	*Slightly positive*	**Accepted**
H5	*Co-dependency on artificial intelligence will affect home & online in a neutral manner*	*Slightly negative / negative*	**Rejected**

Table 4 Hypothesis outcomes

After answering the hypothesis, based on the findings of this study, the spotlight can now be put on the research question. The research question investigated to what extent artificial intelligence influences the daily life around us and how dependent society is becoming on artificial intelligence given the different environments of the person. The findings show that it affects society in many different ways. Some are relatively positive and bring out the good side of humans, while others slack and create problems for humans. So to conclude how it affects society in every life, it affects humans slightly positively in most segments (healthcare, education, work & retail). However, in the home and online environment, it affects us (slightly) negatively due to the implications of the essence of the existence of the social being, a human. This means, in general, the co-dependency on artificial intelligence in daily life will be slightly positive for this research.

5.2 Conclusion, limitations and future research

For the past years and in the presentable future, artificial intelligence, in general, appears to be growing. With new applications every day, both good and bad, artificial intelligence appears to be creating more co-dependency in many segments. This study looked at the literature which highlighted possible relationships between co-dependency and several segments (healthcare, education, work & retail, home & online). By first creating a literature review for past issues and solutions within the artificial intelligence area and interviewing experts in the field of AI as a qualitative way of understanding how the future might be influenced and finding out if there is a positive or negative dependence on AI. The interviews showed a slight difference from the literature study, with experts being more pessimistic than the researchers. The overall co-dependency on AI, however, remained the same, and both experts and researchers agreed that the relationship between co-dependency on artificial intelligence and everyday life is slightly positive in most sectors except for the home and online environment due to the social issues brought into this sector that artificial intelligence appears not to be ready for.

There are some research limitations that have to be mentioned. To start with the time constraint, due to this paper only being given a half-a-year timeframe, the research can only be done in a small amount of time, creating pressure for interviews and a constraint on the amount of information possible to be gathered. Furthermore, the qualitative sample is small, as only five experts could be interviewed. Some experts declined the interview based on the length requirements of between 30 and 60 minutes and the timing nearing the end of the year. Most people are busier. Another limitation of this research is the lack of diversity. The experts were handpicked by the author of this paper through a selection of searches and what caught the author's eye when it came to expertise. The lack of diversity due to every expert either coming from the Netherlands or Western Europe can be seen both as an advantage, and a disadvantage as the paper is more focused on western society and its advancements in artificial intelligence but might be biased due to the sample both being low and impossible to include every demographic, age and ethnicity.

Further research could address different issues. For example, more segments can be analyzed besides the four of this research in order to give a broader view and the possibility to generalize it more. Furthermore, another research could focus on specific detailed artificial intelligence rather than artificial intelligence in general. It would allow for a better focus on

what could be positive or negative about certain artificial intelligence applications. During the interview, one of the experts, Uri, stated something worth looking into when it comes to the development of artificial intelligence, which is transferring the work environment to a completely different model. In the interview, Uri mentions that as artificial intelligence becomes more complicated, it can take more and more work from a human and be done automatically; this can result in more free time for humans until most jobs start to vanish. At this point fewer hours of work are required, and at one point, it could be enough that rather than being paid to work, someone is paid to live and then work. A more detailed version can be found inside the interview, but it opens a new door for future possibilities regarding artificial intelligence taking over.

References

Ågerfalk, P. J. (2020). *Artificial intelligence as digital agency.* European Journal of Information Systems, 29(1), 1-8.

Alansari, H., Gerwe, O., & Razzaque, A. (2021). *Role of artificial intelligence during the Covid-19 era. In The Big Data-Driven Digital Economy: Artificial and Computational Intelligence* (pp. 157-173). Springer, Cham.

Asatiani, A., Malo, P., Nagbøl, P. R., Penttinen, E., Rinta-Kahila, T., & Salovaara, A. (2020). *Challenges of explaining the behavior of black-box AI systems.* MIS Quarterly Executive, 19(4), 259-278.

Benbya, H., Davenport, T. H., & Pachidi, S. (2020). *Artificial intelligence in organizations: current state and future opportunities.* MIS Quarterly Executive, 19(4).

Berente, N., Gu, B., Recker, J., & Santhanam, R. (2021). *Managing artificial intelligence.* MIS quarterly, 45(3), 1433-1450.

Briganti, G., & Le Moine, O. (2020). *Artificial intelligence in medicine: today and tomorrow.* Frontiers in medicine, 7, 27.

Buiten, M. C. (2019). *Towards intelligent regulation of artificial intelligence.* European Journal of Risk Regulation, 10(1), 41-59.

Chen, L., Chen, P., & Lin, Z. (2020). *Artificial intelligence in education: A review.* Ieee Access, 8, 75264-75278.

Davenport, T. H., & Ronanki, R. (2018). *Artificial intelligence for the real world.* Harvard business review, 96(1), 108-116.

Dick, Stephanie. (2019). *Artificial Intelligence.* Harvard Data Science Review. 10.1162/99608f92.92fe150c.

Dickinger, A. (2007). T*HE EXPLORATIVE RESEARCH. In Perceived Quality of Mobile Services: A Segment-Specific Analysis* (Vol. 18, pp. 9–18). Peter Lang AG. http://www.jstor.org/stable/j.ctvc16hfw.4

Dimitrieska, S., Stankovska, A., & Efremova, T. (2018). *The Fourth Industrial Revolution Â€—AdvantagesAnd Disadvantages*. Economics and Management, 14(2), 182-187.

Dörnyei, Z. (2007). *Research Methods in Applied Linguistics.* Oxford: Oxford University Press.

Dunne, R., Morris, T., & Harper, S. (2021). *A survey of ambient intelligence.* ACM Computing Surveys (CSUR), 54(4), 1-27.

Feuerriegel, S., Shrestha, Y. R., von Krogh, G., & Zhang, C. (2022). *Bringing artificial intelligence to business management.* Nature Machine Intelligence, 4(7), 611-613.

Golafshani, N. (2003). *Understanding reliability and validity in qualitative research.* The qualitative report, 8(4), 597-607.

Holzinger, A., Langs, G., Denk, H., Zatloukal, K., & Müller, H. (2019). *Causability and explainability of artificial intelligence in medicine.* Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 9(4), e1312.

Hua, H., Li, Y., Wang, T., Dong, N., Li, W., & Cao, J. (2022). *Edge Computing with Artificial Intelligence: A Machine Learning Perspective.* ACM Computing Surveys (CSUR).

Huang, M. H., & Rust, R. T. (2018). *Artificial intelligence in service.* Journal of Service Research, 21(2), 155-172.

Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). *Vision, challenges, roles and research issues of Artificial Intelligence in Education.* Computers and Education: Artificial Intelligence, 1, 100001.

Jarek, K., & Mazurek, G. (2019). *Marketing and artificial intelligence.* Central European Business Review, 8(2), 46.

Khanzode, K. C. A., & Sarode, R. D. (2020). *Advantages and Disadvantages of Artificial Intelligence and Machine Learning: A Literature Review.* International Journal of Library & Information Science (IJLIS), 9(1), 3.

Ko, M., & Osei‑Bryson, K. M. (2004). *Using regression splines to assess the impact of information technology investments on productivity in the healthcare industry.* Information Systems Journal, 14(1), 43-63.

Lamsal, R., Harwood, A., & Read, M. R. (2022). *Socially enhanced situation awareness from microblogs using artificial intelligence: A survey*. ACM Computing Surveys (CSUR).

Lin, Y. K., Chen, H., Brown, R. A., Li, S. H., & Yang, H. J. (2017). *Healthcare predictive analytics for risk profiling in chronic care: A Bayesian multitask learning approach.* Mis Quarterly, 41(2).

Makridakis, S. (2017). *The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms.* Futures, 90, 46-60.

Mayer, A. S., Strich, F., & Fiedler, M. (2020). *Unintended Consequences of Introducing AI Systems for Decision Making*. MIS Quarterly Executive, 19(4).

Minsky, M. (1961). *Steps toward artificial intelligence*. Proceedings of the IRE, 49(1), 8-30.

Nikolskaia, Kseniia Yu, and Victor B. Naumov. *"The Relationship between Cybersecurity and Artificial Intelligence."* 2021 International Conference on Quality Management, Transport and Information Security, Information Technologies (IT&QM&IS). IEEE, 2021.

Nordhus, A. W. (2021). N*orwegian lower secondary school teachers' and students' beliefs and reported experiences concerning extramural English and language identity in teaching and learning L2 English* (Master's thesis, uis).

Ouyang, F., & Jiao, P. (2021). *Artificial intelligence in education: The three paradigms.* Computers and Education: Artificial Intelligence, 2, 100020.

Poola, I. (2017). *How artificial intelligence in impacting real life everyday*. International Journal for Advance Research and Development, 2(10), 96-100.

Popenici, S. A., & Kerr, S. (2017). *Exploring the impact of artificial intelligence on teaching and learning in higher education.* Research and Practice in Technology Enhanced Learning, 12(1), 1-13.

Puaschunder, J. M. (2019). *Artificial Intelligence in the Healthcare Sector.* Scientia MoralitasInternational Journal of Multidisciplinary Research, 4(2), 1-14

Rossi, F. (2018). *Building trust in artificial intelligence*. Journal of international affairs, 72(1), 127-134.

Silverman, D. (2011). *Interpreting Qualitative Data.* London: SAGE Publications

Tadavarthi, Y., Makeeva, V., Wagstaff, W., Zhan, H., Podlasek, A., Bhatia, N., ... & Trivedi, H. (2022). *Overview of Noninterpretive Artificial Intelligence Models for Safety, Quality, Workflow, and Education Applications in Radiology Practice*. Radiology: Artificial Intelligence, 4(2).

Wirkuttis, N., & Klein, H. (2017). *Artificial intelligence in cybersecurity*. Cyber, Intelligence, and Security, 1(1), 103-119

Yudkowsky, E. (2008). *Artificial intelligence as a positive and negative factor in global risk.* Global catastrophic risks, 1(303), 184.

Zhao, S., Blaabjerg, F., & Wang, H. (2020). *An overview of artificial intelligence applications for power electronics*. IEEE Transactions on Power Electronics, 36(4), 4633-4658.

Appendix 1 Source table

Author	Year	Title	Keyword / summary	Alternative keyword
Ågerfalk	2020	*Artificial intelligence as digital agency*	Impact of artificial intelligence	Artificial intelligence in an information system perspective
Alansari	2021	*Role of artificial intelligence during the covid-19 era*	Trust in artificial intelligence	Artificial intelligence in healthcare
Asiatani	2020	*Challenges of explaining the behavior of black-box AI systems*	Black-box AI	Artificial intelligence as a state of unawareness
Benbya	2020	*Artificial intelligence in organizations: current state and future opportunities*	Development of Artificial intelligence	Current challenges of AI
Berente	2021	*Managing artificial intelligence*	Past & future of artificial intelligence	Advantages of artificial intelligence
Briganti	2020	*Artificial intelligence in medicine: today and tomorrow*	Artificial intelligence in Cardiology (healthcare)	Examples of improvements on AI but also challenges and future direction
Buiten	2019	*Towards intelligent regulation of artificial intelligence*	Problems with law and artificial intelligence	Transparency of AI

Chen	*2020*	*Artificial intelligence in educations: a review*	Artificial intelligence in administration, instruction and learning(education)	Advantages of artificial intelligence in education
Davenport	*2018*	*Artificial intelligence for the real world*	Data analysis for customers and employees	Cognitive technology for the future
Dick	*2019*	*Artificial intelligence*	Historical origin of Artificial intelligence	AI through time
Dickinger	*2007*	*The explorative research*	Exploratory research	Comparison of qualitative vs quantitative study
Dimitrieska	*2018*	*The fourth industrial revolution: advantages and disadvantages*	Timeline for AI	Comparison for overall fourth industrial revolution + AI
Dörnyei	*2007*	*Research Methods in Applied Linguistics*	Qualitative research	Applied linguistic
Dunne	*2021*	*A survey of ambient intelligence*	Artificial intelligence at home and online	Past, current and future for artificial intelligence
Feuerriegel	*2022*	*Bringing artificial intelligence to business management*	Future of decision making for managerial AI	Accountability for Artificial intelligence

Golafshani	2003	*Understanding reliability and validity in qualitative research*	Qualitative research	Reliability & validity
Holzinger	2019	*Causability and explainability of artificial intelligence in medicine*	Artificial intelligence in healthcare	Deep learning & mechanical learning
Hua, Li	2022	*Edge computing with artificial intelligence: a machine learning perspective*	Big data learning for Artificial intelligence	Moving artificial intelligence to the cloud
Huang	2018	*Artificial intelligence in service*	Artificial intelligence in work environment	Replacement of works with AI
Hwang	2020	*Vision, Challenges, Roles and research issues of artificial intelligence in education*	Artificial intelligence in education	Future of artificial intelligence in education
Jarek	2019	*Marketing and artificial intelligence*	Artificial intelligence application in different areas (Working/retail)	Advantages of artificial intelligence in the working environment.
Khanzode	2020	*Advantages and disadvantages of artificial intelligence and machine learning: a literature review*	Artificial intelligence in education	Advantages and disadvantages of artificial intelligence
Ko	2004	*Using regression splines to assess the impact of information technology investments on productivity in the healthcare industry*	Artificial intelligence in healthcare	Impact of information technology investments

Lamsal	2022	*Socially enhanced situations awareness from microblogs using artificial intelligence: a survey*	Artificial intelligence on social media (home/online)	Advantages and dependency on artificial intelligence for improvements
Lin	2017	*Healthcare predictive analytics for risk profiling in chronic care: A Bayesian multitask learning approach*	AI in healthcare	Risk profiling with IA
Makridakis	2017	*The forthcoming artificial intelligence (AI) revolution: its impact on society and firms*	Future of AI (four scenarios)	Disadvantages of artificial intelligence
Mayer	2020	*Unintended consequences of introducing AI systems for decision making*	Risk of artificial intelligence	Decision making artificial intelligence
Minsky	1961	*Steps towards artificial intelligence*	Meaning of Artificial intelligence	Beginnings of AI
Nikolskaia	2021	*The relationship between cybersecurity and artificial intelligence*	Risks of artificial intelligence	cybersecurity
Nordhus	2021	*Norwegian lower secondary school teachers' and students' beliefs and reported experiences concerning extramural English and language identity in teaching and learning L2 English.*	Qualitative research through interview	Referring to Dörnyei

Ouyang	2021	*Artificial intelligence in educations: the three paradigms*	Three levels of artificial intelligence assistance in education	Artificial intelligence affecting social, pedagogical, economic dimensions
Poola	2017	*How artificial intelligence in impacting real life everyday*	Future goals of artificial intelligence	Artificial intelligence affecting healthcare, driving, transport, jobs
Popenci	2017	*Exploring the impact of artificial intelligence on teaching and learning in higher education*	Artificial intelligence in education	Machine learning environments success and failures
Puaschunder	2019	*Artificial intelligence in the Healthcare sector*	AI in healthcare	Access to information and online healthcare
Rossi	2018	*Building trust in artificial intelligence*	Trust (issues) in artificial intelligence	Future possibilities of Artificial intelligence
Silverman	2011	*Interpreting qualitative data*	Qualitative research	Interpreting data
Tadavarthi	2022	*Overview of noninterpretive artificial intelligence models for safety, quality, workflow, and education application in radiology practice*	Artificial intelligence in healthcare	Automation for artificial intelligence

Wirkuttis	2017	*Artificial Intelligence in cybersecurity*	Artificial intelligence online (safety)	Artificial intelligence risks
Yudkowsky	2008	*Artificial intelligence as a positive and negative factor in global risk*	Disadvantages of artificial intelligence	Bias in artificial intelligence
Zhao	2020	*An overview of artificial intelligence applications for power electronics*	Improvements on electronics to allow more advanced AI	Artificial intelligence tasks and life-cycles

Appendix 2a The interview (English)

THE INTERVIEW (English)

Getting the interview started:

Hi, I am Dennis and I am doing a research paper on artificial intelligence and co-dependency of artificial intelligence on daily life. I am writing this paper for my final thesis for the Master Information Management at Tilburg University. Thank you for participating in this interview with me. This paper is about artificial intelligence and how in the daily life of a person is influenced by AI with a more detailed eye for co-dependency.

To start off with I have a few introductory questions prior to starting with the topics of my research, these questions are to get an understanding to your involvement of Artificial intelligence.

- How many years have you been working here at .....?

And how many years have you been involved with Artificial Intelligence from those years?

- Have you held other jobs beside this current job that were related to artificial intelligence?
- What in your opinion is the best artificial intelligence technology created up to this point?

Think for example about the automatic painting program, self driving cars, social media monitoring, bots for all sorts of issues, face unlock.

In order to get a bit deeper into the topic I would like to ask you first for the definition of both artificial intelligence as well as co-dependency to get an understanding what your point of view is regarding these topics. So to start off with:

Definition of topic:

- What is artificial intelligence according to you?

Follow up by addition on definition and asking for examples

"an ever changing definition of mechanical intelligence where a computer can only do told repetitive step by feeding it massive data performing human-like cognitive tasks with a perspective of machine learning being the current best future approach"

● What is co-dependency according to you?

Follow up by addition on definition and asking for examples

"The excessive emotional or psychological reliance on technology, typically who requires support on account of an addiction and lack of understanding of the technology within"

● Do you think in general is society becoming co-dependent on artificial intelligence?

Which segments in your opinion are reliant on AI and which are not?

● In a paper from Makridakis there were described four types of believers of artificial intelligence:
- The optimist, the world will be full and filled with AI such as nanotech and robotics.
- The pessimist, machines will take over the world and people might become afraid of making their own choices
- The pragmatist, through OpenAI and effective regulations, the society can augment and improve but stay above AI.
- The doubter, does not believe that AI will be a threat in any way or form.

Which ones would you put yourself the closest to? And why would u put yourself in there?

Follow up by asking in more detail regarding the points the person brought up

Segments & AI & Co-dependency

● Do you think in the following four segments the co-dependency on AI will be more on the positive or negative side? After you have given answer to all four we will move back to each category and speak more in detail as to why
- Healthcare
- Education
- Work & retail
- Home & Online

- Why do you think healthcare is affected (POSITIVE/NEGATIVE) by co-dependency on artificial intelligence?

  Mentioned the opposites:

  Positive: automatic examinations, decrease report variability

  Negative: knowledge beyond human capability with bias // fragmented data sources

- Why do you think Education is affected (POSITIVE/NEGATIVE) by co-dependency on artificial intelligence?

  Mentioned the opposites:

  Positive: tailored programs, administrative upgrades, automatic review of assignments

  Negative: Biased bots, job and wealth inequality, law cannot cope

- Why do you think work & retail, as in a working person, is affected (POSITIVE/NEGATIVE) by co-dependency on artificial intelligence?

  Mentioned the opposites:

  Positive: reduced human effort, higher efficiency, insight through data analysis

  Negative: higher entry cost, job replacement, cybersecurity issues

- Why do you think Home & online is affected (POSITIVE/NEGATIVE) by co-dependency on artificial intelligence?

  Mentioned the opposites:

  Positive: smart homes, self/assisted driving cars, better security

  Negative: other (Road) users and AI, failure of detection, security issues

- After hearing the opposites of examples you have heard, would you reconsider any of your answers or do you still think the items you have mentioned weigh on heavier on your decision?

Closing:

- Do you want to return to any question we have gone through earlier?
- Do you have any other questions in regards to the research that might not have been mentioned in the interview and you would like to mention now?

I would like to thank you for taking the time with me to do this interview and help me creating a better research.

Appendix 2b The interview (Dutch)

HET INTERVIEW (Dutch)

Getting the interview started:

Hallo, ik ben Dennis en ik doe momenteel mijn scriptie over artificial intelligence en de wederzijdse afhankelijkheid van AI op het dagelijkse leve. Ik schrijf deze scriptie in opdracht van Tilburg University voor mijn master in Information Management. Dankuwel voor het meedoen met het interview. Deze research paper gaat specifiek hoe artificial intelligence het dagelijkse leven van een normaal persoon kan beïnvloeden met een specifieke hoek van afhankelijkheid voor deze technologie.

Om mee te beginnen heb ik eerst een paar introductie vragen voordat ik start met de echte stof van dit onderzoek, deze vragen zijn bedoeld om te begrijpen hoe diep u zit in het onderwerp van Artificial intelligence.

- Hoeveel jaar werkt u nu al hier bij ....?

En hoeveel jaar zou u zeggen dat AI belangrijk is voor uw werk?

- Heeft u andere banen gehad buiten deze die ook AI als onderwerp had?
- Wat is in uw mening de beste artificial intelligence technology gecreëerd tot nu?

Denk bijvoorbeeld aan, automatisch verven, zelfrijdende auto's, social media monitoring, bots van alle soorten en maten, gezichtvergrendeling op de telefoon.

Om dieper in de stof the happen zou ik u will vragen om eerst een definitie te geven van beide technologische afhankelijkheid en van artificial intelligence zodat er een duidelijke beschrijving van beide onderwerpen is voordat de rest van de vragen komen.

Definition of topic:

- Wat is artificial intelligence volgens u?

Follow up by addition on definition and asking for examples

"Een blijvend veranderend defnitie van mechanische intelligentie waar computers taken kunnen doen die zich eigen herhalen bij het voeden van big data met het maken van menselijke-lijkende cognitieve taken met een perspectief op machine learning zijnend de beste toekomstige benadering."

- Wat is co-dependency//technologische afhankelijkheid volgens u?

Follow up by addition on definition and asking for examples

"De excessive emotionele en psychologische afhankelheid op techonlogy, typisch iemand die ondersteuning nodigt heeft vanwege een verslaving of ontbrekend begrip voor de technologie."

- Denkt u dat de samenleving in het algemeen steeds meer afhankelijk wordt van artificial intelligence?

Welke segmenten in uw mening zijn afhankelijk van AI en welke niet?

- In een research van Makridakis daar zijn vier types van volgers voor artificial intelligence, welke beschrijft u het best?
- The optimist, de wereld zal vool gaan zitten met AI zoals, nanotech en robotics.
- The pessimist, Machines zullen de wereld overnemen en mensen zullen mogelijk bang worden om hun eigen keuzes te maken.
- The pragmatist, Door OpenAI en effectieve regelingen kan de samenenleving meer vergroten op het gebied van AI maar de samenleving zal altijd boven AI blijven staan
- The twijfelaar, Deze groep gelooft niet dat AI in de toekomst een bedreiging zal vormen.

Dus welke beschrijft u het best? Waarom zet u uzelf daar neer?

Follow up by asking in more detail regarding the points the person brought up

Segments & AI & Co-dependency

- Denkt u in de volgende vier sectoren dat technologische afhankelijkheid op artificial intelligence meer op de positieve of negatieve kant zullen vallen? Ik zal eerst alle vier de sectoren geven en nadat u antwoord heeft gegeven terug komen per sector om het te behandelen.
- Gezondsheidzorg

- Onderwijs
- Werk en detailhandel
- Thuis en online

● Waarom denkt u dat gezondheidszorg (POSITIEF/NEGATIEF) is door de afhankelijkheid van artificial intelligence?

Mentioned the opposites:

Positieve: automatische scans die worden nagekeken door AI, verlaging in rapport verschillen onderling

Negatieve: kennis boven de werkers met mogelijke vooroordeel // gefragmenteerde data bronnen.

● Waarom denkt u dat onderwijs (POSITIEF/NEGATIEF) is door de afhankelijkheid van artificial intelligence?

Mentioned the opposites:

Positieve: op maat gemaakte programma's, adminstratieve upgrades, automatische antwoorden nakijken

Negatieve: Biased bots, Werk en inkomen ongelijkheid, the wetgeving is nog niet aangepast genoeg ervoor

● Waarom denkt u dat werk en detailhandel (POSITIEF/NEGATIEF) is door de afhankelijkheid van artificial intelligence?

Mentioned the opposites:

Positieve: verlaagde werkers input, hogerere efficiëntie, beter zicht door data analysis. Negatieve: Hogere instapkosten, werk vervanging, cybersecurity problemen

● Waarom denkt u dat thuis en online (POSITIEF/NEGATIEF) is door de afhankelijkheid van artificial intelligence?

Mentioned the opposites:

Positieve: smart homes, zelf rijdende of rij-ondersteuning in autos (zoals lane-assist, crash-assist), betere security

Negatieve: Andere weggebruikers waar AI niet goed op kan rekenen, Het niet aantonen van iets zoals lage brokstukken op de weg, security problemen

- Na het horen van de tegenovergestelde voorbeelden die u nu gehoord heeft, zou u een van uw antwoorden veranderd of zou deze hetzelfde blijven?

Closing:

- Wilt u nog terug gaan naar een van de vorige vragen die eerder besproken zijn?
- Heeft u nog andere vragen of antwoorden voor dit onderzoek dat misschien niet aan bod is gekomen maar nog wel belangrijk zou kunnen zijn?

Dan zou ik u graag will bedanken voor uw tijd met dit interview en het helpen van mij om een betere research te creëren.