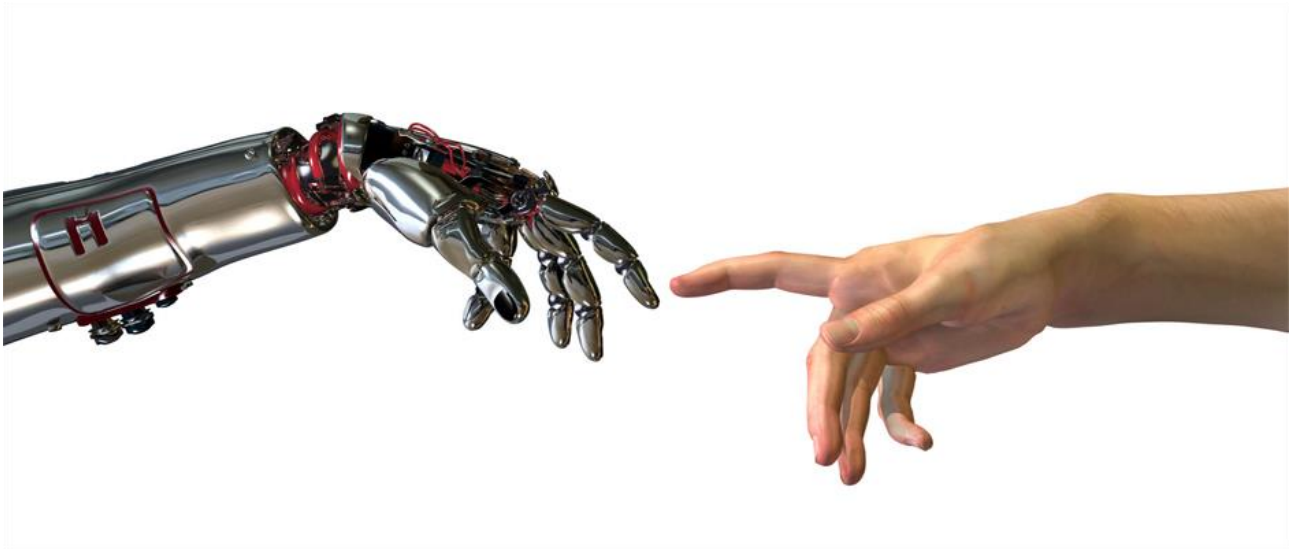
Humans need not apply.

"How robotic accelerator technology are challenging our ideas of work and innovation".



A Master Thesis

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Abstract

This thesis was written in response to the ever-increasing technological advances being made. Science fiction is made reality before our very eyes and an area that is experiencing a huge move forward is that of the self-driving fully automated car. We know that both Google and Tesla in particular is heading the race towards the first consumer self-driving car but how did we get there? What are some of the factors as to why we are seeing this now? Brynjolfson and McAfee have with their book The Second Machine Age given a name to these changes we are seeing. But what are these changes and how are they affecting us. This paper looks at the new automation technologies to see why they could be considered so disruptive and give advice on how we should interpret these new ideas and innovations. It will also look for characteristics of the types of performers that thrive in this new type of technological accelerating world where every job is at risk while the possibilities and abundances stand side by side with inequality and unemployment.

Keywords: Futurology, Self-driving Cars, Google, The Second Machine Age, Employment

Tabel of Content

"Any sufficiently advanced technology is indistinguishable from magic."
- Arthur C. Clarke

Introduction

Robots and technology are already a staple for science fiction, and one of the premier ideas is that of driverless cars getting people from place to place. Although an old idea, the thought of computer assisted driving, or entirely driverless vehicles has until recent years, had its struggles. The first true form of this technology came to be in the 1980s when CMU Navlab, a research and development team from Carnegie Mellon University (Bloomberg, 1995). Since several competitors have tried to create the first commercial success. Many have tried to make the car, that will function on its own, the fully automated car. While progress has been made, and we have seen many technologies spawn from the research, such as speed control and parking sensors to name a few, the consumer available fully self-driving car is yet to be seen, and to many still a fantasy. Until Google, now a subsidiary of Alphabet Inc. set out to change all of that. So what makes the Google car project so special? Well, first of it is Google. One of the forefront companies in technology and in recent years, holders of a vast portfolio of different tech trees at their disposal. This means that when they launch something, the world watches. As such, when they dive into the marked of driverless cars, progress is made. Even if they will not be the first to make it, their mere presence in the market will, and have forced the hands of others. They need to keep up. The Google Self-Driving Car is a project by the X-division, former known as Google X, the secretive research and development section of Google Inc. to make an efficient, safe and practical driverless car experience for consumers. In the paper I have chosen to refer all Google Inc. references as well as the Google cars themselves simply as Google, acknowledging that the proper term would be X, but since Google is a more widely accepted umbrella term for the entire structure, I chose to keep the tone and naming Google Inc. uses in updates and notes. Their goal is to make transportation simple, easy and safer. Their long-term goal is a fully autonomous vehicle, that can transport people from anywhere to anywhere, and aims

both at people driving today but also to the people who cannot themselves drive. The key technology within this project is the Chauffeur Software program, which was initiated in 2009. This program combined with state of the art radars and sensors, allow the Google cars to "see" their surroundings, and act upon them. Every car is connected allowing them to learn from each other. If one of the cars encounters a new obstacle, it will be taught how to deal with it, and then afterwards if any other car would come to this obstacle, they can rely on the previous data to quickly access the situation, and complete the task. This form of digitization of data and sharing of the data means that Google estimates their current cars now possess a 40 years on the road experience level each. The actual car project was revealed in 2010, and has the last couple of years accelerated both the competition and the project itself. That a big company as Google reveals its intentions of going into the marked of cars, driverless cars especially, has meant car companies have had to respond with their own. Nissan, BMW and Tesla amongst many have had their own driverless options seen a boost in development in order to keep up. However, Google is still at the forefront leading the pack. Just in the last couple of years, they have expanded the number of test cars on the roads, and have brought cars out from test tracks to common roads, all hidden away by placing safety personnel in the front seat, and making them as inconspicuous as possible. They are also expanding their test states so to expose the cars to different environments. As Brynjolfson and McAfee put it in their book Second Machine Age, from being proposed an improbable and doubtful candidate to ever be able to handle and understand the hidden finesse and processes in driving in 2004 by Levy and Murnane, (Brynjolfsson & McAfee, 2014) to the projects initial reveal in 2010, to them sitting in the cars in 2012 was a revelation. They remark that the project still lacked testing in harsh environments and heavy urban scenes, but merely 3 years after Google revealed that they had indeed been testing the cars in major cities, the cars now possess a quick situation recognition software that made sense of humans and their irrational behaviors in traffic. One of the company's founders Sergey Brin has publicly expressed his thoughts that a consumer ready, fully functional marked version to be available in 2020. This is also the year other pioneers like Elon Musk have given their own projects for completion. We therefore stand on the very edge of what could be a driverless future. A future in which our cars are taxis, and we do not have to think about safety on the roads. This technology will be integrated with other cars systems so hopefully non-google cars, will have similar systems, allowing them to talk together, so to bring people safely from point a to point b. The car can sense what is around it, and can predict patterns, and act accordingly to traffic. This means a safer way of travel, and eliminates some of the risks of human driving. Because humans inheritably are riddled with flaws. We get tired, unfocused and are prone to be irrational, illogical and overall very troublesome to make into a safe uniform pattern of transportation. According to Google's self-driving cars reports, they have in their 6 years, only had 14 minor traffic accidents. But

they are very adamant to add, that these have been caused by other drivers hitting them, or while a Google employee were manually controlling the car, and as such the software have not caused an accident to date. A driverless car could mean transportation for people who otherwise could not go themselves. Handicapped, sick, young and a general removal of any constraints of the users state of being. Even intoxicated users could "drive" home safely. An idea also sparked by this development, are that of car sharing. Much of a car's life is spent parked, not being used, and this would not be a problem with a self-driving car. It could merely chauffeur the user from one destination to another, and then after that use, drive off to the next in line. Which could clear up the total number of cars. Drivers going long and tedious routes could be replaced, and because any car in theory would be a taxi, we would not need those services done by humans. Therein lies the dilemmas of the technology, as it could replace the drivers of the world increasingly becoming cheaper and cheaper due to Moore's law, resulting in that human service drivers would find it hard to compete. This is the future, and it is coming. Experts at The Institute of Electrical and Electronics Engineers have predicted that by 2040 upwards to 75% of all vehicles will be autonomous (IEEE, 2012). This means that this field will only continue to grow and to challenge in the coming years.

Rationale for this Thesis

My interest has always been towards the future, and how we will evolve our society. In addition, through countless Articles, Papers, TED talks and YouTube videos, such as the one who gave the title of this thesis, made a strong impact. Being exposed to several readings, and books by Brynjolfson and McAfee through my education, I could see how the world, they described were unfolding in technologies today. In addition, working further on one of their focus points, I noticed it had continued to grow in severity since their original publication, made for a perfect emphasis. Nevertheless, where they have a hopeful optimism I feel a certain doubt, which is why this thesis will look at new emerging technology and some of the problems, it might cause while being a solution to others. That is not to say that I am skeptic, just concerned, that the hope that technology will free us from as many evils, as it can create is stretching it a bit, unless we make changes. That it will cause a technological ripple effect in its effect on markets not similar or previously thought joined.

This paper will work to understand, how the level of technology we currently are at, affects both job creation, job transformation and try to give insights in, how we can prepare for the future in regards to understanding automation, innovation and the role of man and machine in a human made and dominated labour force for years to come. This paper has also in parts been motivated by the prediction made by John Maynard Keynes, that technologies and the new discoveries of means will outpace the labour force,

and the reinventing of the uses of labour thus creating an unemployment issue, or rather his answer to the daunting future of mass unemployment.

> "*But this is only a temporary phase of maladjustment. All this means in the long run that mankind is solving its economic problem. I would predict that the standard of life in progressive countries one hundred years hence will be between four and eight times as high as it is to-day. There would be nothing surprising in this even in the light of our present knowledge. It would not be foolish to contemplate the possibility of afar greater progress still.*"
>
> (Keynes, 1931)

It is this expectant view I share, and that has sparked the idea for this paper. What is the greater progress we might achieve, and how do we minimize the risk that are immanent in the technological advances of robotics and digitization, of key aspect of our work life and labour force. And what are some of the sign that we are moving towards this new age of technology. I will set out to try, and find some of these accelerator technologies and examine them, to try to understand what they do to our society, and how they are pushing us forwards. It will draw on recent studies as those in the field of qualifying the deciding factors in job computerization (Frey and Osborne, 2013) as a means to understand which jobs might have a greater chance of being replaced or transformed. Frameworks as to how to methodical decode the susceptibility of jobs being computerized. It will also look on the idea, that we are entering a new era of technology, a Second Machine Age as coined, as the title of their 2014 book by Brynjolfson and McAfee, or the idea that we are facing a technological revolution, in which we really do not know what is going to happen next or could happen. Merely that we currently are in an age of a quickening evolution of the computational capabilities and robotics. This marks a shift in gear upwards from a linear progression to a more exponential. In this paper, arguments as to where we might be on the scale will be made, to try to understand the meaning of certain advances in the grander scale. In this advancement, there is also the fear of jobs being taken, which has been a theme for the last decades, in where we see a rapid evolving technological workforce. I have taken the publications of Brynjolfson and McAfee as a frame to challenge the empiric data, in order to gain insight in where we stand as humans in relation to technology, and to look for the theories in reality. In their book they list some of the limits that computers had even a year ago, which until very recent was thought to have been the frontier, but as months goes by more and more data comes in suggestive of that the limits are moving at a increasing pace. In addition, to gaining new territories, in which we see technology, even as far as advances in what prior were thought to be a human only field. Big data mining have made it possible for computers to gather an unprecedented amount of knowledge about everyday human life, which when combined with the latest in processing powers and speech recognition software blurs the line between interactions in everyday life. Call centers are being replaced with servers, and hotlines services, assistants and planners are being traded for personal assistants contained in every phone, thus making human contact in many surprising places total obsolete.

This creates a gap, in which worker class people with repetitive jobs and low education will be replaced by automation, generating a need for a social change, in the way we perceive work, unless we prepare for a new type of unemployment. A technological unemployment. One in which people cannot find work, not because they are unskilled or untrained, but simply not needed. The conception of jobs in which humans need not apply, will be something we need to deal with for the future world. This is one of the key problems facing us, and a challenge that will only grow the coming years. This could, if not noted and analyzed, numb and gridlock society as a huge portion of our workforce is made obsolete. Which in a capitalistic mindset is dooming. By using articles and statements from researchers, this paper will try to give an insight in what really happens when technology meets the job market. Throughout the later part of the 20ieth century there have been a great deal of advances made in the field of robotics and automation of work, and now we begin to see a boost in the software that mimic or replaces many of the features and skills, we as human perceive as core. The very things we created are challenging us, to further redevelop ourselves and rethink what we believe is true, about what computers can and cannot do. This paper will collect and present cases surrounding key technologies, that have either been created in the last couple of years, or infant tech merely at prototype stages that have the ability to challenge the models of human – computer relations. Recent development as those made by the Google Car projects have created a new set of data, as to what computers can do, and how we can integrate them into our world. The idea of a self-driving car has been a thought for many years, but with the high level of input and calibrations, the human mind has to process, while using intuition to calculate odds and predict other drivers behavior, all of this was though too complicated for a computer to handle. However in the last couple of years and one announcement after another from Google, shows that this in not only a feasible idea, but they have tested prototypes for years, and kept on showing more and more data suggesting it might not be all that long into the future, were driverless vehicles will share our roads. Google is trying to transform mobility and make it easier to go from place to place. And this is just one of many new technologies, that are aimed to help and advance the service level of everyday life, but it also have more dark connotations within. If transporting of people can be made cheaper than having a real human being requiring a salary, how are taxi drivers going to compete with a marked that thanks to Moore's Law decrease in the production costs every couple of months, resulting in a growth rate that is unmatched. If the cab drivers car as a technology were to match that of a computer, it would mean that just like a transistor runs:

"*90,000 times more efficiently and are 60,000 times cheaper than the first one it produced in 1971 a car that uses 15 liters of petrol per 100km and costs $15,000 to improve its performance in similar fashion, it would consume less than two tenths of a milliliter of petrol per 100km and cost a quarter.*" (L.S., 2015)

However, it is these kinds of developments we begin to see in areas, where technology is being increasingly introduced, even in other areas that were previously thought non-susceptible to automation or digitization, which gives way for another of the motivations for this paper: How are we going to keep up with this kind of progress? How can we use this as tools in order to further develop society and ourselves? What makes us stand out, and what should we prepare for in the future in regards to our understanding of jobs. This will be at the core of this thesis.

Cardinal Question

With the acceleration of technology, how will disruptive technology, such as self-driving cars, change or challenge our work understanding, and what alterations will this mean to the future of work?

Research Questions:

While answering this, I would also try to answer the following research questions:

- What types of jobs are susceptible of being transformed or obsolete?
- What are some of the characteristics of this New Machine Age?
- What are some of the risks of this rapid computerization of a large number of jobs?

Methodology.

The method of research used in this thesis takes root in an overall Qualitative Dissertation in an Ontological paradigm, as I will look for answers on the theoretic consequences of the data material. I will then analyze and comment on the findings. This is because the object of this thesis is an actual thing, and not a way of thinking, and not a 'source of truth' as if it were an epistemological approach. Likewise, I am going on a hunch, and will try to answer my questions by letting them appear in my material. I am aware that since I chose the cases and materials to present, my preconceptions will likely shine through, no matter how careful I will be. I have also gathered a great deal of articles and publications by researchers, innovators and people in the business to both get their input as well as get the information straight from the creators. This would mean the thesis takes on a hermeneutic approach. Hermeneutics or the Hermeneutic circle as described by Gadamer is the idea that a subject cannot achieve objective knowledge in a changing focus. (Berg-Sørensen, Den Hermeneutiske Cirkel, 2010). It means as you hear or learn of a statement, you both need to look into the context in which it is made, but also the more objective whole for the grand picture. Thus, a switching movement is produced between just understanding a single statement or piece of data, and then looking at what this means for the overall contexts that it was made in (Berg-Sørensen, Den Hermeneutiske Cirkel, 2010). This approach means that you as a person has some sort of preconceived notion on certain things, which are constructed based from our previous experiences with the social sphere. Gadamer labels these experiences as prejudices we carry towards, the situation we face, and as the things we have to jeopardize, when we seek new information concerning a particular phenomenon. As one obtains the new knowledge, this will be the new baseline, on which future prejudice will be set, which then in turn will be challenged by new information. This creates in theory an infinite practice one can perform, to continually seek deeper into the field of study and understanding of a certain phenomenon (Berg-Sørensen, Den Hermeneutiske Cirkel, 2010) . When using the Hermeneutical approach one will assume the statements and results made in the articles and publications as the baseline and prejudices. From this, one can examine what is behind these results, where the technology that they focus on will be should appear. This is done, in order to pinpoint the exact causes for the change and thus gives a deeper understanding to be used in the discussion.

Research method

In this thesis, I have chosen a documents and literature study as to create a portfolio of publications and internet based articles. The publications are in the field of robotics, jobs statistics and probability of automation. The underlining theme is dealing with the future of technology and jobs. The articles are viewpoint and highlight from newspapers, journals and people within the field as to draw in comments

on the case. The empirical data itself is made up of a storyline of the key elements, dates and facts made around Google, and their self-driving car project, the fully automated car. This source of empirical data was specifically chosen to highlight features, possibilities or complications in regards to aspects of the thesis in relation to the framework and themes. The cases provide data and a curious look into the edges of today's technological advances, and as counterpoints to arguments and limits made by some of the works. A rapid advancement is currently underway, and even during the writing of this paper, breakthroughs has been achieved, and the articles will be used to relate these changes. In this paper, the key elements from the book (Brynjolfson and McAfee), will be analyzed and presented as a starting point of interest. The claims and predictions made here will thereafter be challenge, or exemplified by data collected from other material. Statistical data(Frey and Osborne) and articles of scientific news will lead to a discussion of their results compared to new changes, idea of work and value creation and in general to the research questions made in the beginning. The research questions are made with key elements of the base Brynjolfson and McAfee text in mind as to challenge or further elaborate on their findings. The gathered data has been carefully chosen for the ability to complement, challenge or counter the way we as a society perceive robotics and computers gradually being introduces in more and more fields. The Brynjolfson and McAfee book was selected as a starting point as they in their book paints a picture of humanity being on the verge of a revolution. Or on the sideline of a revolution rather. In addition, as an existing piece of literature it will provide a frame for the data collection and inquiries made in this thesis. It also establishes many of the themes of which the data builds upon, and shares the field of focus that I wanted to toggle in this work. It also fits as a frame, onto what the rest of the articles build upon in the area of automation, job security and future proofing, as subjects of interest for further elaboration and research. The articles and cases will be used to gather data from their findings or quotations. This is done as to compile the essence of the works, in order to take those insights, and use them collectively on the framing thus creating a thesis, that tries to develop a sense of direction in a fast moving, quick changing field of uncertainty. The choice of bringing in data set made public by others was made with the limitations of this project in mind, and the estimation that the quality of data is high enough, so that an attempt to try to generate a separate dataset would seem inefficient and time wasting. The data is also chosen from a point of interest for myself, and thus could be one of the initial prejudice made and evident in the selection of articles, but this makes for a necessary starting point and an interesting one. As mentioned earlier the choice of Brynjolfson and McAfee was made for a general liking of the thought pattern made in their book, The Second Machine Age and the predictions and tendencies outlined within. They raised a sort of optimistic reasoning as to what to expect from robots and what still was an impossibility for them as a technology. I wanted to challenge some of these limitations and delve deeper

into some of the possibilities. This meant finding examples of technologies presented in the book, creating a portfolio of articles and publications both for empirical date such as The Google Car Project and thoughts about society's transformation and dilemmas. I then discovered a recent publication made by Frey that gave a huge dataset of statistics covering job transformation, provided easy spreadsheet to data mine, and analyze. All articles, papers, books covered in this thesis share a common thread, the future of technology in special regards to job transformation and security. From the data presented, I have tried to draw in the main results, and these were used in creating a discussion on the theoretical premise of the thesis. How technology could, and will transform jobs now, and open up for new ones in the future. This thesis contain a large amount of second hand literature. This is a conscious decision made to get an overall feel of the communities in which these changes are being made. Newspapers, technical articles and Business specific data will all serve the purpose to maintain a general focus for the discussion with the cases creating an in-depth pendant. Especially in the Google materials, many of the company's own words are used, and the scientific data and papers are firsthand. This creates an overall thesis that is a study in documentations and source criticism. When possible I have sought firsthand sources, and if that was impossible to find, made sure that, the data was backed up either by others or from a credible source. The advantages of using Brynjolfson and McAfee is that it is a good base for further investigations, plus Frey and Osborne as they created a methodology and data set that is perfect for data handling and overview. This makes the paper eclectic, but by keeping the base frame of Brynjolfson and McAfee will offer multiple angles of interest, and serve to maintain a red thread. In all selection, there is a deflection, which as a subjective being is impossible to completely avoid. Another path the thesis could have taken is to look at educations instead of jobs thus looking preemptively at which educational courses would be at risk more specifically as to change the educational system. This could also have been made as an in-depth company based thesis, in which a certain organization or job was scrutinized and analyzed for a specific branch or job feature. Another angle, which I also considered, is to try to determine where on the exponential progression line as mentioned in The Second Machine age by gathering data and qualifying breakthroughs and research, and plot their speed as to see which square on the cheeseboard we currently occupy. This would need a vast dataset spanning over many fields of study, and require a possible new method of assigning values and meaning to events, that is to haughty to try in this kind of paper.

Using The New Machine Age as a framework to theory

The theoretic groundwork used in this thesis, is taken from The Second Machine Age by Erik Brynjolfson and Andrew McAfee in their 2014 book, in which they identify the characteristics of the advancements we are currently seeing, to describe these key definitions, as well as propose two new phrases to try and describe the changes that we are seeing. The three key characteristics of this new age are: Exponential, Digitization and Combinational (Brynjolfsson & McAfee, 2014,p20). In my thesis, I will look for signs of these characteristics in a market that is evolving around us: The self-driving car. The authors themselves use this field as an example, but I will discuss that even they did not understand how fast it would evolve. I will also look for signs of caution were Brynjolfson and McAfee might hold on to a more positive self-sorting future. Especially with the two consequences, they describe the Bounty and the Spread (Brynjolfsson & McAfee, 2014, p9). I will argue that an issue with a Second Machine Age is not only limited to the fields in which innovation is created, but also that there is a spillover to other markets and sector, which does not traditionally fit together or are considered adjacent. The key theories used in this Thesis is then as follows.

Exponential

Exponential - the growth we are seeing in computers advance is gaining speed, developing faster, and ever increasing. Technology based on software and machines reduce in cost and become better by a magnitude over time, than we are struggling to fathom (Brynjolfsson & McAfee, 2014, p21). Exponential Acceleration is a term given to the increases in innovation and technology. With the rise in computing power, it has been identified that this evolutions and increase does not follow the linear growth that we are used to seeing. The idea is that with only machine and tools, we were able to raise our work capacity beyond that of a single individual. With a car, you can tow many times your own strength, and propel yourself many times that of just one person's capabilities. Moreover, with machines, we as a society could advance and produce output many times the initial input. Still, as it is remarked in Second Machine Age for a long while after the invention of transistors and computers we did not see the same development. However, for many years the computer was a tool but nothing more. Nevertheless, all that are to change as we now see deep-thinking computers, jeopardy masters and software becoming faster and smarter by the minute. Other machines could not match this growth. An airplane does not become cheaper and able to fly further at the same pace as the software in your phone. It far outmatches that. This is an indicator that this Second Machine Age is one that relies on computers, software and transistor that develop at an exponential speed. In addition, the innovations and technologies found in this era should reflect this.

Digitization

Second, we are experiencing a huge Digitization – The way our data is created and knowledge, goods and services are being made digitalized means faster distribution, cost reduction in reproductions and in return an even bigger data collection through various household appliances connected to each other, with the ability to gather and share information (Brynjolfsson & McAfee, 2014, p29) of our world. Data and information is being produced and generated at faster rates than ever seen before. Our sources of information, leisure and all general knowledge is being digitalized for an easier access than previously. The amount of gathered information is overwhelming since as more and more everyday objects become connected, they are able to sense and gather their own information. A great effect of this is illustrated by the quote:

> "*Information is costly to produce but cheap to reproduce.*"
>
> (Brynjolfsson & McAfee, 2014,p32).

The reduction in cost of distributing data and sharing it, means that we have more information readily available than ever before. This of course means new ways of managing property and rights are needed and with the continually increasing amount of data, this will be harder and harder to smoothly administrate. This also means much of our privacy is being replaced with connectivity. We pay for free online goods and services with our information, and recently a lot of focus on who is storing this data, and who is in charge of keeping it safe is common front-page news and still a unanswered question in many cases.

Recombining

Thirdly, we are in greater ways Recombining our world creating new from old (Brynjolfsson & McAfee, 2014,p35) – Using old data to create new data, thus using innovation as new ways to combine existing ideas meaning we do not need to reinvent the wheel just use the knowledge in a sector or market where we did not think it useful before. This idea is built upon the current idea of innovation as a discipline in creating from where there were nothing before. Adding additional building blocks to the equations, And that these could be used up like another resource, and as such is prone to be depleted. Just like any finite resource. However, Brynjolfson and McAfee argue that this will not be an issue in the digital world as one of the great things about a digital world is that it cannot be used up. Moreover, with the increasing amount of data we will simply have more and more building blocks to work with meaning a theoretic unstoppable wave of innovation. We simply have to keep up with the data amount in processing it, and revealing which combinations will work, and which should be discarded. Also where we get these inputs

for new ideas are changing, as we see new ways to use old data. This is the essence of recombinatory innovation. This is the idea creating motor that will secure innovation for the future.

The last of the theories from Second Machine Age I will utilize are the Bounty and the idea of Spread.

Bounty

Bounty – the great advancements and gifts technology has to offer. The riches involved in creating innovations and markets, the boom in cheaper, better goods for consumers and the boost in production we are seeing in all areas that are being automated. This definition is given to the amount of increased productivity and yield, we are experiencing especially with computer companies. This way that a smaller and smaller input, will lead to a greater and greater output, and the generation of value it is creating. The bounty idea is that we are looking at a future of abundance. Where we will be able to work less to achieve the same amount of yield, that this yield will increase beyond monetary and production. That what technologies are giving us is not only measurable in money, but also knowledge and ease of use. All interactions with your phone teaches that phone your ways of using it. It learns from your patterns and customs. This will lead to more specialized phone interfaces and utility based on the individual needs and preferences instead of entire market shares. Again, this could be seen as a reduction in privacy. The digitization of the music industry has given us easier than ever access to all the music of the world. Much of it, free. YouTube have brought both a platform for expressing ones artistic self but also a viewing entertainment platform for viewers to gaze through more footage and uploads than humanly possible to absorb. The technological age we are entering gives unprecedented possibilities with its ease of access and distribution of ideas. In addition, with the reduction in manufacturing costs as technology increases to develop new and improved ways of producing goods The Second Machine Age also argues for more leisurely goods and higher quality on the market, for cheaper. This is the Bounty that we can expect to see increase, as we travel further into this new age.

Spread

The last term is the Spread – As we are noticing a higher productivity, we are not seeing this reflected in the common workers wage. The automation have moved to middleclass workers that earn a living sitting behind a desk, doing spreadsheets, middle managing and generally the essence of a white collar worker. There seems there is an increasing gap that forces the middleclass to go up or down thus emptying our middle class system in a way, we are not prepared for. We need new ways of measuring these gaps of inequality, as the bounty both generates a lot of new goods and services, but also does not distribute it well out to all parts of society. This evolved from the idea and notion that there is an increasing gap in workers earnings and general productivity. As the bounty keeps producing more and more and making

some people wealthier than ever. Brynjolfson and McAfee also argues that as we see a bigger gap and fewer people get a piece of this increasing cake this is making inequality in society worse. The wealth is spread to fewer and fewer. One guy controlling hundreds of A.I. workers and making huge profits does not bring value to the surrounding communities, and while software- and tech company deals and merges fill our newspapers with new record breaking amounts of cash payed, the common worker sees none of this in their lives. Technology is also making mundane repetitive tasks obsolete and with the recent invention of deep learning computers and advance pattern recognition, our machines are able to understand and process our world better and faster than the average human. We see a hollowing of the middle class leaving many people behind as they are either forced to further educate themselves, and take more creative innovative roles than ever before, or drop and find lower tiered jobs that may not pay as well. People in the top tend to be fine and stay there, as they through their resources can continue to keep up. In addition, this means that people who are unable to keep up with the advancements made, are being put into technological unemployment. Not because they are bad, lazy, under skilled or unwanted but simply because a machine can do their work better, faster and cheaper. However, our system is not build to accommodate these people, and as such people who before sat at middle, or even higher administrative work are being let go. For 30-40 years this has been a pressing issue for factory workers and blue-collar workers, but now we are seeing software capable of white-collar work. Assistants, accountants and the like are being forced out of businesses for low cost buy-once software like TurboTax (Brynjolfsson & McAfee, 2014,p62), a program for home use that can do all the tax filings, that before needed a more expensive human worker to calculate and formulate. Review work of any sort are ever increasingly being done by the end users on Yelp, Trip Advisor means that your entire trip planning can be made by yourself based on other users data and plan flight, car trips, hotels and routes without having to utilize more traditional travel agencies. YouTube allows us to both be the creators and users of our own entertainment. We do the work for them and they grow bigger.

On the subject of self-driving cars

Autonomous, robotic, self-driving or driverless cars have long been a prediction stable of science fiction, and a go-to for recent year's innovation in the automotive community. The idea of a driverless car or even just an automated driving system is not a new one. Rather almost since the birth of the modern car back in 1890ties there have been efforts made to remove the human driver aspect. Countless technologies and innovations have since been introduced to provide a varying amount of automation, and service to

the drivers from cruise control to GPS assisted directions. Moreover, already several milestones in the technology have been surpassed, putting pressure on legislative and administrative branches to encompass these new developments and innovations. But in order to differentiate between these different levels of autonomy as to make a clear distinction between autonomous and automated driving technologies in the United States, the National Highway Traffic Safety Administration(NHTSA) have taken the following classifications into use as to give levels to the amount of assistance.

Levels of automatous vehicles

No-Automation (level 0)	The driver is in complete control of the primary vehicle controls – brake, steering and motive power – at all times.
Function-Specific Automation (Level 1)	Automation at this level involves one or more specific control functions. Examples include electronic stability control or pre-charged brakes, where the vehicle automatically assists with braking to enable the driver to regain control of the vehicle or stop faster than possible by acting alone. Cruise control and automated parking systems are other examples of this level of automation.
Combined function Automation (Level 2)	This level involves automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions. An example of combined functions enabling a level 2 system is adaptive cruise control in combination with lane centering. Here the driver can also relinquish some of the tasks in driving i.e. Foot of the speeder for example while still responsible for monitoring the roadway and being available for control at all times.
Limited Self-Driving Automation (Level 3)	Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions, and in those conditions

	to rely heavily on the vehicle to monitor for changes in sufficiently comfortable transition time. The Google Car is an example of a limited self-driving automation. Drivers at this level are still responsible but not required to constantly monitor the roadway.
Full Self-Driving Automation (Level 4)	The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip. This includes both occupied and unoccupied vehicles.

Figure 1 Department of Transportation Press release on its Police on Automated Vehicle Development, National Highway Traffic Safety Administration, NHTSA(2013) U.S.

There is much debate on how far we are, and how fast we will reach the first real level 4 automated car, and make it accessible for consumers. These recent years we have taken greater and greater steps forwards at an increasing quicker pace. Since the dream of an automated driving brought with it by cars such as the Firebird 2, introduced in the 1950s throughout the 1960s, driving along an imbedded wire in the roads controlled by an "electronic brain" (GM Corporate and Concepts, 1956) to 2010, were four driverless vans traveled from Italy to China and more recent when in August of 2012, Google announced that their self-driving cars had completed over 300.000 miles of 'accident free' driving. What cannot be questioned is the fact that we are in the middle of a revolution of transportation. One of the reasons of this big push towards innovation and advancements might lay in the changing of the systemic landscape. Building on the Idea of Traditional Players and disruptive players (Sidhu, et al., 2013), one of the key features of this revolutions is that the incentive, and drive comes primarily from non-traditional players. It is not the car manufacturers that are at the forefront, but rather disruptive tech companies like Tesla and Google.

One of the more notable example of the history of self-driving cars in more recent times is the case of the Google Car. The next part will look at their road from search engine to chauffeur.

Google Car Project and Self-Driving Vehicles

The tech giant Google have for over the last decade epitomized the idea of a capital rich giant buying out smaller companies, that for what they lack in funding, they make up in sheer innovation and ideas. This

has resulted in over 180 companies acquired by the computer software and search engine business, and since 2010, this has leveled out at around one company every 16 day according to Wikipedia's list of mergers and acquisitions by Google (Wikipedia, 2016). This means that they have a huge back catalog of services, they now offer under the Google brand, and means their research and development have the freedom of not having to compete, or reinvent ideas and technologies. They simply buy the technologies, and thus get to cherry pick ideas and projects, while to a certain extend not put funds into the startup and test phases of these developments. And the story of how Google come upon the automated driverless marked actually starts, as investigated by IEEE Spectrum (Harris, 2014) with a small company called 510 Systems, Berkley California. They together with their sister company Anthony's Robots had for long time dabbled in robotics, and many of the founders had participated in the 2005 DARPA Grand Challenge. It was after a couple of other ventures that three engineering colleagues from Berkeley started 510 Systems. They started worked on Googles mapping project in 2007. The project itself started in 2001, but it wasn't until the 510 Systems developed a computer controlled camera with the ability to incorporated GPS data for positional data encoding, that the service started looking like the one we know of today. . This meant that pictures taken could be geotagged and logged as to make a detail image map. Google were quick to buy this technology and it was then renamed into what we now know as Google Street View, a revolutionizing feature of Google Maps. One of the biggest hurdles when dealing with an automated driverless car, is how the car is made aware of its surroundings. How it navigates, handles or even drives, is useless if it cannot perceive the world around it. And just outfitting it with cameras would not suffice as this doesn't give information of where it is in relation to the environment. It lacks spatial awareness. Andrew McAfee in an interview asked his audience to close their eyes and point first to the door, and second to themselves, then explaining that they had just completed one of the major problems of robotics, the SLAM problem or Simultaneous localization And Mapping (Prose, 2014). Here 510 were also tinkering and they pioneered a type of Lidar, the smaller lighter version of radar. It scans the surroundings using lasers guided by mirrors to map out a three dimensional image of the world around it. The system was so precise it could differentiate between the individual wires in utility and power lines, as to calculate whether they were too tight or too low. This technology gave 510 the success and lust to try to make a fully autonomous vehicle. They were approached by Discovery Channel in 2008, and asked to make a self-driving pizza delivery vehicle for a television show. The chosen model for the project was a 08 Toyota Prius. Engineers often turn to electric vehicles to automate, as they are a far simpler mechanical and already have an advance electronic control system. The route was planned to stretch from San Francisco's waterfront to Treasure Island crossing the Bay Bridge. Though it had to be escorted for safety reasons as they were nervous about its lack of prediction other drivers behavior, it made the trip

fairly without problems. It was a success and a milestone in fully automated driving. After working for Google doing mainly hardware integration for a couple of years, the company was approached and bought by Google in 2011 being absorbed as a key part in Google X, Google's secretive experimental division. This was kept quiet, not making any headlines or even figure in the list of acquisitions and mergers by Google. This brings us to the big announcement in 2010 that Google wanted to develop new technology that would help prevent traffic accidents, give more free time to people and reduce carbon emission by 'fundamentally changing car use' (Thrun, 2010) In the beginning a big hindrance was legislation. How to allow driverless cars to drive around as to test them especially in human traffic to gain insights and data that could be put back into the software and make it better. After some lobbying the first state to grant this permit was Nevada on June 29th, 2011 when they passed state law that allowed the operation of autonomous cars. This went into effect March 1st 2012, with the first license being issued for a Prius, modified with Google's experimental driverless technology named Google Chauffeur, in May 2012 (Slosson, 2012). As of writing three additional states have passed laws for robotic driverless cars. Some cities have passed similar municipal bound law allowing self-driving cars. Particularly the laws allowing automation of cars have had a prominent place in tech and law online media, as it would seem to be a growing marked. Already many changes have been made to allow an increasing number of functions regarding to automated driving. Regarding a fully functioning self-driving automobile, changes are still being thought out, as this is unprecedented in the scale of affected areas. Cars and road vehicles are used for almost every level both commercial, private and governmental. Removing the driver in any of these would have consequences on both legal and social levels. Other fields already have comprehensive automated assistance already in places, and mostly recognized of these could include the airline industries. Autopilots have been a standard in many companies and models for almost as long as there have been planes. Sticks tied to controls and crude navigational gadgets at first, later directional, speed control and where today fully functioning self-flying option of today means the planes in many cases can fly themselves to a great extend. Today, 100% of takeoffs and over 99% of landings are made by the pilots hands manually while the midflight are mostly done by the auto pilot function. There is still a huge amount of fine and constant tuning involved but airline manufacturers have taken steps in trying to create a fully remotely controlled airplane. The biggest boundary as to why we cannot fully automate planes seem to arise the same place as other heavy automated areas with a direct handling or regarding humans.

The legality.

The legality of responsibility involves in who is in control, who is answerable and how we should regulate. I attended a lecture back October 28th, 2014 on Robots in the Hospitals (Kromann-Andersen, 2014), with a resident doctor from a Danish hospital in charge of a ZEUS robotic surgical system, a medical robot made to assist human surgeons in fine precision work, and keep surgery invasion to a minimum, wo retold that the reason there still was the need for an human in charge was twofold. Firstly, surgery was never as planned, every body was different, there was always a lot of on the fly adjustments, that could not yet be programmed into the robots. Their pattern recognition was simply not as fine tuned as humans and adaptable to slight variations, thus making it impossible for them to satisfy the high standard of precision needed. Secondly, if anything went wrong, people needed someone to blame, to know that there were someone in charge. He mentioned that many people do not trust robotic assistants enough. and that is even with data suggesting, that they have a far better track record, based on the idea that if, for some chance an error would occur, they would be adaptable enough for the situation. In addition, as robotics are based on input values for the "judgement" in places where difficult choices were to be made they would like to have the ability to sometimes take chances. Going by on hunches. And Instinct. Concepts that still are exclusively biological and human in nature. Therefore, the doctor personally did not think, that we could fully automate yet, as it would be a legal nightmare. If there is an issue, who is to blame? Where does responsibility lie? The doctor, the programmer, the manufacturer. We as humans like to put a face on an issue, to have someone to relate concerns and if necessary ask for reasoning. The same could be transferred to the airline industry. They too have too much riding on the idea of having someone able to make a change. Even though in a lot of accidents the error is found to be human, or mechanical outside the range of save-ability of the onboard pilots. We just might not as a society be ready to go up and sit in a plane, where there simply are a sensor and processor in the front seat. But this might only be in these first stages of travel automation. Trains, metros and trams have been without a driver for years and we think nothing about it. This might also be a bias regarding to the specific travel forms in that they are on rail therefore giving the feeling that no specific control is needed. However, this is simply because technology takes over the control, and while still requiring control centers for centralized management computers have made this particular transport quite simple in comparison.

The Ethics of driving

If within 30 years, we are all driving around with no hands or steering wheels we might look differently on the scenario. On the matter of making quick decisions and the inlaying responsibility the entire automated vehicle, self-driving vehicles have one ethical big issue they must face. It is a scenario and problem found in utilitarianism and one version of the problem is that: You are standing next to a train

track with a rail-switching button in front of you. From one end, a train is speeding towards you. The switch you are standing in front changes the path between two forking rails. Your switch changes the direction into which of these two paths the train will continue down. On the path, that it is currently on stands a group of 10 workers, drilling/ heavy machinery blocking out all sounds and vibrations so that they cannot hear the train coming. On the other track, a single worker also engaged in a specific work situation that also leaves him incapable of hearing the oncoming train. Now the dilemma is, do you press the button? Utilitarianism in the traditional Bentham school of thought tells us that the most amount of utility to the largest amount of people is what decides whether a choice, an act, is right or wrong. Now in our scenario we have the lives of 10 versus the life of the one lonely worker. Thus we should secure the least amount of loss and press the button switching the lane, diverting the train into the single worker. This is a simply math question about the larger sum. Well without too much of a spoiler on the last 200 years of ethical philosophy, this scenario have been discussed as not that simple. And the reason ties in with the idea of responsibility from above. If you do nothing, then 10 men are dead and no one is to blame. Force Majeure if you will. If you press it, a total of 9 lives is saved, but you will highly likely be faced with some sort of consequences as being a direct source of the life lost. There is one to blame. To take the responsibility, but from a rational optimal Homo Economicus standpoint the choice will result in a net loss of 9 compared to a positive 9 if it is 'only' the one guy dead. But this is a very narrow scenario designed specifically for proving that the rational optimized choice when mixed with human choice, ethics and morality can be quite hard to gives simple answers to complex ideas and questions. Now this is only a thought experiment, the real life comparison that the robotics community might face very soon, with especially self-driving cars, is how these cars would take the decisions. Rearranging the previous setup a real future problem these cars might face is in an accident type situation where a non-automated car or groups of pedestrians, suddenly pose a danger to the self-driving car. Will the car avoid the group of more people to save as many as possible even at the danger to the sole driver? Again, worst-case scenario would be for the car to take such aversive actions that would endanger the passengers, even killing them. Driving off the road, into oncoming traffic to minimize the possible lives lost.

Now this would be a marketing nightmare. How are anyone supposed to sell a product that in the face of danger would sacrifice the user, and who would wittingly buy such a product. As we are only still in the relative infancy of self-driving cars with the predictions, these are ethical issues that face manufacturers and car companies. This is one of the new areas were we need to reconfigure or even make new laws to govern. New policies and develop the robotic ethicality towards their use in everyday life. Automated heavy machinery and equipment such as storage warehouses could harm people not knowing what they were doing or where they were. This is not that big of an issue, as these are closed

systems and accident are more human forgetfulness or neglect, rather than an issue with the robotics. Also granted, the sensors and processors in the automated storage facilities are mostly incomparable with the software and hardware involved in a fully driverless car, but where human and technologies meet there are often somewhat clashes, and in an everyday thing such as transportation it would demand a fair bit on safety features involved. But as Google will tell you, it is just until we are all connected and every car are automated. Tests from their self-driving Prius and Lexus car fleet shows that in 2013 they would in general drive safer and abide by the rules more than their human counterparts (Knight, 2015). And especially the idea that when the automated self-driving car increase on the roads this will lead to more safety and controllability is one of Google own prime reasons as to why they are investing in this field. This safety focus was proven when as of August 2012 Google felt they were ready to move the number of control personnel in the cars, just as an precautionary feature, whilst not touching anything, from two persons to a solo driver (Urmson, 2012). This was based on the project completing its first 300,000 miles without any accidents. After the Google Car had mastered the open roads, Google decided that they needed a bigger test, a much trickier and demanding playing field. The urban city sprawl with all its random, chaotic, unpredictable human glory. They had had success with some urban driving in Mountain View, California but now wanted to gather some data, and prepare the project for safe driving in even the most complex of situations (Urmson, , 2014). This would still require a lot more driving in Mountain View, California, but the idea that the true test for a driverless car, and also that a possible consumer wouldn't suffice with a gadget vehicle that only did automated driving in the flat country sides, meant that the new goal was introduced. At this stage the vehicles had driven over 700,000 miles with the fleet of cars consisting at least of six Prius Hybrids, one Modified Audi TT this being the original fleet and three Lexus RX450h added in 2012 (Lavrinc, 2012). On May 11th, 2015 Chris Umson, head of the Google Self-Driving Car Program, elaborated in an online article(Urmson, 2015) that the team now had completed 1,700,000 miles where the cars had autonomously driven just under a million of those and the fleet had grown to 20+ cars. He followed with the statistic that 95% of crashes are driver errors and while they had suffered 11 minor (14 as of other sources) accidents,

> *"Not once was the self-driving car the cause of the accident"*
>
> (Urmson, 2015)

Many of the crashes were rear end crashes, were the cars behind fail to stop in time, or neglect to keep a safe distance. People simply are not paying attention to the roads, were the feedback from the safety drivers, when they were out driving with the cars. And then most recent on June 3rd 2015, Google announced they had broken the 1,000,000 miles mark for fully automated driving and fully navigated

200,000 stop signs, 600,000 traffic lights and seen 180 million vehicles (Google Self-Driving Car Project, 2015). Google have both brought driverless cars on the agenda in the US, as well as proven that the technological advancement moves very rapidly compared to ordinary technologies and car development of the past, but also worldwide car manufactures have seen the benefits of autonomous systems and are starting their own projects. Companies like Tesla, Nissan, Volvo and Mercedes have stepped up their efforts in developing these features, though they still draw a clear distinct line between automated and autonomous. Autonomous would mean level 4 automation while many existing car companies still focus on level 2.

In the next section, I will try to look at the advantages and potential benefits of a driverless car and possible problems facing the market.

Robot cars, What's not to like?

The first fully autonomous car is still somewhere out in the future, but that future is coming closer and closer. Nissan and Toyota have been out mentioning their expectations of a developed fully level 4 automation car by 2020, and Audi will have their ready by 2025 (Passary, 2015). Goggle hopes to have a commercially available model out by 2020 and Elon Musk have in an interview with Fortune Magazine, accelerated his predictions that Tesla will have a fully automated car on the market in just 2 years (Korosec, 2015). This is a far shorter calculation than his previous predictions stating that level 4 would take 5-6 years at least. Other car manufactures have been out stating they are implementing a higher level of autonomy and assistance based equipment in their models. Level 2 and 3 automation have been announced by Volvo and General Motors have announced a new feature called Super Cruise (Korosec, 2015) that implements hands-free lane following, braking and speed control in their 2017 models. All of this shows that existing car companies have taken the idea of automated cars to heart and developed and increased the features, even if they are not going all the way of self-driving cars, this shows that the technology have driving the existing market to perform better and seek new ways to alleviate the tasks involved in driving and securing new safety features to make a better product. The announcements from Tesla CEO Elon Musk came after their October update that introduced a couple of new features in their models. The autopilot system came with a lot of added assistance, and the widely media mentioned Summon feature which basically allows the owner to step out of the car, and have the car drive itself into place in a garage to park, and with a flick of a button can drive itself out again and standby for human driving. This is the first commercial hands-free drive feature and propelled Tesla into the lead of the pack

almost overnight. The service which was based on a wireless patch also exemplifies one of the benefits that a technological advance car might possess. Upgrades, new features and system fixes now work as they do on ones phones with no need to visit a mechanic as it is merely a systems updates. This also makes the updating process cheaper and easier as there is no need for a physical install process. This is one of the beneficially aspects of an automated car but far from the only one. Being in an automated system that constantly speaks with other elements such as other cars, we would see that some of the most common issues in traffic could be fixed. Human errors, which accounts for most of all traffic accidents could to a higher extend be avoided completely. Human reaction time, tail gating, rubbernecking, aggressive drivers can be written totally out of the equation. The multiple arrays of sensors and computing power allows the cars to be completely aware of their surroundings and not miss a thing. Handling a vast amount of inputs at an even higher capacity than we are capable of, means that the cars cannot miss a thing or get distracted. Ranging from other vehicles, drivers, pedestrians, bicyclists, children, and potential obstacles can be analyzed, and gauged at a much higher speed than humanly possible and a reaction can be made in a safer and more controlled manner (Miller, 2014) . This means a reduced amount of accidents and collisions worldwide, which would both mean we could save human lives from the drives, but also reduce fatalities associated with vehicle accidents. This connectivity would also mean a higher road capacity and a reduction in traffic congestion, as the onboard system would be able to not only know where the car itself where, but also talk to every other car, and determine where they are heading allowing for the computer to map out a optimal route and placement for every car in the system. Knowing where all vehicles were and where they were going would also allow for higher speed limits. It would also bring the entire driving experience to everyone as with a fully automated car the biological limits of the occupants would not factor in. Underage, old, blind, handicapped or paraplegic could all be chauffeured around. Even with or without driving licenses. Having a designated driver for a night out would also never be an issue. Again, this would mean we would have to give up the privacy of going where we want without being tracked.

In the next part, I will start my analyses of the self-driving car technology in regards to what we should expect from the Second Machine Age, and how far we are so far. In addition, I will branch out and discus apparent consequences from a societal standpoint in regards to where this leaves us.

How Self-driving cars can teach us where we are in the Second Machine Age?

The following section will analyses on the case of automated driving and driverless cars, and try to find key relations to the key features from The Second Machine Age in an effort to relate current tech with the theory, as to discover how they fit together. From the announcements to the results, we are seeing in the field of automated driving, schedules, and advancements has been coming quicker and quicker it would seem. This might very well be because there is an emerging market now and this has meant an increase in development. It also represents the massive advancement A.I. technologies have been seeing in the last decade. Software is being made, evolved and shared at a massive rate, which dwarfs that of conventional mechanics. This one of the advantage a self-driving car has among others over traditional cars. They are part of the transistor tech family. Gears and engine blocks are all so small, laser cut into perfection and tuned that there really is not many ways one could optimize a mechanical only car, which also may be why we mainly see advancements in optional services and software packages in modern cars. It is more about comfort and options than in the physical components the advertisements claim to be innovative. But when you turn digital, there is no limit in sight. I think it is reasonable to assume that what ever technology the self-driving cars bring with it, even if we adopt giving up driving will change the world we live in. Following the theory of the acceleration, we should expect to see this kind of technology being brought to the masses in a more frequent amount. The world of tomorrow and science fiction become just another Tuesday. The google self-driving project is a great example that when a resource heavy company set out to develop technology that will revolutionize a so fundamental building block in today's society, with the funding, tech savvy background and aggressive mergers and acquiring of creative skills, and idea companies technology can move very fast. It has evolved from 10 years ago where fully automated cars still were a thing of dreams to predictions of the first commercial car being ready within just couple of years. But are we ready this? Are we prepared for a self-driving world and its consequences? As I will point out later, the impact both in the world this single technology could upset and the potential markets and areas it could affect, is maybe not as simple as just having a gimmick car that can park itself. One of the biggest keys as to why the field is improving is without of doubt its digital character. That these cars are primarily based on their software and that it is this that makes them smarter than their mechanical only counterparts. Battery cars are a simpler car than their mechanical cousins are, but their service level of software far outplays them. They are able to do many of these things simply because they have far more sensors and monitoring capabilities than ever before. And this digitization of control and services in the cars even in the level 2-3 automation cars we have on the street today leads to a lot of data being registered and stored on everything driving related. Paths, customs, behaviors and simple seat positions preferences are being saved by the car. But this data that at first is meant for costumers to save their favorites and make the cruise experience better and simpler will also give

engineers and car manufactures input on how to improve cars. The amount of GPS data and other sensory input could lead to city and street planners to redraw cities (Djursing, 2015). This is already happening today and even though we will see an increase in data collected this way through new innovations and means is already happening. Where this gets really interesting is when it is combined with at fully automated driving system. The amount of new input would likely skyrocket as more sensor come in to service. And this might push us into new territories in which we aren't sure of just what to expect. When the first cars saw the light of day over a hundred years ago for the first many decades they were too expensive and crude to pose a real challenge to the travel- and transportation sector of society. Speaking in terms of innovation these were a revolutionary innovation in that it was unexpected and a completely new way of thinking yet, as with its label as a luxury good, they did not change or challenge the current markets. This was until 1908. The year the Ford model T was introduced. This was low cost, easy to produce and made it available for the masses. The common workers. And soon the market was automotive only. This was a disruptive innovation. Now this meant that the already existing modes of transportation were soon pushed from the pedestal of usefulness into a shadow of their former glory. The web based educational producer CGP Grey puts it well when making the analogy of the horses of them to us today (Grey, 2014). Paraphrasing his episode on the robotic take over, if we today imagine our reluctance to accept that we might become obsolete and in particular, robots will take over the driving roles of our world, we stand as the horses of days past. We can imagine us as the horses a hundred and ten years ago watching this gimmick technology. Luxury goods like Tesla and higher end cars bosting exotic technologies with a more crude and simpler by immediate comparisons as the Bents Motorwagen and Daimlers may have seemed odd to horses that at the time stood for everyday transportation for the common people. Technology have always been tools that reduce the amount of effort and optimize. Now at the time big steam engines and machines has brought horses from rural work areas into the cities to transport people around so the horses might as well says; 'Heck, so far our lives have become easier, the jobs here are much better than hard farming labor, cross country deliveries and such. Even with that clumsy new car thing, we most certainly are just getting a better and better deal'. But with the power of hindsight we can see that the working horse has almost ceased to exist. We are facing that issue right now. The grand digitization of our lives has made it possible that in the bounty of technology lies our replacements. We have always used tools to boost our output. Mechanical muscle like trains made it possible to exert much more power and speeds that even our animal helper could provide. Mechanical finesse like tool made it possible to achieve feats beyond our body's capabilities. And now we stand at the dawn of mechanical minds. Processing power that in some areas already surpass ours, and with the added exponential growth that far outshines our biological evolution powers we are at a decisive moment.

We lack the prediction skills, to see when we reach the point of no return, but our progress can be viewed as an allegory parallel with one of the origin myths of the chessboard, and the story on how the inventor chose his payment in that he wanted rice grains on a chessboard. Each new square double the amount so as to put 1 grain on the first, then 2 on the next, then 4,8,16.. and so on. While we can follow along for a while but with 64 squares you would end up with a number of 18,446,744,073,709,551,615 or roughly 1000 times the global production of rice in 2010 (The Economic Times, 2011). And this is where as Ray Kurzweil in his 2000 book The Age of Spiritual Machines use the term 'The second half of the chessboard' as a technological strategic term to illustrate how an exponential factor will begin to affect economic and business decisions and how it is in the second half things start to get a bit silly. This illustrates the power of exponentials and it is why that when you deal with a mechanical force that seems to grow itself at this rate, you start to wonder where we as society are on the chessboard. Are we in one of the starting squares, or are we nearing the crossing to the second half? Truth is, as stated above, we have no real way to determine that. And that is why it is so exiting to think of the self-driving car as one of the really out there bounty we have seen. The technology is coming. Whether Musk gets it right with his 2-year prediction and have a commercial ready product, how well this product is, and how fast we will adopt it depends on many factors. But it will change the way we drive. Simply because the cars do not have to be the perfect driving experience. They just have to be better than a human is. And they will be. They will not need sleep, food, breaks, wage and even ride comfort so they are the perfect candidate for hauling goods and transports for longer periods. The only cost for running is a bit of power but compared to a human this is a fraction of the other cost. They do not make mistakes as humans do, and even if they do, they would be able to instantly tell their surroundings to avoid accidents. And while Tesla and Google are toying around with the idea of a consumer car the possibilities are many. When the autonomous technology exists, new ways of implementing it in other systems, in ways not yet imagined would be possible. Recombining innovative measures from one field might prove fruitful in another. And here the idea of a self-driving fully autonomous car becomes an issue for us all. How many jobs today revolve around driving? Freight trucks, taxis, busses, chauffeurs in this sector alone millions of people would be effected by simply being made obsolete. In the battle between workers and technology, technology wins. Every time. The economic incentives to utilize automated driving vehicles are just too big. This is the truth we are facing. When we moved the idea of a car as a simple transportation tool into the digital age by taking all the characteristics and digitalizing them, we created the demise of the car as it is viewed today. By placing the car in the Second Machine Age, we allow the forces of that to change it. We are already seeing how fast it is changing and developing and we can see that the cars in general are becoming smarter and more aware in general as new features or old are being added as software. The

cars that can drive themselves are part of this bounty this new age is said to bring us. It would be a marvelous feat to reimagine a car that could think for itself, and this would open up to new features. The ideas that we could rethink and rebuilt the entire car as a concept, and not be limited by the past's mechanical boundaries. With no controls, a larger seating cabin could be made. Transport vehicles and work vehicles would not need an operating cockpit or seat, and a full city rethink could change city planning for good, as we would no longer need parking spaces in the same amount as now. This is another of the characteristics of The Second Machine age showing itself. Recombining ideas to create new ones. Until now, most of the self-driving efforts have been in producing and making a consumer product but why stop there. Every driver-operated mode of transportation could cease to exist, as we know of it now. A bus and a car is fairly similar for a computer in regards to operating. It is only dimensions and number variables that they are well capable of doing. I would dare to say that the question is no longer if we are ready to fully give up control, but how long it is going to take until we adopt the new way. Trains, planes, work vehicles. The technology would soon be able to adapt to most modes of transport, as the more automated driving systems we implement they will learn and become better at their tasks.

The automated takeover 2.0

However, this still leaves us with the question of where we fit in. The modern world is based around our jobs. We work, we get payed and we live. And this will likely mean changes in almost every sector. Now Tesla and Google are as mentioned trying to produce a consumer good. But a consumer good that has the potential to change the entire transport industry as it ripples out the markets. In Denmark in 2010, there were around 12.000 people in the taxi industry. This makes up around 10.2 percent of the total transportation industry in Denmark, which means this is roughly 120.000 people (Dansk Taxi Råd, 2010). In the EU, this number is more than 10 million people (European Commision, Mobility and Transport, 2011). And this is transportation only. That is a huge amount of peoples whose jobs are effectively obsolete. The benefits simply are too many: Cost reduction, safer, less prone to human frailties. And car insurers would love the idea of an always vigilant driver than a texting human driver anyway. When businesses are choosing between an automated work force and a wage hungry imperfect human worker, history will tell us humans often loose in the end. And as such the self-driving car and its massive potential is merely an indication on what we are facing on a much bigger scale. The robots are not just coming to take our driving privileges. They are coming for all the jobs. In a paper by Carl Benedikt Frey and Michael A. Osborne from 2013 in which they look into the susceptibility of computerization of jobs they have developed a framework to try to give a probability of the chance of automation. Their findings show that among those in the top the transportation industry are well represented with a few selected here:

Probability of automated work in select transport occupations

Taxi drivers and Chauffeurs	0,89
Bus driver, School and special clients	0,89
Light truck and delivery services	0,69
Bus drivers, Transit and intercity	0,67

(Frey & Osborne, 2013)

Now these findings is research being done in how easy it would be to computerize these job functions. Computerization here can be seen as a parallel to digitization. Their list in its complete form has 702 jobs in ranking order from a 0,99 to 0,0028 for telemarketers and recreational therapists respectively. Just to clarify 1,0 would be a 100% chance and 0 is no chance. Now their timeline states that this would be in the near future if it has not already happened. The entire paper draws a general feel that change is coming. Their data suggest that 47% of total US jobs is at risk of being digitalized/computerized. That is alarming numbers.

A Increasing Spread and loss of the middleclass

This will at first seem to widen the Spread even more. Both Brynjolfson and McAfee, and Frey and Osborne speak of a hollowing process at work in our job markets. The later mentions this as a:

"Increasingly polarized labour market, with growing employment in high-income cognitive jobs and low-income manual occupations, accompanied by a hollowing-out of middle-income routine jobs."

(Frey & Osborne, 2013)

This is created when digitization take the low cognition routine jobs with represents much of computer typing jobs, assistant work and a huge percentage of our workforce. The recommendations and conclusions from Frey and Osborne is that worker need to learn more creative skills, more social skills and further educate themselves to save them from being made obsolete. Higher cognitive, creative and social jobs are still safe, for now.

In regards to how companies today feel about the technological change and future Danske Bank in the Yearly Magasin for 2015 asked the question: Is the bank of the future a robot? In the publication Tonny Thierry Andersen, director of Personal Banking in Danske Bank responded with his thoughts on the matter. The issue is that the organization spends 2 billion kroners each year to further their IT capabilities and make banking easier for the private user to use and remove face-to-face time. The banking industry

is one of the places where digitization are becoming a more and more day to day occurrence as we develop new technologies to ease the banking world for the private user. Danske Bank has logged the development in their sector and can report that in the last 20 years cash payments and checks in Denmark has fallen from being 80% of the total revenue in stores to 25% with a continuing tendency. This is a stark development even for Denmark, which is placed lover in cash users compared to other European countries. But the reason for this drop is not that we don't use banks less but rather that the usage has changed. Andersen states that the banking world has changed and much of the services a bank has been providing in the last decades are made obsolete or easier by technology. In Denmark, Mobile Pay, Netbank and mobile banking has made the idea of transactions taking days, and meeting after meeting to get a car loan or physically take time out to sign heaps of paper for a credit loan, simply outdated. He compared the progress with that of clothing stores or the music business.

"When I was young we stood in line down at the shop for the newest LP's or clothing and couldn't imagine anything else. Now 30 years later it is completely natural to stream music, and shop online and we settle for asking experts only when it really matters"

(Andersen, 2015)

He goes on to the idea of banks no longer needed for money transfers as a general concept. Money mobility and lividity is made easy and safe so bankers can focus more on customer relations. The counseling and meetings for when a customer has need of their expertise. This means the banks even though in day to day the face-to-face time is lowered the type of face-to-face meeting is of higher quality. The small tasks have been automated and digitalized and as such, the bank personnel can spend more time counseling customers in how to best get value for their money. Banking is not about just moving money, but helping clients and customers to gain the overview and the safety they need to realize their ambitions and dreams he concludes. Many of the things being digitalized are the little tasks, the time consuming tasks where are the situations where customers still want a human face to ease their concerns banks now more than ever focus on the costumer direct services. Even with developments and the uncertainty of the future, Andersen is confident that people still wants a human face to guide them but will accept a service or technology to make tedious tasks quicker, safer and easier. Thus, the bank of the future will still have human workers but maybe in a more direct service and consulting sense. Which fits the idea that we still want human faced to put on hard or serious decisions and while at least the automated apps has for many tasking away the hassle of receipts, quick transfers and easy payments getting loans or arranging mortgages people still call and make meetings in their local branch. But my concern is if we can make jobs enough. As of now, there is no plans in Denmark made public to potential

save the transportation sector if predictions are correct and we in 10 years' time have made the human driver extinct other than as leisure. The horse example from above seem to tell I best. We still have horses around but very little are working in the traditional sense. There simply is no reason for them. We might be facing the first generation of people who are unemployable not because of the lack of skills, will or other capabilities but simply because there is no room for them in an ever technological growing and faster pacing world. They are made technologically unemployed. It is really a struggle for the middle classes doing manual routine work with little or no cognitive or social activation. Brynjolfson and McAfee would tell us this is part of the Bounty of technology. That work would be a thing of the past. But sadly most of societies still measure labour as a key element in getting wage. There is a discrepancy in that. If jobs aren't being created fast enough and those who are being replaced and let go are forced to either build up skills needed for the small new wave of jobs, or struggle making ends meet in a low paying position, without a clear political focus on the matter, I would argue it will be a problem that is only building in magnitude. The real winners are the technological companies. The ones on the cutting edge that are not trying to win a race over the robots. They are running with the robots. Tesla and Google car will with their already presence in the fully automated self-driving vehicle have a strong advantage. And like Google are doing by merging and buying smaller think tanks and start ups they have a renewing source of ideas in that they continually recombine existing organizational knowhow and add to it finding solutions for problems far beyond the initial difficulty.

A new type of superpower

Through looking at the automated car world and working out how this is a symptom of the Second Machine Age I would suggest that there is argument for a new organizational structure. One that moves quicker looks further and dreams bigger. In this new and changing world, the winners seem to be a special kind of company that seems to thrive. One that I would dub a Disruptive Innovative Technology Agent, DITA. A key feature of this new breed of DITA's is that they are fairly new, they do often not have a long company history, highly entrepreneurial, often software or technological in origin, and have a huge financial baggage. Frequently with no existing business model or revenue in the areas, they spread into. The best examples are the aforementioned Google or Tesla. Both as companies lead by a charismatic team/ leader. In the case of Tesla, Elon Musk a wide accepted pioneer and entrepreneurial front figure of modern risk-taking and pushing the boundaries of technologies in both commercial and private sectors. One minute Tesla allows ordinary consumers some of the bounties of modern technologically advance cars and the other SpaceX provides extraordinary results in a reusable rocket in the pursuit of

cheaper means of space transport and reduce the general cost of space travel. Google can with their immense amount of capital out buy competitors for their projects and have in the recent years expanded their portfolio of operations from a search engine to artificial intelligence, material design, e-commerce tech just to mention. They have the luxury to drop a record-breaking amount of money after another in their quest for furthering and diversifying their brand. They are invested in bringing a complete encompassing service to users, and instead of getting different platforms to work together, they simply buy the different platforms, and bring them under one roof. Both Tesla and Google are quite recent in their accelerated conquest, but both companies move very fast in their fields. Tesla was acquired by Musk in 2008 on the brink of bankruptcy and today are on the forefront of technologically luxury cars. Both companies share the same entrepreneurial spirit off setting high goals and looking outside their comfort zone to achieve them. They also diversify and have several project that benefit from each other without being directly connected. Google with their purchase of artificial intelligence for their Google DeepMind projects have both benefited them in their internet services but also in their Chauffeur project, which led to what we call their driverless car, or Google Car. Google Chauffeur being the project name for the software. Elon Musk had no previous experience with space travel prior to 2001 but meeting with the existing communities, he was ridiculed with his ideas of making space travel affordable and cheaper. Using what he did have experience in, software engineering, he applied the principles on rocket manufacturing and concluded he could not only do it cheaper, but a lot cheaper. He could cut the price of launch by a factor of 10 and still have a 70% gross margin (DraperTV, 2015). Taking existing knowledge and applying it in different fields than they were originally thought out for is another of the key features of this new type of disrupter. Summarizing these companies, as well as other of the new boundary pushing companies of today, show common characteristics of being a tech/software heavy company making switches or impacts in traditional markets using their technological superiority and financial backing to make leaps in progress utilizing different thinking to existing ideas to reap the bounties offered by a Second Machine Age. They are formed in the fast-paced world and as so can change quickly and are highly mobile in their work. They are the driving force of innovation. In addition, these companies are the ones that will shape the coming years and markets. Nevertheless, the real core of the issue is this: Automated cars are already here. It is not a question of when but how long before they replace human drivers on a large scale. The thing is, they do no not even have to be perfect. Just better than humans. Self-driving cars do not get tired, they do not text, and they do not blink incorrectly, the do not speed or do random lane changes and drive erratic. They talk to each other's at all times thus making sure every car knows where the other one is going. In Denmark according to Danish Statistics (Danmarks Statestik, u.d.) in 2014 there were 182 killed in automotive accidents while in the US this

number was 32,675 according to National Highway Traffic Safety Administration. 95% of these were caused by human error, which means they could be prevented by automated cars. We simply cannot compete. And this will be a battle that stretches many sectors and applications. Sound Hound is an intelligent assistant program for your phone like Siri or Ask Google. What is special about Sound Hound, is the speed you can ask it questions and talk to it. Multiple layered questions with a remarkable fast response time. An internal tech demo came out in the summer of 2015 (Inc., 2015) and beta testing for a consumer version have started. Think Jarvis from Avengers kind of assistant. Why spend your money on having a person scheduling appointments when you could do so from your phone. The future is coming, and it is coming fast.

Conclusion

We are in a very exciting and changing period of time. All the worlds' knowledge at our fingertips. At a push of a screen, every kind of goods in the world will be brought to our doorstep. Everyday a new discovery that will revolutionize the way we think, work, play or sleep. The future is now. But are we ready? A faithful companion to many and vital part of our lives, the common car is at a crossroad. One path is the same mechanical marvel we know. The other is strange, new and unfamiliar. There is not even a steering wheel. In fact, there are no visible controls. A voice greets you as you enter, and asks for a destination and if you have any requests for a particular path. And off you go. Weaving through traffic and intersections, you pass other cars, different looking but all with a key characteristics. They all have passengers but no driver. Trucks with the cabin removed to allow for smaller profiles. Busses looking like metros but above ground and going all over the place. You arrive at your destination at exit where after the car simply drives away. This is the future Google imagined when they started there Self-driving Car project, The Chauffeur project back in 2010. Since they have had a technological magical cloud surrounding them letting out incredible statistics and mileage in intervals. Made discoveries, and shared insight into the project and its creed and goal. To create a safer, easier and cost reduced driving experience that could be enjoyed by all. Around the same time, Elon Musk and the people at Tesla were tinkering with how they could continue to create future proof cars. They already had the luxury battery car market and this seemed like the only logical step. And developing their own projects side by side with Google their predictions soon became within reasonable time. Moving closer and closer as technology sped up around them. In the meantime, we saw many steps towards a fully functioning self-driving autonomous car experience. Level 1. Level 2. Level 3 came along and with every progress the goal seemed ever more realistic. The car became digital. This means that it enjoyed the same exponential growth we see in computers and software, but we biological beings lack. And our previous mechanical machines. After the

transistor age and the computer evolution changed. From slow, to faster to fairly fast but still laniary in its progress. For a long time we saw that computer were fairly dumb. They needed to be taught, managed and upgraded if a new task were to be implemented. This was until the leaning computer. While still simple compared to us, even computers today evolve at an incredible pace. They are not linear they are exponential. Moreover, something peculiar happens in exponential gains. They start of fairly slow. As the Chessboard example. The first 32 squares are quite easy to follow along but then it starts getting weird. It grows explosively and to unimaginative heights quite fast. And this is the fascinating part about looking at the evolution of robots- and why self-driving cars are an excellent example. This particular field bears the marks of The Second Machine Age. They develop faster than their mechanical counterparts did, they are digitalized so they are both collecting and able to access huge amounts of data and use this in a many times more focused way than a human driver could. They show how different fields of expertise can be rearranged and recombined to give progress in new areas. Tesla with their features coming in as patches downloaded straight into your car and give you completely new features. The time we are in, is the example of a great technological bounty. Nevertheless, this also leads to a huge spread. There is a clear gap between the rising production and lowered cost, and then the wages of a common worker. The ones who strike it big, sell for record after another in most paid purchase or merger ever. WhatsApp was bought by Facebook for 22 billion $. That is 7 billion $ more than Iceland's BNP. So the people who struck gold are really getting rich these days. It seems every few weeks a fairly simple program, service or piece of software are being bought by a technological powerhouse that simply buys new sources of creativity and innovation. And with production on the rise it would seem that the cake is getting bigger but fewer get a piece and only few pieces grow with the whole. We also see an increase in robotics taking over white-collar jobs creating a hollowing out effect in the middle labour-class. These people sit behind desks at work with computers, spreadsheets, assistance, managing, calculations and numbers. All are facing being made obsolete. The robots are learning and they are talking together. We have no way of outrunning the robot at this point. But we have another option. To run with the robot. It will demand a huge historical change in how we perceive work, wage and labour. But unless we are prepared to face the first of many generations of human work forces that are simply technological unemployable to no fault of their own. Disruptive technologies will happen with the pace of robotics and mean even what we think we are safe from now could change tomorrow. It is still only 6 years ago we were certain that humans could never be taken out of the car- and that creative writing and managing were a field exclusive to humankind. The second machine age is upon us and we need to act now. We should gather around our innovative gurus. The DITA's. If we are to keep up the advancements, we are to look for the ones that control it. They are the dream creators than makes science fiction, science fact. We should rejoice seeing

the bounties but respect at what costs some of them come. What is a luxury good at first could destroy an entire work sector simply by existing. We are also giving up more privacy than ever before. And with an always connected automated computer as your driver, it could be registering more info than you might think. This means we need to come to terms with a future of reduced social discretion, reduced privacy in general and the idea of much of our information and patterns are out in the open. Information and ideas will be the currency of the future. The idea of getting innovation and new ideas out of nothing is still a human mastery and one we should nurture and utilize so the utopia of tomorrow stays that and not turn into a dystopia. And in the end if robots can learn, adapt and become better. Why shouldn't we?

Reference

Andersen, B. V. (2015). *Danske Årsmagasin 2015* . Hentet fra Danske Bank: https://www.danskebank.com/Documents/Publication.html?id=a0e5b66e

Berg-Sørensen, A. (2010). Den Hermeneutiske Cirkel. I e. al., *Videnskabsteori i statskundskab, sociologi og forvaltning* (s. 654). Hans Reitzels.

Berg-Sørensen, A. (2010). Den Hermeneutiske Cirkel. I e. al, *Videnskabsteori i statskundskab, sociologi og forvaltning* (s. 151). Hans Reitzels.

Bloomberg. (1995). *Look Ma, No Hands*. Hentet fra http://www.bloomberg.com/: http://www.bloomberg.com/bw/stories/1995-08-13/look-ma-no-hands

Brynjolfsson, E., & McAfee, A. (2014). *The Second Machine Age*. W. W. Norton & Company .

Danmarks Statestik. (u.d.). *Tilskadekomne og dræbte i færdselsuheld*. Hentet fra http://www.dst.dk/da/Statistik/emner/trafikulykker/faerdselsuheld

Dansk Taxi Råd. (1 2010). *Analyse af det danske taximarked*. Hentet fra http://www.taxi.dk/: http://www.taxi.dk/Files/Billeder/Rapporter/P%C3%85_VEJ_-_DTR.pdf

Djursing, T. (18. september 2015). *Sensorer og Big Data forandrer verdens byer*. Hentet fra Ingeniøren.dk: http://ing.dk/artikel/sensorer-og-big-data-forandrer-verdens-byer-178803

DraperTV. (28. 1 2015). *SpaceX and Why they are Daring to Think Big | Investor Steve Jurvetson*. Hentet fra Youtube: https://www.youtube.com/watch?v=3aXNWGwis4w

European Commision, Mobility and Transport. (13. 4 2011). Hentet fra All facts and figures: http://ec.europa.eu/transport/strategies/facts-and-figures/all-themes/index_en.htm

Frey, C. B., & Osborne, M. A. (2013). The Future Of Employment: How Susceptible Are Jobs To Computerization?

GM Corporate and Concepts. (1956). *GM Corporate and Concepts / 1956_GM_Firebird_II / 1956 Firebird II*. Hentet fra http://www.oldcarbrochures.com/: http://www.oldcarbrochures.com/static/NA/GM%20Corporate%20and%20Concepts/1956_GM_Firebird_II/1956%20Firebird%20II-12-13.html

Google Self-Driving Car Project. (3. juni 2015). *Google Self-Driving Car Project*. Hentet fra plus.google.com: https://plus.google.com/+SelfDrivingCar/posts/iMHEMH9crJb

Grey, C. (13. august 2014). *Youtube*. Hentet fra https://www.youtube.com/watch?v=7Pq-S557XQU

Harris, M. (19. november 2014). *The Unknown Start-up That Built Google's First Self-Driving Car*. Hentet fra http://spectrum.ieee.org/: http://spectrum.ieee.org/robotics/artificial-intelligence/the-unknown-startup-that-built-googles-first-selfdriving-car

IEEE. (5. sep 2012). *Institute of Electrical and Electronics Engineers*. Hentet fra Look Ma, No Hands!: http://www.ieee.org/about/news/2012/5september_2_2012.html

Inc., H. b. (2. juni 2015). *Hound Internal Demo*. Hentet fra https://www.youtube.com/watch?v=M1ONXea0mXg

Keynes, J. M. (1931). Economic Possibilities for our Grandchildren . In J. M. Keynes, *Essays in Persuasion* (pp. 358-373). London: Macmillan, 1931 [first edition] .

Knight, W. (22. july 2015). *Google's Self-Driving-Car Chief Defends Safety Record*. Hentet fra MIT Technology Review: https://www.technologyreview.com/s/539611/googles-self-driving-car-chief-defends-safety-record/

Korosec, K. (21. december 2015). *Elon Musk Says Tesla Vehicles Will Drive Themselves in Two Years*. Hentet fra Fortune.com: http://fortune.com/2015/12/21/elon-musk-interview/

Kromann-Andersen, B. (28. 10 2014). Robots in the Hospitals. (C. o. Manager, Interviewer)

L.S. (18. April 2015). Hentet fra www.economist.com: http://www.economist.com/blogs/economist-explains/2015/04/economist-explains-17

Lavrinc, D. (16. 04 2012). *wired.com*. Hentet fra Exclusive: Google Expands Its Autonomous Fleet With Hybrid Lexus RX450h: http://www.wired.com/2012/04/google-autonomous-lexus-rx450h

Miller, J. (20. august 2014). *Self-Driving Car Technology's Benefits, Potential Risks, and Solutions*. Hentet fra theenergycollective.com: http://www.theenergycollective.com/jemillerep/464721/self-driving-car-technology-s-benefits-potential-risks-and-solutions

Myers, M. D. (2008). Positivist Research. I M. D. Myers, *Qualitative Research in Business & Management* (s. 38). SAGE Publications Ltd (3 Nov. 2008).

Passary, S. (27. december 2015). *Elon Musk: Tesla Will Have Fully Self-Driving Cars In Two Years*. Hentet fra techtimes.com: http://www.techtimes.com/articles/119527/20151227/elon-musk-tesla-will-have-fully-self-driving-cars-in-two-years.htm

Prose, P. a. (7. feb 2014). *Andrew Mcafee, "The Second Machine Age"*. Hentet fra https://www.youtube.com/watch?v=KoC63M33lvw

Sidhu, I., Sheet, L., Phillips, D., Pandit, A., Luo, J., Long, G., . . . Hudda, R. (2013). *Self Driving Cars*. Hentet fra The Coleman Fung Institute for Engineering Leadership: https://ikhlaqsidhu.files.wordpress.com/2013/06/self_driving_cars.pdf

Slosson, M. (8. maj 2012). *Google gets first self-driven car license in Nevada*. Hentet fra reuters.com: http://www.reuters.com/article/uk-usa-nevada-google-idUSLNE84701320120508

The Economic Times. (24. Juni 2011). *The Economic Times*. Hentet fra World rice output in 2011 estimated at 476 mn tonnes: FAO: http://articles.economictimes.indiatimes.com/2011-06-24/news/29698994_1_rice-production-paddy-production-rice-output

Thrun, S. (9. oktober 2010). *What we're driving at*. Hentet fra googleblog.blogspot.dk: https://googleblog.blogspot.dk/2010/10/what-were-driving-at.html

Urmson, C. (2012, august 7). *The self-driving car logs more miles on new wheels*. Retrieved from googleblog.blogspot.dk: https://googleblog.blogspot.dk/2012/08/the-self-driving-car-logs-more-miles-on.html

Urmson, C. (28. april 2014). *The latest chapter for the self-driving car: mastering city street driving*. Hentet fra googleblog.blogspot.dk: https://googleblog.blogspot.dk/2014/04/the-latest-chapter-for-self-driving-car.html

Urmson, C. (11. maj 2015). *The View from the Front Seat of the Google Self-Driving Car*. Hentet fra backchannel.com: https://medium.com/backchannel/the-view-from-the-front-seat-of-the-google-self-driving-car-46fc9f3e6088#.vsr5wtljn

Wikipedia. (3. febuar 2016). *List of mergers and acquisitions by Google*. Hentet fra wikipedia.org: (https://en.wikipedia.org/wiki/List_of_mergers_and_acquisitions_by_Google

NHTSA. (2013) U.S. Department of Transportation Press release on its Police on Automated Vehicle Development, National Highway Traffic Safety Administration. Retrieved from www.nhtsa.gov