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I dedicate this work to Vienna. A city that has profoundly changed my social discourse and enriched my life perceptions. A city that felt like home.

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1. Introduction

The idea of a fully autonomous vehicle that can drive, float or fly itself has been popular for many centuries in legends, popular culture and science fiction novels. 1880's Flying Carpet painting by Russian painter Viktor M. Vasnetsov depicts Ivan Tsarevch, one of the main protagonists of Russian folklore, coming home on a flying carpet after capturing the Firebird. However, the image of flying carpets has graced folk-tales from Russia to Iran for a thousand years before that. There are countless stories of flying carpets being portrayed as individual autonomous means of transportation. They combine two once-fantastic dreams: autonomous vehicles, and flight. Those dreams are largely accomplished today: airplane navigation relies heavily on auto-pilots and unmanned aerial vehicles (UAVs), or drones, carry out air strikes around the globe at a push of a button.

However, one deceptively modest dream has rarely ventured beyond the science fiction domain: the self-driving car. Unlike Mars rovers or planes, that are free to explore the vast emptiness of space around them, cars need to navigate the complex world of city streets, passing centimetres away from fragile, litigious human beings. Furthermore, introducing the autonomous car as an equal participants in road transportation, presents a series of profound challenges on issues of technology, ethics and legislation. Its mere existence challenges conventional notions of who or what is doing the driving and who bears the responsibility for the activity – which makes carmakers, regulators and scholars very cautious regarding the implementation of the idea.

Despite the underlying issues, things are about to change and the dream is, most likely, about to become reality. Over past decade automotive and technology industries have managed to achieve technological advancements that are aspiring to replace people in what has been considered a solely human activity: driving. This development has come about gradually and relied largely on numerous researches and introduction of new automotive technology systems over the years such as adaptive cruise control, lane departure warning and collision warning systems, GPS systems, machine to machine (M2M) interface and so forth.

Nearly every bigger car manufacturer and some technology companies like Google are investing heavily in this new technology trying to develop complex computer systems that would enable a car to operate fully autonomously and to complete multifaceted driving tasks in a predictable and safe manner. At the same time they are trying to mobilise public and political support for this new technology by making promises of future benefits that range from improved safety and efficiency to reduced carbon footprint and generated savings for the economy. Arguably, the company that has gone furthest in this endeavour is Google. After years of equipping number of different types of cars with the self-driving equipment, and lobbying (Markoff, 2010) to have them registered for regular use on public roads (so far they managed to do it in four states in the US), in 2015 Google has developed their own custom vehicle, which does not have a steering wheel nor pedals and does not require to be supervised by a human. Google's Self-Driving Car Project has also gained large coverage in the media and the legal and policy circles in the US and around the world which is why it is at the focus of this research.

Google pitches its car as a "safer, easier and more enjoyable" way to get around. Its goal is to "help prevent traffic accidents, free up people's time and reduce carbon emissions by fundamentally changing car use" (Google, 2010). Despite multiplicity of goals in the statement, safety seems to be the first priority in the project. Reducing deaths in traffic is the first reason listed in "Why the Self-driving car matters" section on Google's Self-driving car Project website (Google, 2015) and it has been widely used as a main reason that supported the project development (Google, 2010). Safety has also been a strong argument behind the need for a new law governing autonomous vehicles in the USA. The importance of the concept of safety is apparent in the California's State Senator Alex Padilla statement when he introduced the new legislation: "The vast majority of vehicle accidents are due to human error. Through the use of computers, sensors and other systems, an autonomous vehicle is capable of analysing the driving environment more quickly and operating the vehicle more safely" (Slosson, 2012).

It is evident from the above that Google believes that their vision of the future of transportation will be able to reduce the number of traffic accidents and cut the number of lives lost to those accidents by half; more than 1.2 million lives are lost every year in road traffic accidents worldwide (Rosen, 2012). The key for that achievement is the advanced technology epitomised in the shape of a self-driving car. The project seems to be in an

advanced stage (Google cars are being tested on public roads in real-life situations) and Google believes the car will be ready for broad-scale use within five years.

As things stand at the moment, there is strong enthusiasm for the new technology both from the car and technology industry and the public, but it is slowly starting to be contested. The automation of the driving process raises many safety related issues of technical, legal and ethical nature. Following the discussions on different posts on Google Self-driving Car Project Google+ account and comments on news articles about autonomous cars one can get an impression that people, in general, are really excited about the number of lives that can be saved by the potential wide-scale introduction of autonomous cars. Placing most of the blame for car accidents onto the drivers (Google claims that 94% of accidents in the U.S. involve human error) and replacing them with intelligent machines seems to be a convincing and appealing idea. However, autonomous cars will not just replace the driver, they will change the circumstances and timing of traffic conditions and will likely affect which accidents occur and therefore who gets hurt or killed. The identities of many (future) fatality victims would change with the introduction of autonomous cars. One would think that there is something deeply troubling when technology is a mediator in trading lives. And this is just one of the possible ethical problems. Substantial concerns about privacy (who will have access to any driving information these vehicles store?), security (hackers could theoretically take control of the vehicles) and wider societal implications (changing the concept of driving, complex human-machine interaction, overreliance on technology) are also on the list of challenges inherent to Google self-driving car, or any other autonomous vehicle, for that matter. A vision of such automated future is about creating a certain society that implies responsibility that goes beyond instrumental use of innovation technologies.

As with any purposive social action of such a magnitude there are unintended consequences and that is understandable. The self-driving car technology is very new and its implementation has not started yet, however the road is being paved for it. Therefore its impact on the socio-technical system of road transportation is obscured by the complexity of interactions in the system and the promises of a better future by main political, industrial and legal actors which are a part of the discourse creation. Evidently, there is inherent inconsistency in almost every social action, but what keeps the social fabric together is our tendency to adapt to, coordinate and normalise the variation. In this case it is very difficult for a society to “distinguish novel or threatening from familiar and manageable events, productively innovative from functionally destructive deviance” (Silbey, 2009, p. 360).

For the moment, academic interest in autonomous cars is limited. Partially because it is considered as an extension of the development efforts in the field of artificial intelligence and partially because it is a rather new field of inquiry and autonomous cars are not yet a reality so the academic scrutiny is still to gain momentum. There are quite a few books, reports and articles available that deal with technical capabilities of autonomous cars, potential economic benefits of their use, legal and market barriers to implementation and required policy recommendations (for further information see Lin, 2015; ENO Center for Transportation, 2013; Anderson, et al., 2014; Forrest & Konca, 2007). They provide good understanding of how this technology is imagined to work in conjunction with business and policy environment and the underlying assumptions of its perceived desirability. However, the body of literature exposing potential long-term societal implications arising from the diffusion and the impact of these newly-introduced autonomous agents on everyday human interactions is far from abundant. Furthermore, there is very little research on the mechanisms employed by innovation technology actors to support smooth and opposition-free acceptance of this technology and make sure it stays on the path worth of an innovation success story.

That is why this master thesis aims at shedding some light on the social construction of the Google self-driving car through the complex process of creating, transforming and negotiating Google's socio-technical visions of car safety and expectations of the new technology that should lavishly improve it. It will look at Google's intention to position itself as, what Hilgartner (2015) calls, a "vanguard" of technological revolution that not only brings material change in society but also constructs and changes the perception of what is imaginable. Google, as a main actor in this socio-technical change imagines a future with its self-driving car as a pillar of shift toward safer road traffic and actively works in (re)creating the attributes of that future that will, most likely, be radically different from the past it replaces. It is in the aim of this thesis to investigate how these visions of the future are raising issues concerning desirability and importance of required, and many time referred to by Google as amazing, socio-technical change through creating expectations. The importance of expectations and visions lies in the fact that both are "a special set of cognitive rules that are oriented to the future and related to action" (Geels & Raven, 2006, p. 375), since they provide guidance to the development activities and pave the path for future acceptance of the technology.

Ontologically speaking, expectations are projections of expected future state that may or may not become reality. However, the dynamics of the innovation process has a strong future-oriented component that relies upon previous development and points towards creation of new opportunities and capabilities (Borup at al., 2006). The desired technological futures are enacted through those expectations and the various routes and agencies through which they emerge. It means that despite the intrinsic uncertainty of the potential of new technologies (like the Self-driving car), their timeline of implementation or the end result of the entire venture, (which is difficult to predict) there is a mutually reinforcing interaction between all the actors on the scene that push the expectations in the direction of a self-fulfilling trajectory. In that sense, the possible acceptance of the future with the self-driving car as an everyday technology can be considered as an outcome of the co-production of people's imaginaries of automotive mobility and safety and the expected benefits of this new technology. Google's efforts to introduce and advance the visions of that future in the larger collective complements and completes this complex construct.

In order to explore the socio-technical world Google is trying to create and the methods employed in achieving that goal a multimodal discourse analysis was used in this research by subjecting to scrutiny four promotional Google Self-driving car Project videos. Opting for this type of material for the research has given me an opportunity to explore the strong persuasive character of an effective multimedia tool these promotional videos undoubtedly are. It has also provided an insight into the discourse elements used to promote ideas behind the Google self-driving car concept and get people engaged with this new product and the visions of the future of which, it should be an important part. The safety discourse is the main topic of interest and by studying the displayed visions of desirable futures, exercised appeals to technology, metaphors of progress and appeal to different emotions (from excitement to fear) in the videos I can show how this discourse is used to create expectations for the Google Self-driving car and, at the same time, realise Google's socio-technical visions of the future.

It has been proven many times that when it comes to introducing new ideas that turn the public eye and spawn (technological) revolutions, it may require a smaller group of "socio-technical vanguards" – entrepreneurs, pioneering scientists or enthusiasts – to promote their visions of the future. Google's goal with the self-driving car is to secure a vision of the future where the existing socio-technical system of road transportation is replaced with a new one that is (virtually) accident-free and poses no threat to the people and the

environment. It is a huge, paradigm-shifting step towards safer road transportation that involves replacing a human driver with an autonomous robot. This is a vision of the future that will redefine an entire socio-technical system and will have deep and wide societal implications which places Google in the driver's seat of the technological and social change. Hence, Hilgartner's (2015) notion of "socio-technical vanguards" have been used as a sensitising concept in the research as the most fitting one. The study will also address Google's efforts to elevate its imagined future above the similar multiple competing imaginaries that will provide Google with a dominant position for policy purposes to further advance their vision's penetration into the "assemblage of materiality, meaning and morality that constitutes robust forms of social life" (Jasanoff, 2015, p. 4).

Scrutinising Google's visions of recreated social order that is acceptant of its self-driving car will help identify principal underlying issues of autonomous vehicles and the related broader societal implications. The project will add qualitative insight to the issue of interaction between technology and society and will provide good source of information to support arguments to policy debates on the subject. Furthermore, it will provide more information to the body of knowledge about understanding the practiced creation of expectations for acceptance of and policies for technological development and their importance in emerging innovation systems for digital technologies. The focus of the thesis is on the expression of expectations by an innovation technology actor and (re)creating a discourse that influence the technological innovation system and current and future technological trajectories. Due to Google's media exposure, it will also contribute to increased awareness of societal, ethical, safety and privacy concerns regarding autonomous vehicles and hopefully help people make informed decisions when choosing which technologies to use.

As said before it is the goal of this thesis to explore the above matters. In order to achieve that this thesis is organized in seven chapters.

Chapter 1 provides an introduction to the overall aim of the project and the research focus. It outlines the future of the self-driving car as imagined by Google, possible issues with the concept and the adopted approach in discussing the topic through the use of STS concepts.

Chapter 2 gives an overview of the socially constructed understandings of the self-driving car that form the basis for shared assumptions about the reality of traffic safety and driving, provides insight in Google's perception of autonomous cars solely as a computer problem

and discusses the reasons behind the decision to focus the research on Google's Self-driving car.

Chapter 3 aims at presenting the research question and the underlying proposition as a starting point for the investigation that follows. The main research question refers to Google's efforts to introduce its visions of the future by providing a solution to the safety issues in road traffic in a form of a self-driving car and it was split in several sub-question to complete the discussion.

Chapter 4 describes the theoretical background and the sensitising concept used in this research. Hilgartner's "sociotechnical vanguards", Jasanoff's "socio-technical imaginaries" and the conceptions from the sociology of expectations have been used as interpretive devices and as a starting point for this qualitative study. Their purpose is to draw attention to important features of social interaction and provide guidelines for researching this novel technology in specific settings.

Chapter 5 deals with the materials chosen for the research and explains the research processes behind the writing of this thesis. The thesis relies primarily on qualitative content analysis of Google Self-driving car videos used as a tool to condense the texts (verbal and visual) through coding and make them more receptive to the multimodal discourse analysis that followed. The particular focus of the research lies with the safety discourse and related discursive elements.

Chapter 6 presents the main empirical findings of the thesis from the analysis of the four Google Self-driving car videos. It provides a particular perspective into the three main themes extracted from the corpus of rhetorical elements identified in the texts that support the safety discourse and promote Google's imaginaries of the future.

Chapter 7 summarises the main points of the analysis from the previous chapter and presents a complex picture of socio-technical discourse of safety, visions and Google's autonomous cars. Based on empirical evidence presented in the earlier chapters the construction of the Google Self-driving car as a solution to traffic safety issues is scrutinised and critiqued.

2. Social construction of the self-driving car

In order to understand the imaginaries and expectations of the future of self-driving cars it is important we discuss the development of the safety discourse in road traffic and the historical background of the autonomous vehicles. It is important to understand the details of how the technology has developed and grown and what visions of the future were guiding the development process. It will also provide us with some context about the issues of how that process promoted and inhibited sociotechnical change and what makes this new, once unimaginable, technology imaginable and plausible (Hilgartner, 2015). In the last sub-chapter I will reflect briefly on my decision to focus my research on Google self-driving car and explain the reasons behind it.

2.1 The story of road traffic safety

Motor vehicles are inherently dangerous technological artefacts and yet relatively unsupervised in their use. Navigating them through traffic requires high degree of motor coordination, sound judgment and a certain level of skills. Yet, driving a car is not an activity that has been bestowed to highly trained and accredited professionals like in the case of planes, trains or ships. It is a routine, everyday activity of most over-eighteen adults. It decreases the transportation time significantly and brings great ease and convenience in life. However, there is a flip side to the story. Risks inherent in this socio-technical system resulted in an estimated 1.24 million deaths worldwide in 2010 (WHO, 2013). However, despite their obvious aggregate impact, in the 2007 Global Report on human settlements traffic accidents were included in the group of small-scale hazards (UNHSP, 2007). That means they affect only individuals, families, or households unlike large-scale hazards that affect entire communities or groups at a larger scale and, as a result, get disproportionate attention. The same report advices use of targeted polices and interventions in order to prevent and/or minimise traffic accidents and admits that this issue has been neglected and underemphasised.

Reason (1999) argues that “safety is defined and measured more by its absence than by its presence” (p. 4). We are safe when there are no accidents. Therefore, in order to reduce the accidents we try to minimise the risks associated with them. Physical risks are inseparable

part of human existence. But the kinds of risk people are exposed to in everyday life, how they distinguish between acceptable and unacceptable risk and the options available to them in order to avoid or minimise those risks have changed significantly over the centuries. Also, new ways of knowing the risks and expertise available today for their mitigation play significant role in the ways risks are assessed and managed. Risk of fatalities and injuries on the road arises out of the developmental processes of modernisation and, according to Beck (1992), falls in the category of socially manufactured rather than naturally produced risks.

Indeed, road transportation is a massive socio-technical system that had developed from a technological catering of a social need. It is a system in which, the social element is open to, and interacting with, its physical environment. This interaction allows for an internal dynamics that makes possible for such systems to acquire new properties and transform gradually resulting in emergent characteristics and evolutionary developments (Burns & Machado, Technology, Complexity and Risk: Social Systems Analysis of Risky Socio-Technical Systems and the likelehood of Accidents, 2009). In the case of road traffic, the car, as a technical object and the road infrastructure define a framework of (inter)action with the human actor that blurs the boundary between the social and the technical. In this interaction humans are de-scripting the inscribed standards and values in the physical environment (Akrich, 1992). On the other hand, they are recognised as moral agents that shape, reshape and implement normative and other moral rules. They poses intentionality which gives them a freedom to make a choice to deviate, oppose or act in different and new ways relative to the norms, values and physical structures of the particular socio-technical system of which they are a part (Burns, 2006). However, the scope and extent of users' interpretations of the "script" of road traffic depends largely on the vision(s) of the designers of cars and road infrastructure, which sets constrains upon humans' likely future actions (Akrich, 1992; Woolgar, 1990). As we can see, it is the human that, intentionally or not, sometimes deviates from the "prescribed" protocols of navigating roads and city streets behind a wheel of a car – a passive instrument of transportation – which, Google and other car manufacturers believe, can be much more.

Traffic accidents are one of the unintended consequences of the complex interactions between technological systems and human beings where humans perceive, reason, make decisions, and take actions in relation to their technological environment in a way that jeopardise their physical integrity. The lack of a favourable stabilisation of this human-machine interaction lead, in the early 19 century, to development of the idea of accident

proneness: the tendency of a particular person to have more accidents than most people. This designation, created a shift in social strategy toward minimising accidents by diverting particular people away from dangerous environments. It is worth noting that in the late 20th century the concept of accident proneness started to fade away and gave way to experts' and policymakers' efforts to engineer safety for everyone by providing technological fixes which gave rise to hidden, but radical, egalitarianism (Burnham, 2009).

As it is mostly the case with new technologies, the early adopters of cars were the wealthy that used it for leisure activities, mostly sport. Sometimes, the car owners had caused accidents and crashed into people on the streets. It was popular opinion at that time that there was a causal link between recklessness and accidents which gave rise to the idea (and the need) of reforming the individual drivers. With the increase of traffic through the years, the car became more commonplace and it became apparent that quality of the vehicle itself and the road infrastructure played a significant role in accident causation which resulted in development of traffic control and road design as safety interventions (McAndrews, 2010). Despite this, the focus on driving behaviour never waned. Albert (1997) argues that progressive reformers believed motorization reflected an underlying chaos in modern society and the remedy for poor driving behaviour, and resulting chaos, was two-fold – create and enforce laws focusing on behaviour and educate and train people before granting them access to the transportation system. This system created a link between driving and citizenship, where good drivers are also good citizens (Albert, 1997; Packer, 2008). This is an important relationship since it embeds the idea of accident free driving deep in the milieu of socially desirable values which, in consequence, assumes a very normative and linear causal link to issues of road safety.

2.2 Self-driving car – A computer problem

Unlike other issues of road safety (use of mobile phone in the car, drinking and driving…), acted upon by public officials and other agencies, that are targeted towards correcting specific human activities, Google's self-driving car attempts to achieve better road traffic safety by taking human activity completely out of the picture and replacing the source of the risk – the human – with an autonomous robot. Safety has been of outmost importance in vehicle development in the past decades and autonomous vehicles are believed to improve the good record even further. The statistics in the US show that human has been a primary factor in car accidents in 94% of cases and this is the number that developers of autonomous cars are hoping to change.

The first recorded worthy attempt to build an autonomous vehicle was in 1977. The project research was carried out in Japan and the car was able to reach the speed of around 30 km/h following white markers on the road. It is believed that the first significant development in the field of autonomous vehicles was achieved by Ernst Dickmann's team in 1980's – their prototype was able to achieve 96 km/h on the roads without traffic and the demonstration went without any problems (Forrest & Konca, 2007). However, it was not before the 2005 DARPA Grand Challenge that comprehensive work on designing a real-world capable autonomous car has begun, which set the foundations of the Google Self-Driving Car Project. The robotic vehicle designed by Sebastian Thrun (founder of Google Self-Driving Car Project) and his team won the challenge and set the path for possible commercialisation of the idea of autonomous cars.

First Google Self-Driving Cars were heavily modified passenger cars that drove by themselves. They used numerous sensors, advanced software and lots of hardware modifications to "ordinary" passenger cars that helped them navigate different types of roads and environmental contexts with almost no direct human intervention. At all times there are so called "safety drivers" present in the vehicle to take over the control of the vehicle manually if the situation dictates. However, Google has decided to develop its own car (it was presented in May 2014) from the ground up after it has faced numerous limitations by adapting cars that were not meant for self-driving (Google, 2014).

Google's self-driving car is a technical artefact which development has come about gradually and relied on numerous researches and the introduction of new automotive technology systems over the years such as adaptive cruise control, lane departure warning and collision warning systems, GPS systems, machine to machine (M2M) interface and so forth. From an engineering point of view it is a robot that acts in a context previously reserved for humans. In a sense, in this context humans are being replaced by robots. However, given the fact that this is a relatively new field of technological application, the question of whether humans can be replaced in specific scope of action is formulated very generally and is still being a central issue of an interdisciplinary technology assessment (Christaller, et al., 2001). Decker (2007) proposes three levels of autonomous system differentiations in terms of the ability to transfer the concept of autonomy to other research contexts of artificial intelligence and robotics – technical, personal and ideal autonomy. According to this taxonomy the autonomous cars are comparable with the second-level autonomy which basically denotes "the ability of persons to spontaneously adopt attitudes and carry out actions which are in

principle not predictable. Personal autonomy takes place in the form of actions in the sphere of reasons. These do not have to be determined morally or, in a narrower sense, rationally" (Decker, 2007, p. 317). He also argues that replaceability should be evaluated in terms of means-ends in order to address the issue of responsibility. Indeed, justification of delegating a task of driving to an autonomous robot is a way of withdrawing from moral and legal responsibilities of presence that could lead to establishing unbalanced relation of power between the various actors in this socio-technical system. In reality, Google's self-driving car will not just replace the "imperfect human", it will change the circumstances and timing of traffic conditions and will likely affect which accidents occur and therefore who gets hurt or killed. Latour (1996) and Callon (1987) maintain that the construction of such technology always involve creation of networks of human and non-human interactions that results in realisation of the designer's goal (Wetmore, 2004). It means that safety technologies, like the self-driving car, need to be promoted, developed, and maintained by networks of organizations, individuals, and other technologies. That in turn necessitated the allocation and reallocation of responsibilities throughout these networks.

However, the approach taken in solving the inherent hazards of road traffic is, it seems, purely engineering in nature. In his interview for one of the Google's Self-Driving Cars Project promotional videos, Chris Urmston (Project Director) says that the work on the project began when they started thinking about "the fact that self-driving cars is really a computer science problem" (Google, 2014). It suggests that the issue of driving has been treated as a complex engineering system by eliminating, to a various degree, diverse non-technical elements, such as social, political, economic and institutional ones. Despite the claimed wider societal benefits the development of the Google self-driving car seems to follow a developmental path of stand-alone technical artefact that is quite linear in its perceived impact on society without taking into account the functioning of social (legal, institutional, economic) elements and the behaviour of various actors. In order to explain this "narrow" perspective Simon (1996) argues that the science of the artificial closely resembles the science of engineering because engineering deals with the synthesis of things. Unlike scientists, engineers and, in particular, designers are concerned with how things ought to be in order to attain goals and fulfil a purpose. Characterising the technical artefacts in terms of "goals and purpose" (Simon, 1996) and "functions" (Kroes at al., 2006) is one of their striking features. Simon considers technical artefact to be "a kind of interface between an inner environment, the substance and organization of the artefact itself, and an outer environment, the surroundings in which it operates" (p.6). So, the idea that the

function of technical artefacts can be understood or transformed by looking only at their physical make-up is rather flawed and its applicability should be contested, at best.

2.3 Why Google?

This seems a legitimate question since there are other manufacturers like Mercedes-Benz, Audi, Chrysler and others (some of which have been building cars for over a century) and some other automotive technology and electronics companies like Delphi Automotive and Bosch who are in the advanced stages of their autonomous car development and testing. And yet, the interest of this research lays with Google, the least automotive company of all. There are good reasons for this and they will be explained further down.

Google is an American multinational technology company founded in 1998 that specialised in Internet-related services and products. These include online advertising technologies, search, cloud-computing, software and advanced technology products, some of which are not marketed yet. Due to its rapid growth, since 2001, Google has acquired a number of companies, primarily small venture capital-funded firms. In 2014 alone, Google has already made upward of 20 acquisitions. The reason behind it is constant search for new ideas for development and innovation, their integration in the existing Google services and the potential of opening new markets. According to Business Insider (2014), Google CEO, Larry Page, is interested in usefulness and long-term investment potential and benefits hence its activities are largely oriented towards the future.

We should bear in mind that Google is in essence an information company. Hundred millions of people use Google services every day. Its search engine deal with over 3.5 billion queries every day and its 3 million servers all around the world process over 100 petabytes (100,000,000 gigabytes) for the same amount of time (Amin, 2013). As Megan Rose Dickey (2014) pointed out in her article for Business Insider “Google has the largest search engine in the world, biggest video platform (YouTube), biggest web browser (Chrome), most-used email service (Gmail,) and the largest mobile operating system (Android)”. On top of it, Google is finding more and more ways to integrate itself into nearly every aspect of our lives. Google's moonshot projects — like self-driving cars and Google Glass— in addition to the advertised benefits, will also help Google's quest in becoming a (virtually) total knowledge company. Its goal with all these products and services is never a niche market; it's always the entire world and the way we live our lives. The potential combination of globalization and

digitalisation, a unique occurrence in economic history, makes Google's objectives very realistic (Schulz, 2015).

To understand this, we must take a look at the wider environment around Google. It is located in the Silicon Valley, an innovation and technology hub, which is in essence a network based industrial system organised in a way to adapt rapidly to continuously changing markets and technologies (Koepp, 2002). It allows the actors in the network the needed flexibility to pursue multiple technical and technological opportunities that facilitates entrepreneurship and innovation that keeps companies alert at all time. The only way to do that and to try and maintain company's existence is to dig deeper in the future and seize every feasible opportunity. In the world of Silicon Valley innovation is not just central to long-term economic growth but also crucial for survival of the company. Secondly, and equally important, is the shared culture that goes deep among the companies in the Silicon Valley and has proportions of a religion. There is a strong collective believe among the people from the valley that the technology can greatly benefit humanity and that high-tech solutions will be responsible for a better future for all of us and that it is the only way to go forward (Schulz, 2015). Novel visions of the future are readily accepted and further developed. This discourse of technological determinism is being constructed jointly by an ensemble of different actors and storylines in the political realm of the Silicon Valley and the wider collective of the USA, something that Hajer (1993) refers to as a "discourse coalition". It is interesting to observe the interconnectedness between different actors in the valley since there, the Schumpeterian concept of enterprise encompasses both, commercial enterprises and those of government, academia and other types of organised activity. That creates enough open space for vanguard visions to interplay with well-established and institutionalised imaginaries and "refresh, morph, refocus and perhaps subtly challenge" the foundations they lay on (Hilgartner, 2015).

The connection with the academia, especially with Stanford University, located in the Valley (Carnegie Mellon University (CMU), also has a branch), in the case of Google self-driving car is particularly strong. Sebastian Thrun, the founder of the Google Self-driving Car Project, was a research engineer at CMU and a head of the Stanford team that won the 2005 DARPA Grand Challenge with its robotic vehicle. He was later an associate professor at Stanford University from 2007-2011. The Director of the Google Self-driving Car Project, Chris Urmson, holds a PhD from CMU and is also an associate professor at CMU. Larry Page, the founder of Google has also graduated from Stanford University.

This connection between Google and Stanford University is so strong that, the university in its 2011 Report described it as the “Silicon Valley's most mutually beneficial relationships between academia and industry” (Stanford University, 2011, p. 11). The company's extensive scope of activities have created new opportunities for interaction with Stanford University and students. According to Stanford records, over the last decade, Google has provided support for more than 40 projects at the University. The technology areas covered range from internet commerce to development of mobile systems and other interest stretch into the domain of social sciences (Orenstein, 2011). This physical and conceptual vicinity helps evening out possible contradictions and conflicting visions – between technological vanguards like Google and the more collectively shared imaginaries – at the knowledge production level and thus create local, inclusive perspective of the future.

Interestingly, this feeling of control over future events and the notion that the future is not merely imagined but can also be made makes the technological giants of the Silicon Valley overly confident in their ambitions that borderlines with arrogance. In his interview for the German newspaper Spiegel, Sebastian Thrun said: "I would like to change society and I asked myself how I could maximize my positive influence on the world" (Schulz, 2015). According to the same source, long ago, Thrun put together a list of 20 areas where he could change peoples’ lives. At the very top of the list was his desire to improve traffic safety. Apparently, the creation of the Google self-driving car has taken care of that item, leaving 19 more to go.

Hence, to sum it up, the aim of this thesis is to explore the visions and the construction of the social world that should embrace a personal robotic mobility vehicle without a human behind the steering wheel. Placing the focus on Google and its self-driving car will provide this research with interesting aspects of Google’s vanguard visions of the future and its interaction with the collectively held socio-technical imaginaries of mobility. The decisions it makes regarding, and expectations it creates from this new technology have consequences extending very far beyond current circumstances. Google’s strong believe in technology as a cure for all societal ills and its powerful influence over knowledge production and re-imagining of the world we live in are at the very core of the STS enquiry. It is a company that is well established as a technology and innovation giant, has great exposure in the public and their self-driving car seems way ahead of other similar projects in terms of how radical are the changes proposed to the established socio-technical system of road transportation.

Scrutinising Google’s visions of recreated social order that is free of traffic accidents and, at the same time, acceptant of its self-driving car will help in identifying principal underlying

issues of autonomous vehicles and the related interplay between technology, expectations and visions of the future. The project will add qualitative insight to the issue of interaction between technology and society and will provide good source of information to support arguments to policy debates on different topics pertinent to discourse analysis, deconstruction of corporate communication strategies, socio-technical imaginaries and the importance of expectations. Due to Google's media exposure, it will, assumedly, contribute to increased awareness about the mechanism of initial expectations which produce and establish meanings about a technology in a context of imagined future, through the exposure of the discursive topography surrounding the safety of the self-driving car.

3. Research question and hypothesis

In a general sense, the aim of this thesis is to develop an understanding of how traffic safety issues are being discussed, portrayed and compared in present and future context, as well as to argue that socio-technical visions in relation with Google Self-driving car aim at creating a narrative of expectations for the future of autonomous vehicles as a safer and, by and large, better means of transportation that is worthy of large-scale implementation. Detailed understanding of the used discursive elements in the Google's videos that point out to a better future through the use of a Self-driving car and the displayed predictions of smooth social adoption of this new technology give crucial information about many aspects of Google's visions of the future world (they think) we like to live in.

As pointed out before, the specific focus of this study is the analysis of several (four, to be specific) Google Self-driving car promotional videos to be scrutinised in the context of car safety and expectations created for the future with self-driving cars. In light of this, the research addresses the following question:

How is a discourse of safety used to create expectations for the Google self-driving car as an embodiment of Google's socio-technical visions of the future?

Put differently, this thesis explores the intention of creating expectations about the Google self-driving car in order to gain support for the novel visions of the future that the self-driving car will help achieve. The study will also investigate the noticeable interconnectedness between Google's visions, considerable application of technology in the self-driving car concept, and wider societal imaginaries of road traffic and technology in liberal-democratic societies and expectations surrounding the notion of road traffic safety. In order to answer this question, during the course of the research I will answer a few other questions:

1. *What is the role of technology in these visions of the future of road traffic safety?*

   This question points to the arguments presented in the videos to use technology as a solution for human driving errors. The answer to this question will shed more light on the function(s) this technology serves and what instruments are employed to secure social acceptance, how it reflects our human aspirations about better-quality

life and how it relates to our understanding of a desirable future attained through technological progress.

2. *What are Google's novel visions of road traffic safety and how does it relate to the wider socio-technical imaginaries of road traffic in Western democracies?*

   Building on the previous issue, the answer to this question will explore the attributes and the wide ranging implications of Google's vanguard visions of creations of technology that by intervening in present realities create future realities. Also, it will call attention to the important intersection of the company's ventures beyond the limits of present reality with collectively held imaginaries of technology driven futures that are crucial to the transformation of the former into socio-technical imaginaries held by larger collectives.

3. *How are expectation created and what function do they serve in Google's narrative of the self-driving car?*

   Reaching to the STS branch of Sociology of Expectations and coupling it with wider understanding of different appeals to emotions will provide the answer to this question which, in turn will offer an insight to an interpretation to the dynamics of expectation and their (sometimes) decisive impact on the pace and direction of innovation processes. Exploring this issue will further assist the research in identifying the features of expectations and their assumed coordination potential at various levels of networking between wider actors and groups in the society. We can also see if embedding them in the narrative of the self-driving car actually helps occupy the social space surrounding the technology and what are the potential benefits.

These sub-questions are thought-provoking in their own right but in this research they will be put in a context of the main research question in order to help me answer it. The following chapters will provide the necessary theoretical background and a set of empirical findings to support the achievement of a sound and comprehensive resolution to above issues.

4. Theory and sensitising concepts

The evocative idea of "sensitising concept" was introduced by Herbert Blumer (1954) over fifty years ago. According to Blumer this concept emerges when the researcher discovers something worth problematizing and addresses the concept to the objects of investigation thus producing precise and accurate evidence of chosen phenomena. The idea is to use exploration and investigation techniques as tools in order to "attach" theoretical concepts to the events in the empirical world that serve as guidelines for the research.

Following the above assertion the theoretical basis for this thesis can be summarised through three broader concepts. The first theoretical framework is the socio-technical vanguards and their advancing vanguard visions. It is a concept used by Hilgartner (2015) to explore different aspects of evolving vanguard visions and their co-production of a new socio-technical order in the field of synthetic biology. However, it is strikingly fitting to this research to investigate how Google, as a relatively small collective, acts intentionally to promote and induce acceptance of its sociotechnical visions of future transportation by a wider population. The second concept, very much related to the first one is based Jasanoff's (2015) theory of socio-technical imaginaries that are defined as a "collectively held, institutionally stabilised and publicly performed visions of desirable futures" (p. 6) that are attainable through science and technology. Last, the sociology of expectations, as a field in STS that provides particular perspectives about the role of expectations in the context of science and technological innovation, is used to understand how and if self-driving cars will flourish into a mainstream day-to-day personal transportation pods, replacing the ordinary car in the road transportation system. All three concepts will be briefly described further below.

4.1 Socio-technical vanguards & vanguard visions

As said before, socio-technical vanguards is a designation for a group of people that share particular socio-technical visions of the future and are actively involved in promoting them. Hilgartner sees them as members of the avant-garde that assume leadership and visionary roles that publicise themselves as collectives that "possess superior knowledge of emerging technologies and aspire to realise their desired potential" (Hilgartner, 2015, p. 34).

This seems like a quite fitting concept to use in relation to Google and its self-driving car. It is a huge technology corporation that is very proud of its research and development portfolio

and shares its location with similar-minded companies at the heart of the Silicon Valley. Google operates in many areas of techno-science (Google Self-driving Car Project, Google Human Body Project, Google Glass, Google Robotics Projects…) where future, very different from the time and place we inhabit now, is being created and its properties constituted. Many of these projects, have the potential to revolutionise certain areas of human life leading to unavoidable social changes. The innovations they foster strive from sociotechnical visions that develop and are re-created in a dynamic environment where proponents of certain visions encounter with other actors with different or similar goals and interact with established collective imaginations and visions of the future (Jasanoff, 2015).

Projects like this position innovation companies at the vanguard of a revolution, ushering material change in society and at the same time promoting and inhibiting social change. They act intentionally to promote and induce acceptance of their sociotechnical visions of the future by a wider population. In the world of emerging technology and in the context of technological and scientific innovation there are multiple vanguards with (mostly partially) overlapping visions that are trying to push their sociotechnical visions. Most often, they share a strong dedication and commitment for realizing a techno-scientific innovation, related to a specific societal challenge. This is mostly true in knowledge-intense contexts (like the one being scrutinised in this research) where knowledge workers are united by a shared set of normative and principled beliefs and practices. If we follow Hilgartner's reasoning that "the visions of the few are integrated into the imaginations of the many" (2015, p. 35) we can see that shared images of the future within a certain "epistemic community" (Haas, 1992) are embedded in a wider network of actors that allows for more heterogeneity and porosity. This type of environment stimulates reshaping of the original ideas that get subtly adjusted or radically changed by the ongoing process of aligning the views of the best way to advance a certain technology field.

In this flexible, contested and ambiguous environment it is oftentimes the case that a vision poses a turn from the public's comfort zone. In order to prevent opposition and to make dramatic visions appealing, sociotechnical vanguards tend to use metaphors and free-riding on the success of previous technologies. As Hilgartner (2015) points out societies will much easier imagine future technologies using past experiences as templates and the approach most often taken by vanguards is to make them using the vocabulary and institutional instruments that are currently in place. Irrespective of the fact that appeal to emotions, metaphors and use of narratives of past technological success are terminologies and

concepts that most often borrow from the past and present, the epicentre of a sociotechnical vision is the future. The application of interdiscursivity and the use of interlinked templates by the vanguards to promote their visions of the future that tap into plausible instances of replicated success are, apparently, most effective on a new terrain.

4.2 Socio-technical imaginaries

Sociotechnical imaginaries is a theoretical concept that is applied in this research because it inform visions of futures of larger collectives in which sociotechnical assemblages play an important role. Kim and Jasanoff (2009) describe sociotechnical imaginaries as "collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects" (p. 120). Jasanoff (2015) refines and extends this idea further to be inclusive of other non-national collectives and organised groups such as corporations, social movements, and professional societies that have the power to drive technological visions into different aspects of social life. Taking the above into consideration, socio-technical imaginaries are defined as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff, 2015).

As suggested, an imaginary describes the visions, symbols and associated feelings that people have about something. In this instance, the imagination does not just live in an individual's mind, but is shared among individuals in the society and helps to produce systems of meaning and guides how we collectively see and order the world in its histories as much as its futures. According to Taylor (2004) imagination is an organised field of social practice and a key ingredient in making social order that influence behaviour, feelings of individual and collective identity, and the development of narratives, policy and institutions.

It is important to make a distinction between the vanguard visions coming from relatively small groups and the sociotechnical imaginaries as described by Jasanoff. As said, the later are institutionally stabilised, have relatively long histories and exhibit greater stability than often confusing, inconsistent and short-lived visions of self-proclaimed sociotechnical vanguards. However, the collectively held, sociotechnical imaginaries can sometimes originate from vanguard visions through exercises of power or sustained acts of coalition building but the status of imaginary is only granted after the vanguard vision becomes communally adopted (Jasanoff, 2015).

The significance of the theory of socio-technical imaginaries for this research lies in its capability to provide a means to better analyse and understand how non-scientific actors and institutions receive and promote certain scientific and technological projects and agendas. Scientists and technologists are "constantly trying to understand the present by borrowing from a cautiously imagined emergent future, filled with volatility, and uncertainty, but in which faith in practices of techno-science become even more complexly and interestingly constructed" (Marcus, 1995, p. 4). The imaginaries fill in the cognitive gap and the tensions between the often conflicting visions of future being promoted by political actors and innovation and technology companies like Google. By promoting their techno-scientific visions they reinforce their position as visionary leaders and, at the same time, fuel the confidence and trust in scientific practices that shape the social milieu through technological means. These perspectives then inform and, more importantly, are used to justify the views and actions of individuals working in these areas, shaping new scientific fields in the process. Policy makers are no strangers to the field either. They also draw on imaginaries to inform and justify their actions, especially when it comes to new investments in science and technology, which in turn reaffirm the state's capacity to act as responsible stewards of the public good. In this respect, sociotechnical imaginaries serve both as the ends of policy and as instruments of legitimation.

In relation to this research the use of this concept helped in understanding how Google's visions and resultant research and development process interact with these imaginaries by influencing expectations, impacting technological and scientific discourse and creating believable futures with self-driving cars as an everyday object. The theoretical framework of socio-technical imaginaries allowed for a critical investigation of the co-evolution of self-driving car technology and the (co-)created discourse of safety that accounts for the relative expectations and the real (or manufactured) social demands for this artefact.

4.3 Sociology of expectations

The concept of expectations has been attracting growing interest in science and technology studies in recent years. Expectations are an important feature of modern societies and part of this research mainly for their "constitutive" or "performative" powers (Borup et al., 2006). They are much more complex and go deeper than either simple role expectations or cognitive estimates of future happenings. If we follow Borup et al. (2006), they describe technological expectations as "real-time representations of future technological situations and capabilities" (p. 286). Expectations' performativity plays an important role in

determining the direction of technological change and the rate at which innovations are adopted. In their classic paper on sociology of expectations, Nick Brown and Mike Michael (2003) argue that expectations regarding the promise and feasibility of emerging technologies vary according to the relative position of an actor to the production of knowledge, and how established a field of innovation is. This further includes factors such as the stability of relations between actors (regulatory, economic, scientific, public…) and activities (regulatory frameworks, market readiness, funding structures, research agendas, etc.).

There are several important aspects of expectations that are of interest of science and technology studies. First, positive expectations help to attract actors and funding to emerging innovations and to align their interests and activities which makes it good coordination mechanism for actors and activities (Konrad, 2006). Second, these processes of alignment and coordination of expectations can create a protective niche around a technology which makes the technology more likely to be positively evaluated, hence often creating legitimacy for its diffusion (Brown & Michael, 2003). Third, expectations play an important role in mobilising resources for the new technology and when/if sufficiently shared they tend to reduce the uncertainty perceived by technology developers and thereby guide the process of technological change (Borup et al., 2006). Expectations thus play a critical role in attracting actors to the technological innovation system, mobilise resources and gain support from the wider population. These collective expectations or visions of future possibilities of techno-science are closely related to the concept of sociotechnical imaginaries discussed above.

In the context of this study, it is worth noting that research has shown actors close to the innovation process (developers, scientists and engineers), in private, tend to be cautious about the promises of a technology, while when acting from a position of a technological visionaries (individual or group) they tend to promote more optimistic expectations which can be essential for the framing of lay-expert interactions. Optimally, expectations can self-reflexively create trends by being themselves predictive in the first place. As Borup et al. (2006) note, “Expectations are both the cause and consequence of material scientific and technological activity” (p. 286). In this sense, expectations of Google Self-driving Car create the dynamics of the future market which is crucial for the new technology to gain momentum. Optimistic expectations can rapidly increase share values while Google, in essence, is not bound to fulfil promises, hence the incentive to produce hyperbolic

expectations (at no cost). Hence, Brown and Michael's (2003) term the "entrepreneurial techno-scientist" can, at the same time, express uncertainty in private and encourage inflated expectations in order to (in the case of Google Self-driving Car) attract support and legitimise de-regulation of the autonomous car market.

The above-discussed temporal variabilities in expectations create a complex network of variations and unpredictabilities that has been simplified and linearized in order to provide convenient interpretations of socio-technical change. One such tool for discerning the hype from viability of new technology when companies are making bold promises is the Gartner Hype Cycle. It provides a graphic representation of the maturity and adoption of technologies and applications, and show their potential relevance to solving real societal/business problems and exploiting new opportunities.

In August 2015 Gartner Inc. has placed the autonomous vehicles at the top of the hype peak (which is when (often inflated) expectations for certain nascent technology are producing results and many companies are joining the hype) with the following explanation:

> *"While autonomous vehicles are still embryonic, this movement still represents a significant advancement, with all major automotive companies putting autonomous vehicles on their near-term roadmaps. Similarly, the growing momentum (from post-trigger to pre-peak) in connected-home solutions has introduced entirely new solutions and platforms enabled by new technology providers and existing manufacturers".*
>
> (Gartner, Inc., 2015)

Peak hype is defined by a technology that is almost—but not quite—technologically viable but not yet commercially available. Tech Insider (2015) reports that just a year ago, autonomous vehicles were still in the pre-peak stage on Gartner's hype chart. And while the technology is still in its early (or as Gartner put it, "embryonic") stage it's move forward in the cycle is significant. The "Peak of Inflated Expectations" generally means that Gartner thinks a technology is at least two to ten years from the "Plateau of Productivity" (Loeb, 2015).

Figure 1: Gartner Hype Cycle

Source: Gartner, 2015

This research fully agrees with Borup at al. (2006) critical position on the hype cycle for being highly simplistic and linear representation of technology's path dependency that fails to provide account for the constant adjustment and reconfiguration of the technology artefacts during development and use. However, in order to understand the modes of creating expectations and promoting visions of the future one must understand the templates and pre-assumed innovation technology processes the innovation companies uphold to.

5. Method & materials

Before presenting the analytical findings it is necessary to provide some observations about the choice of materials and the methods used for the analysis. Appropriate and comprehensive materials for data analysis and a sound methodological approach are essential requirements for a good research and contribute greatly to achieving the set goals of the thesis. For this study, apart from the arguments presented above, the reasons for selecting video materials – and corresponding methodology – as a starting point for the analysis, take into consideration the context of the project – namely, the foreseen timeframe and availability of resources. Doing interviews with management and researchers at Google was not a realistic plan and while there is a fairly large amount of articles on the Internet about Google self-driving car to provide solid basis for document analysis the videos still present the most immediate and comprehensive picture of Google's imaginaries of road traffic safety and its visions of future of mobility.

Furthermore, one should consider the reasons why Google has decided to promote such a ground-breaking vision of the future through a series of videos. Through a video, viewers get to see all the unique features of a product that pictures and text cannot easily explain. According to marketers, promotional videos add depth, show the product in a more natural setting, and demonstrate how it actually works and the combination of seeing and hearing encourages trust and loyalty and gives the business a bit of personality (Hall, 2011). Having covered all the main aspects of a good promotion, the Google Self-driving car videos offer multi-sensory stimulation that make the information contained easier to digest. This particular communication borderlines between educating the public about car safety and promoting Google's products and services. In that way consumers associate positive feelings about changes for the better with the business (Google) and the product (Self-driving car) which makes a memorable experience and a highly persuasive tool for conveying radical and innovative socio-technical visions.

Hence, a video analysis seemed a legitimate and accessible method to study Google's use of the safety discourse in creating expectations from this new technology and promoting their active role in shaping the future, which is the focus of this research.

5.1 Materials

The four videos analysed in this paper were part of the seven videos (there were six when I started the analysis and the seventh video was published on YouTube on 15 May 2015 and a link added to the Google+ page) posted on Google's Self-driving car Project page on Google+, which, until recently, was the main access point to the information regarding the project. However, in the course of writing this thesis, Google has decided to have a separate web site dedicated to the project and now it is also the first result when you search for a "self-driving car project" on Google, which clearly shows the intention to redirect internet traffic to the newly designed page. The new web site has completely revised design (http://www.google.com/selfdrivingcar/) and some of the videos are not directly available. The two videos that are available are located under different themes that focus on the attributes of the Google's proprietary prototype vehicle. Nevertheless, despite this slight inconvenience in terms of conceptual significance where the videos analysed are no longer part of the main communication channel, they can still be accessed on the Google+ project's page - https://plus.google.com/+SelfDrivingCar/videos and they are a valuable resource for qualitative exploration of visions of future mobility inherent to the Self-Driving Car Project. The project describes itself as a "moonshot factory for working on sci-fi sounding solutions to really big problems in the world" with a main goal to "improve people's lives by making it safer, easier, and more enjoyable to get around". The Google+ page is used as a public relations tool for promoting the project, providing information about the progress and updates and interaction with the public. The page has more than 28,000 followers and over 9.3 million views at the time of writing (February, 2016).

In order to shape public awareness of this new product and to present its features and anticipated benefits to the society at large, Google has organised the videos around multiple themes pertinent to the Self-Driving Car Project – from the initial idea, through the development, to the production of the prototype vehicle. In the videos, Google team members present the important aspects of the project in relation to real-life situations, talk about the efforts involved in its realisation and (in the "First drive" video) present the self-driving car to potential consumer groups and capture their reactions and attitudes towards this new concept of driving and traffic issues in general. The videos, it appears, aside from seemingly informal and laid-back atmosphere being presented, all follow a well thought out structure supported with a clear narrative and reinforced by well-chosen audio-visual elements. In the remainder of this sub-chapter I will give a brief synopsis of the four videos

being analysed as part of this project. It will provide some flavour of the analysis that follows.

1. Behind the Google Self Driving Car Project (3:26 min)

The main protagonist, Chris Urmson, Director of Google Self-driving car Project, provides on/off camera narrative throughout the duration of the video. It starts with introduction of the merits of transportation (covering great distances, freedom of movement) followed by presentation of facts about the price we pay for it (deaths on the road, congestion) and immediate identification of the problem *("ninety plus percent of it is human error"*). Then a solution to the problem is presented in a form of technology that is a *huge opportunity* and should not be missed. This statement is backed up by a short history of the development of Google self-driving car project which is presented as a collective endeavour of a group of enthusiasts with great focus and dedication to their work. Main attributes of the Google self-driving car are presented with emphasis on *naturality* of the car's behaviour and its linear connection with safety (*"when it's natural – it's safe"*). The video ends with a futuristic view of "transformed" city presented with obvious enthusiasm.

2. Why design a self-driving vehicle from the ground up? (2:15 min)

In this video, Jaime Waydo, Systems Engineer on Google Self-driving Car Project, also provides on/off camera narrative and explains the limitations the Google team is facing when dealing with the constraints of existing vehicles. That is why they started thinking about designing their own *"custom build vehicle for self-driving"*. This vehicle was designed with sensors and their placement in mind that required a specifically shaped vehicle to allow for optimised field of view that will again provide a linear link to safety and make the car "as safe as possible". Other technological advancement are also presented in this video (proprietary hardware and software and redundant breaking and steering systems) together with their importance ("it's really the software that makes the car self-driving") supported by the claim of achieving perfect optimisation between various elements (data from the sensors, software and hardware). Safety is also mentioned as something that is learned by the team (collaborative effort) in order to push the technological development forward in a shape of a vehicle that is also, in her words, "nice to look at".

3. A First Drive (2:53 min)

In the opening scenes of this video an unnamed member of the Google team greets a group of people, on what resembles a large parking lot, for their first ride in the Google Self-driving

Car. The appearance of the car is followed by facial expressions and sighs of excitement and admiration and comments like “isn’t it cute?” as people of different age/social groups (senior couples, mother with a child, girl with her dog, visually impaired person) gather around the car and wait their turn to take a ride in it on a closed circuit. Different scenes of people enjoying the ride change as Chris Urmson, Director of Google Self-driving car Project, provides on/off camera explanation of the efforts put in developing the car. The success of those efforts is depicted in several scenes where these new passengers praise the attributes of the car (“it knows when it needs to stop, it knows when it needs to go” and “it rides better than my old car”). They appreciated the engineering of the car and the “human touch” in it that makes them feel safe. Chris Urmson wraps up the video with a statement about the importance of the progress being made and how empowering it is for the people.

4. A Ride in the Google Self Driving Car (3:32 min)

In this video, Priscilla Knox, Safety driver on Google Self-Driving Car Project explains (on/off camera) what information the car needs to have in order to self-drive and makes reference to the different sensors and equipment in and on the car that provide the data being processed. Most of the scenes in the video depict a moving self-driving car, shot from both, outside and inside of the vehicle. There is a great deal of metaphor used in explaining how sensors “see” and can “talk to each other”. Computer generated images are used throughout the video to show how sensors differentiate between different traffic participants (cars, cyclists, pedestrians) – shown as boxes of different shapes and colours – and off-camera narration explains the complexity of processing these information because “safety is always the top priority”. Different traffic situations are presented as well as self-driving car designed responses to those situations with an emphasis on being able to do it in a “naturalistic way because… it is safer”. The protagonist concludes the video with brief reference to her role as a safety driver which is to keep her and everyone around the car safe and to provide “detailed feedback to developers” to improve the safety and ease of transportation.

The initial intention was to analyse all (at that time) six videos. However, that plan has proven to be time consuming without added value to the quality of the project because most of the occurring themes are present in all the videos and the data collection has reached its saturation point after the analysis of the fourth video. Including more videos to the analysis would yield no significant results in terms of providing different or enriching the existing perspectives of the concept of a self-driving car.

5.2 Methods

Today's scholars use a rather wide range of methodologies when conducting social research. The complex nature of human social interactions require different approach and application of variety of theoretical and methodological perspectives. The resulting diversity of theoretical and methodological perspectives in the field of social sciences allows selecting from a wide range of methods to be applied to any particular study (Carter, 2011). There are a wide range of quantitative and qualitative research methods to choose from when conducting research but those who assume that relying solely on quantitative methods may neglect the social and cultural variables in the data will opt for the qualitative approach (Silverman, 2000).

Interviews, participant observation, focus groups, various case studies and ethnography are part of the assemblage of qualitative research methods (Lindlof & Taylor, 2002). However, as Carter (2011) points out in her dissertation, Lindlof and Taylor (2002) argue that qualitative research has "no particular defining method" (p. 18) and that "intimate knowledge of situated practice" (p. 28) resulting from complex human interactions actually guides the selection of qualitative method being applied. However, the use of digital technologies in today's world extends the range of resources for communication and embodies wide range of modes, often in new inter-semiotic relationships with one another, in ways that shape and reshape practices and interactions (Jewitt, 2013).

5.2.1 Multimodal discourse analysis

This is where the concept of multimodality comes in. As an inter-disciplinary approach multimodality provides resources to support a complex fine grained analysis of artefacts and interactions across different modes of communication. It is a relatively new take of the previous practices in order to being able to analyse the complex communication content of multimedia messages. Jewitt (2013) argues that "while language is widely taken to be the most significant mode of communication, speech and writing are just a part of a multimodal ensemble" (p. 251). Multimodality challenges the notion that the central role of any interaction belongs to the language (even though it often does) and supports the principal assumption that there is a potential in all modes to contribute equally to meaning (Norris, 2004). Hense, from a multimodal perspective, there is an ensemble of modes, each one with its own specific ability to co-create meanings – a conception which is further emphasised by today's rapidly changing social and technological landscape.

Following these suggestions, the preferred analytical approach for this research is multimodal discourse analysis in order to extend my exploration beyond the semiotic mode of the language used in creating the discourse of safety in Google Self-driving car videos. Spoken language in these videos is embedded within complex configurations of actions, and the visual data suggested that studying the verbal expressions without studying the nonverbal actions and the settings can actually provide a distorted interpretation of the discursive actions. Therefore, multimodal discourse analysis, with its focus on all modes of communication, encouraged a more holistic investigation and allowed explanatory consistency at the level of the verbal and visual modes and in their complex interplay.

In this thesis I loosely adopt the social semiotic approach to discourse analysis in the communication of different knowledge in Google self-driving car videos. As Machin and van Leeuwen (2007) argue, the intention of a multimodal investigation is to make sense of the meaning behind the text, and to understand how the semiotic modes and their intermodal relations recontextualize social reality in complex texts. So far, researchers have used multimodal discourse analysis, for example, to examine how photographs and other graphic elements, children's toys, government web pages, and companies' ads are used by social actors to construct and/or contest dominant social meanings. According to Kress and van Leeuwen (2001), "discourses are socially constructed knowledges" (p. 4) and, from this point of view, the selective use of the knowledge pertaining to traffic safety in Google videos can create specific social reality and desired futures that depend on the interests and purposes of the institution that promotes that knowledge.

For the first stage of the analysis I was using the techniques for transcription and delineation of pro-filmic units from multimodal video analysis. A unit can be a "word, sentence, paragraph, image, article, television program, or any other description of content based on a definable physical or temporal boundary or symbolic meaning" (Riffe, Lacy, & Ficko, 2005, p. 69). In this sense, the following textual, verbal and visual elements have been taken into account during the transcription of the video (adapted from Rossolatos, 2014 a).

- Monologues, voice-overs and external narration.
- Protagonists/characters – a character is deemed salient for the discourse insofar as she/he affects the main actions involved in the deployment of the narrative (Chapman, 1980).

- Setting – the spatial/temporal configuration (room/office setting and landscapes, for instance) in which the deployment of the narrative is embedded. Settings are as important as actors in the creation of the discourse to the extent that a change of setting occasionally signals a change in the meaning orientation in the storyline.
- On screen-texts and typographical features – as they allow us to recognize the incidence of a rhetorical figure (e.g. texts add new information for the purpose of added validity to the ongoing narrative or to emphasise the already made statements).
- Colours – either of actors' clothes or settings, as they affect the semantic content of a verbal/visual scene.
- Kinematic elements – body language, gestures and facial expressions.
- Tone-of-voice – refers to particular utterances or the overall "feel" of the video. Properties such as timbre and pitch are crucial for emotionally conditioning an audience's receptiveness to messages.

Regardless of the type of elements identified in the video they have all been translated/converted into texts which necessary entails a level of interpretation especially for the non-verbal parts. For this purpose, and the consequent coding, a computer assisted qualitative data analysis software (CAQDAS) was used, namely Atlas.ti. It has proven convenient in efficiently storing, organizing and managing of data that enabled more focused analytical reflection. However, Atlas.ti does present certain limitations when it comes to video analysis. Especially evident is its lack of separate text layouts for verbal and visual modes of communication which required some deal of improvisation on my part when placing all the texts in a single layout and still be able to tell them apart. Apart from this idiosyncrasy and couple of other niggles the software performed consistently and reliably and helped me a lot in having "at a glance" reference of an evolving complex coding system.

5.2.2 Qualitative content analysis

According to Rosengren (1981) content analysis has a long history in research, dating back to the 18th century in Scandinavia. At first it was used as an analytical technique and a quantitative method before its use gained momentum in the qualitative research domain in the late 20th century (Hsieh & Shannon, 2005). Today, qualitative content analysis is one of numerous research methods used to analyse text data by focusing on the characteristics of language as communication with attention to the content or contextual meaning of the text

(Tesch, 1990; Hsieh & Shannon, 2005). As said before, the text data in this research have been obtained from the narrative and visual elements in the video sources being analysed. Classifying large amounts of text into an efficient number of categories that represent similar meanings (Weber, 1990) in this case go beyond mere statistical operations and aim at subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes and patterns.

The content analysis employed in this research does not maintain allegiance with any particular methodology even though it resembles, in part, to the approach employed by Grounded Theory. The main difference lies in the fact that Grounded theory does not start with testing an existing hypothesis, but uses the empirical data to generate concepts and theories (Glaser, 1978). In other words, it rejects the need for a priori assumptions and researchers are encouraged to avoid "preconceived theoretical data" (Myers, 2009, p. 108) while my research has clear assumptions about Google's visions of the future and the intention to create certain social realities. These assumptions can be valuable in the sense of providing better understanding of the research findings but they did not guide the analysis process and there were no pre-set codes used during the initial coding stage.

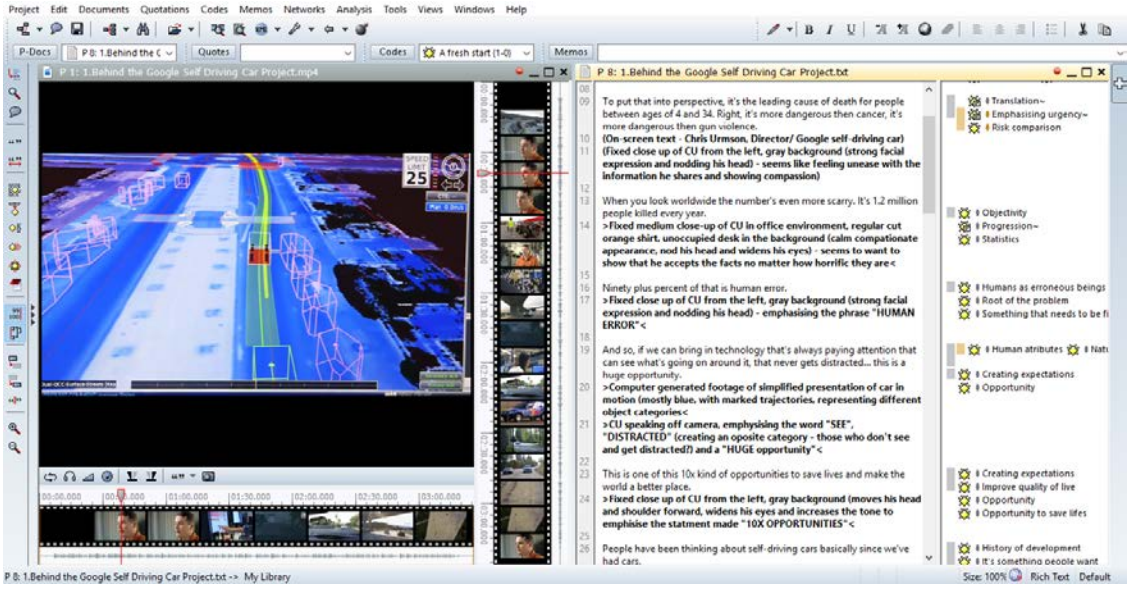
However, in order to understand and explain the social phenomena, grounded in particular contexts identified in the videos, an inductive reasoning process was employed to help me stay engaged while interacting with the data and investigating the construction of discourse narratives. In other words, it was necessary to recognise that understanding the implied and assumed effect the videos will have on the audience is a matter of reflection on observed phenomena inasmuch as of reflexion on the multiple premises and constructs that have been employed for making sense of the observed phenomena.

Following the transcription and several close readings, an initial coding was performed which involved a selection of a corpus of extracts deemed relevant to the research question.

As indicated, Atlas.ti was used as a computer application tool at this stage of the study. Using a computer software requires things to be done in a certain way and the videos and the transcripts of the identified audio and visual elements have been uploaded to the programme as primary documents (PD). The coded elements that make up a PD are stored under a Hermeneutic Unit (HU). It is worth mentioning that, once uploaded, the transcription of all verbal elements (protagonists' dialogues, monologues and voice-overs) and visual components (description of settings and actions according to the above list) was

edited in separate lines (where the beginning and the end of each transcribed line matches the respective beginning and end points of the corresponding verbal components) and adjusted in a way that the end of each line was in line with the respective markers in the video. This way, a direct transcription of the videos' filmic text is accomplished that ensure matching of action that takes place in the visual mode, under each verbally delimited unit of analysis. This is how it look in Atlas.ti:

Figure 2: Atlas.ti HU screen shot (transcription)



Once the transcription has matched nicely with the video segments, the following step in the process was to assigning quotations either to entire textual segments (verbal and visual) for each PD. Quotations essentially consist of the textual segments of the transcribed text. Numerous sections of text have been selected and were marked as free quotations, coded and/or linked to a memo. I found this feature of the software quite useful because it helped me understand the full context of each individual PD before I began to consider categories that cut across the entire project. After completing the stage where the videos (and respective transcripts) have been properly assigned their corresponding quotations, I moved on to the coding phase.

> *"A code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data. (…) Just as a title represents and captures a book or film or poem's primary content and essence, so does a code represent and capture a datum's primary content and essence."*

(Saldana, 2008, p. 3)

As described above, code names are concise, dense descriptors for concepts emerging during the stage of closely studying the data. Atlas.ti allows for assignment of more than one code to each textual segment a feature which allowed easy and convenient way to identify and denote the overlapping and multi-layered concepts. Coding in-vivo (coding as you go) has generated more than 200 codes that were later arranged in 22 distinct code-families. Given the nature of the research and the research question no distinction was made to segment the codes based on their occurrence – verbal level, visual level or verbal-visual interaction level. The following screen-shot and the sample of a code-family (full list of code-families can be found in Appendix 3) can provide an understanding of the coding process.

Figure 3: Atlas.ti HU screen shot (coding)

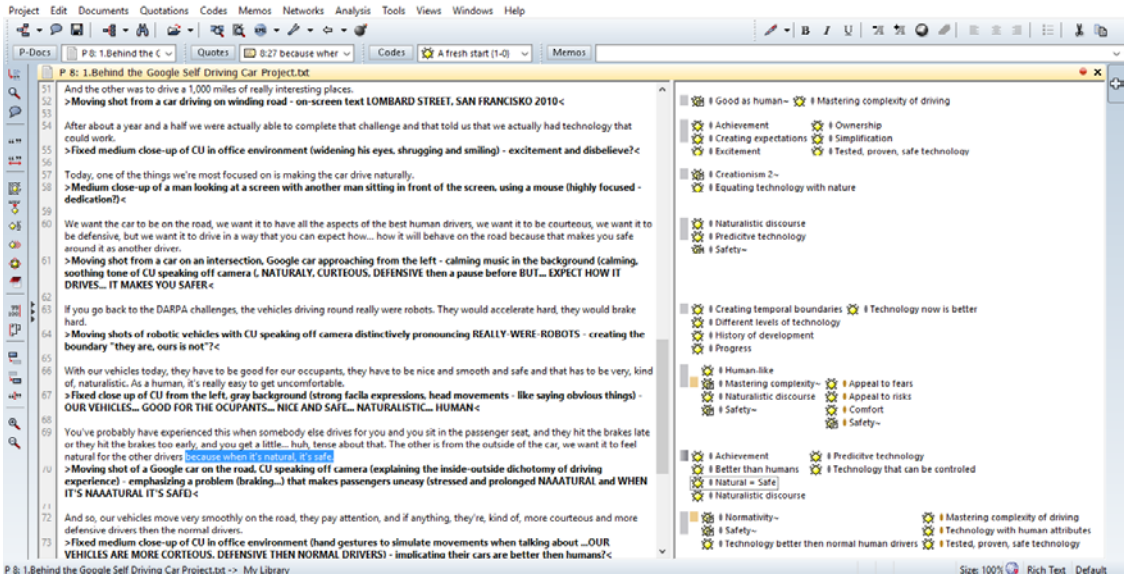


Figure 4: Atlas.ti HU code-family sample

Code Families

HU: Self-driving cars
File: [C:\Users\Emil\Desktop\Master STS\Master Thesis\Project\Self-driving cars.hpr7]
Edited by: Super
Date/Time: 2015-07-09 13:04:24

Code Family: CREATING EXPECTATIONS
Created: 2015-06-03 19:04:28 (Super)
Codes (14): [A fresh start] [Amazement with technology] [Better future] [Creating expectations] [Done with the past] [Excitement] [Google cars - Imminent reality] [Improve quality of live] [Improvement] [It's something people want] [Opportunity] [Opportunity to save lives] [Solution to the problem] [Worrylessness]
Quotation(s): 23

Code Family: HUMANISED TECHNOLOGY
Created: 2015-05-28 21:31:53 (Super)
Codes (9): [Technology mimics human behaviour] [Technology that can be felt] [Technology that is aware of the environment] [Technology that makes decisions] [Technology that sees] [Technology that talks] [Technology that works] [Vehicle as human being] [You can engineer human behaviour]
Quotation(s): 12

Further refinement of the 22 identified code-families was done with a view of addressing the research question with the modes of verbal and visual rhetorical configurations present in the Google videos. The result was five themes (Technology is the Solution, Creating Futures, Emotions, Controlling Everything and Problematic Human) that capture the essence of how different rhetorical and discursive elements were used to pass a message about the vision of a world of future and get people engaged and excited about it (see the list below).

The Problematic Human theme as well as the Controlling Everything theme blended nicely with the Technology is the Solution theme in the analysis stage and were not analysed separately. The former depicts the (assumed) problem for which technology can (supposedly) provide a solution while the latter illustrates the imagined inherent feature of the technology that allows us to control the world whose full potential is yet to be unleashed. The following chapter deals with the themes of technology as a solution to the driving problem, imagined and created futures and used metaphors and appeals to emotions necessary to make those futures happen.

Figure 5: Main themes with corresponding code-families

TECHNOLOGY IS THE SOLUTION	**EMOTIONS**
Smart technology	Appeal to emotions
Technology is better than human	Feeling of being in control
Trusted technology	Feeling safe
Humanised technology	Natural is good
CREATING FUTURES	**CONTROLING EVERYTHING**
Creating expectations	Feeling of being in control
Creating versions of reality (relational)	Metrics as basis for decision making
Importance of progress	Optimisation
Making things better	Trusted technology
Predicting future events	Boundary drawing
PROBLEMATIC HUMAN	
Erroneous human driver	
Human driver - a problem	

6. Empirical findings

As suggested before, during the detailed analysis of the videos, many interesting perspectives and discourses on issues of car safety, technology and visions of the future have emerged. The coding exercise helped to condense the texts into brief, summary format that pointed out to several categories of interest which can be combined and interpreted in many number of ways. This analysis takes into consideration the most interesting and prominent themes that are directly related to the research question(s) and can provide an understanding of the ways safety discourse is created and communicated in Google's videos.

The analysis also revealed, surprisingly, that the video contains a high degree of interdiscoursivity (simultaneous occurrence of different discourses and genres in a communicative event) that created a complex interdiscursive mix, something that was not obvious from just watching them. Despite Google's intentions to present the videos as a neutral statement of the transportation problem and the possible "computer science solution" there are elements (some obvious, some more subtle) of corporate advertising discourse apparent in phrases "it's a huge computer-science problem that will have big impact in the world and that's exactly a kind of problem that Google likes to solve" and "…this is an order of magnitude more than anyone had even driven before" and in the company name that appears few times in the video as on-screen text and on the sides of the test cars. In several occasions this is also coupled with strong conversational discourse that simulated through the use of personification of both, the viewers and the Google project team responsible for the development of the self-driving car (addressed as "you", "we" and "us"). However, according to Bell and York (2010) this type of public relation framing is common whenever corporations employ narratives that positively link themselves to the certain visions of the future in order to avert possible controversies, "mobilize bias" (appeal to culturally determined worldviews and ideologies), and in our case, create anticipation for the new technology.

The narratives used by Google in these four videos generally revolve around three clear themes: technology is the solution to the traffic safety problem, the imagined future with the self-driving car in it will be much better and safer than the one we inhabit now, and expectations of that future should make us all very excited. Within these storylines Google makes its socio-technical visions come alive and mobilise support for acceptance of its self-

driving car. These three themes and the embedding narrative are analysed in detail in the following sections.

6.1 Authority of technology

The first clear theme used by Google is its dedication to technology in the spirit of Winner's (1997) statement of technological determinism as the belief that modern technology is a univocal, a unilinear, and a self-augmenting force that can provide solution to every societal problem. Martin Heidegger (1977), in his critique on the classical canonical views on science and technology, goes even further in arguing that the authority of science and technology invades every aspect of human life and that its operations are designed to institute a universal mode of control. The transformation that technology brings about is given a priori – it is taken for granted. There can be no solution to a problem, no transformation of nature "into technical reality" without accepting the authority of technology as such (Marcuse, 1964).

In this particular case the problem is the human behind the wheel and the solution comes in the form of a self-driving car. In the "Behind Google Self-driving Car" video (Video 1) the human driver is identified as the main reason for the high death toll on the roads today and that assumption (supported by some factual data) is a concurring argument for the conceptualisation of a pressing need to do something about it by means of technology that underlies the narrative in all the videos.

> *"When you look worldwide the number's even more scary. It's 1.2 million people killed every year. Ninety plus percent of that is human error. And so, if we can bring in technology that's always paying attention that can see what's going on around it, that never gets distracted... this is a huge opportunity."*
>
> *Chris Urmson (Video 1)*

This statement is reinforced with Chris Urmson ordinary appearance (sitting in an unoccupied office wearing a simple, regular cut orange shirt) and his calm and compassionate demeanour with some very subtle body language (nodding his head and widens his eyes) that show us both, his sympathy with the unnecessary loss of human lives and his acceptance of objective, scientific truth no matter how unpleasant it is. Fine changes in the tone of voice can be observed when emphasising the key words in the sentence – "*human error*", "*see*", "*distracted*" and "*huge opportunity*". These few seconds of the first

video convey a strong message of cause and effect and a possible (nearly obvious) solution at hand and colours the remainder of the video with evident presumptions.

Presenting humans as erroneous beings – "*Ninety plus percent of that is human error"* – the video points at the key problem that needs to be fixed. By problematisation of the situation Google likes to present itself and its self-driving car as an indispensable actor in the reality it creates. Without any intention to explore this in more depth, it is worth noting that this process is resonant with creation of the obligatory passage points (OPP) in actor-network theory's (ANT) focus on the making of socio-technical networks (Callon, 1986; Söderström, Paasche, & Klauser, 2014). According to Callon (1986) the key step in the process of creation of socio-technical networks is the definition of the problem that needs to be solved, portrayal of the actor(s) involved and the creation of OPP (a solution to the problem), through which this actor will be in a position to solve the problem (Söderström, Paasche, & Klauser, 2014). Problematisation of humans as drivers goes one step further by emphasising the features of the new technology "*that can see*" and "*never gets distracted*" which automatically creates an opposite category of entities that "don't see" and "do get distracted". This category in these videos is reserved for humans only.

The idea to place blame in humans for being humans is not new and has been subject of interest in psychology, sociology and engineering in the last century. Conceiving of human "error" grew out of the teachings of cognitive psychologists in the 1960s and the engineering sciences tried hard to anticipate every type of accident that may occur and build in safeguards. In 1962 an American safety expert stated boldly that engineering was the way to go: "What engineering revision has done is to make the job relatively safer despite the man…" (Hatch, 1962, p. 2). The engineering approach in the past was therefore aimed essentially at adopting an egalitarian approach and overriding the individual differences among humans by introducing technological changes to the wider socio-technical system that will accommodate the imperfections of human drivers. Google's approach however aims at replacing the ordinary car, the "error-tolerant, forgiving technical solution" (Saari, 1995, p. 185) by using (new) technology that will protect people from encounters with (old and obsolete) technology. In this endeavour Google states that the technology proposed is human-like but better than human. This is done by abundant use of personification (a figure of speech where inanimate object are given human characteristics) in all analysed videos. Hence, the car sensors can "*see*" and "*feel*" and the vehicle can "*talk*", "*anticipate*" and "*take into account*" the actions in the world around it. The self-driving car is not just human-like but it needs to be that way in order to function properly – "*for a vehicle to drive itself it*

needs to know where it is in the world and it also needs know what's around it" *(Priscilla Knox, Video 4)*. When talking about the data communication between different hardware and software elements of the self-driving car, the Systems Engineer Jaime Waydo explains it this way:

> *Then you have that handshake between the data from the sensor and the software running on the computer that is perfectly optimized for self-driving.*
>
> *Jaime Waydo (Video 2)*

This statement is supported by strong body language (simulating the handshake with both hands), making a small break just before the word "handshake" and then heavily accentuating it. What she was doing is causing the emphasized word to be highlighted as particularly important, signalling to the viewers that when they infer meaning from what she is saying, they should take particular care with understanding the meaning she has given to this word. This type of communication in the videos connects the viewers with the technological artefacts that are personified. It makes description of these non-human entities more vivid, and at the same time creates emotional bond with the self-driving car and the technology that surrounds it. These framing techniques used by Google aim at gaining support for this new technology by making the self-driving car more acceptable to people by anthropomorphising it. The narrative is constantly used throughout the videos and helps building the safety discourse. It seems that these efforts have a good reason because according to a recent research almost half of consumers wouldn't want to be a passenger in an autonomous vehicle, 43% wouldn't trust it to drive safely and 16% of people are "horrified" by the idea of being driven in one (Griffin, 2015).

As said before, the narrative used in the videos aims at convincing viewers that the technology of self-driving car can offer the best of both worlds – integrate the desired attributes of humans and, at the same time, improve on the intrinsic imperfections of human cognition and behaviour. The following quote illustrates nicely this dichotomy.

> *So think of the sensors as the car's eyes and ears. But eyes that can see far off into the distance and 360-degree around the car.*
>
> *Priscilla Knox (Video 4)*

Comparison and drawing boundaries by resorting to inclusion and exclusion seem to be the dominant rhetorical devices used to illustrate change or a trajectory of achieved/desired

development – "*you can get from A to B so quickly compared to, you know, a hundred years ago*", "*it's more dangerous than cancer, it's more dangerous than gun violence*" – or to show the (desired) departure from limiting human potential – "*our vehicles… are more courteous and more defensive drivers than the normal drivers*", "i*t actually rides better than my own car*"). Both devices are used to define the benefits of self-driving car in terms of escaping from the present situation and presenting them as near facts by using this linear connection. There is a light, cheerful conversation in Video 3 between Walt and Linda, an older couple, after some time spent as passengers in the self-driving car:

Walt: What she really liked was that it slowed down before it went around a curve. And then it accelerated in the curve. She's always trying to get me to do it that way.

Linda: That's the way I learnt in high school driver's ed.

Walt and Linda (Video 3)

This conversation is presented as a testimony from ordinary people who are able to see the advantage of the self-driving car over "normal" drivers. It performed its driving tasks by the book ("*That's the way I learnt in high school driver's ed*"), as it is preferred ("*she really liked was that it slowed down*") and as everyone should ("*She's always trying to get me to do it that way*") but does not. People sometimes do not learn which, again, strengthens the narrative of humans as erroneous beings.

This storyline openly paves to road to the idea that technology can provide a solution to the road traffic safety issues resulting from inadequate cognitive and motor skills of a man. The behavioural problem of individuals has become the behavioural problem of humans as a species. The technology of self-driving car in the Google videos is promoted as optimised, smart and trusted technology. In doing so Google goes through a lot of effort to present these impressions as objective and scientifically sound and therefore a result of an impartial and disinterested judgement. Objectivity, Fuchs (1997) argues, since the Age of Reason has moved its focus from representing positive qualities of the world around us to pointing out absence of "individual, idiosyncratic, accidental, and contingent forces and circumstances" (p. 4). Hence, using objectivity as rhetoric aims at persuading the viewers that the statements and the propositions in the videos are free of values and accurately correspond to the independent reality around us. In using dry facts, externalisations and passive voice ("*33,000 people are killed every year*", "*sensors… can see 360 degrees around the car*", "*the*

laser which pics up on the details of the environment") and making subtle (and sometimes obvious) links between texts of the videos and scientific knowledge – Chris Urmson stating "*…we started to think about the fact that self-driving cars is really a computer science problem*" while there is a moving shot of scientific books on the shelf (Video 1) - Google, quite convincingly, eliminates references to agency, subjectivity and construction to persuade the audience that text indeed "mirrors reality and contains objective knowledge" (Gilbert & Mulkay, 1984, p. 155).

Optimisation is one of the catch words Google uses in the videos. Optimisation is closely linked to rationality, which follows the idea that objective knowledge is possible and desirable and provides a favourable means-ends relation. It involves choosing the best means to one's ends and is naturally akin to conceptions of utility and probability. In Video 2, Jaime Waldo makes direct connection between optimisation and safety while describing the features of the newly developed self-driving car:

> *One of the things we really spent a lot of time thinking about was the placement of our sensors and so we started by optimally placing those on the vehicle where they would have the best field of view and they can see 360 degrees around the car and they can see up to two football fields away. And then we created a vehicle shapes where the sensors are mounted on the vehicle and the edges of the vehicle are really falling away from the sensors to really optimize the field of view so we can be as safe as possible.*
>
> *Jaime Waydo (Video 2)*

This 25-second long section of the video is full of rhetorical devices (comparison, personification, appeal to logic), body language and facial expressions (head nodding, smiling, hand movements), different camera angles (close-up, medium close-up and long moving shots) and a combination of different shots that aim at supporting the claims made in the above text. The first emphasis falls on "*optimally*" and in the process creates an opposite, undesirable category of vehicles that have sensors that are not optimally placed. Consequently, words "*best*" and "*see*" were emphasised and there was a subtle smile when the range of the sensors was translated into easily understandable measurement – a football field. It is interesting to observe how Google tries to gain support for a highly technological artefact by assuming that some facts need to be translated into "layman terms" in order to be understood which closely resembles the highly criticised deficit model of science communication.

The next emphasis falls on "*then we created*" backed by a camera shot of two men working in front of a screen showing some CAD graphics and a moving long shot of Google cars parked in a big room resembling a small research facility. This combination of voice and moving picture constructs a situation where the audience should assume that big efforts were put in designing the car and nothing is left to chance when scientific and rational approach is adopted. This creates a feeling of trust and safety. Further link between technology and safety is created in the last sentence where increasing the effectiveness of the sensors by optimisation leads to being "*as safe as possible*". There is a tranquil, soothing music playing in the background throughout this video segment which complemented by calm voice and appearance of the main protagonist creates an ambience of comfort, protection and safety.

Trust is an important factor in helping users overcome perceptions of risk and uncertainty in the use and acceptance of new technology. Brown at. al (2004) define trust as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (p. 117). In the case of the self-driving cars people's *willingness to be vulnerable* is twofold – it involves trust in Google as a technology provider and trust in technology it provides. The former is addressed by blending textuality from two different disciplines – scientific and corporate – to create an *intertextual chain* (Fairclough, 1992) in creation of the discourse for these particular communicative efforts. In the videos Google uses a lot of statistical data, fairly technical language (occasionally adjusted to layman's understanding) and computer graphics-heavy video segments to inform the audience about a high-technology product that has been developed after years of research (shots from DARPA grand challenge event, the talk about early tests and goals, shots of collaborative work in Google's offices and research facilities) which, all together, packed in around tree-minute long videos, blur the perceived boundaries between academic/research institution and a corporate one. This is cleverly done to benefit from the general presumption of trustworthiness that is generated by the axiological and normative framework typical for the domain of science and its ethos based on the four principles proposed by Merton (1942; 1979).

The trust in technology on the other hand is achieved by associating the all-seeing and all-knowing technology with its ability to control the world around it. This link between obtaining information and analysing it in order to "know" and being able to control what you know about is at the very root of the modern mind's search for certainty. According to

Descartes (1641) it is obtained through a sustained, uninterrupted, all-encompassing view, which would confirm the certainty – and therefore truth – of that which is seen. Having said that, absolute certainty can only be achieved if one is watching everything, all the time. The desire for certainty is fundamentally a desire to control. And when you have full control you can predict behaviour and hence the future. In order to achieve this the self-driving car has been designed to gather data about the environment, use various algorithms to analyse it, recognise patterns and act accordingly. Through use of intense personification in Google videos this has been translated into car's ability to see, feel, recognise, anticipate and even learn over time. This narrative is present in all the videos and can be seen in different audio and video segments: "*(sensors) can see 360 degrees around the car*" (Video 2), "*for a vehicle to drive itself it needs to know where it is in the world and it also needs know what's around it*" (Video 4), "*we've also taught the vehicle to recognize and navigate through construction zones*" (Video 4), man hesitating to cross the street, crosses it, the car "sees it" and slows down (Video 4), "*the vehicle takes into account many things like how close it is to other objects, or matching speed with traffic, or anticipating other cars cutting in*" (Video 4) and so forth.

In Video 2 Google goes one step further in showing how trustworthy the new technology is. Explaining the new features of the self-driving car, Google Systems Engineer Jaime Waydo, says:

> *When it comes to the physical operation of the vehicle the sensors and the software are really doing all the work so there's no need for things like a steering wheel and a brake pedal so all we really had to think about was a button to signal that we're ready to go.*
>
> *Jaime Waydo (Video 2)*

This statement goes along with a still three-quarter close-up shot which, complemented with protagonist's calm voice, steady diction, subtle nodding (as an emphasis gesture and sign of affirmation of what she is saying) and very little facial expressions demonstrates confidence and commitment and adds to the credibility of what was said. However, by removing the only two means of physical control over the vehicle (the steering wheel and the brake pedal) it also shows Google's over-confidence in the technology it is promoting. Being acceptant of idea to give away complete control over the moving vehicle is further supported in the Video 3 where an older lady, during her first contact as a passenger with the self-driving car, with a slight disbelief and amazement says: "*There's no steering wheel in*

the way". Here, a steering wheel, an instrument of control, is being transformed into a hindrance, an obstacle that needs to be removed and, at the same time, inscribed in the narrative of positive transformation towards increased safety.

6.2 Creating futures

As stated before, technological innovation is an intensely future oriented activity. Creations of technology not only intervene in present realities but they also, both symbolically and materially, create future realities. In our case, the rhetoric that surrounds Google self-driving car produces imagined futures, while concrete technological achievements of Google engineers have the power to produce very real futures materially. However, the rhetorical construction of the future world where cars drive by themselves directly (and indirectly) influences the decision if this technology is brought into existence by, for example, rallying public support, instigating policy directives, providing justifications for funding etc. The rhetoric used by Google in supporting this new technology "derives legitimacy from the expertise of those making the claims yet also from the widespread belief in the determinacy of scientific and technological progress" (Selin, 2008, p. 1879).

The theme of "creating better futures" in Google videos builds on the previous one where technology was identified as the solution for human unfavourable cognitive and mechanical skills in an attempt to convince the public to invest its social, political and financial capital in the expected values of the self-driving car. It is worth noting that certain segments of the videos that have been analysed in the previous sub-chapter can be found in this one. The reason for that is the interdiscursive character of the videos that spans across many themes and can be scrutinised using different glasses. The discursive set of narratives present in the previous theme is pretty much present in this one. Comparison, or more precisely, contrast is the dominant discursive element used to present the self-driving car as a positive transformation towards a better future. In Video 2, Google System Engineer Jaime Waydo, explains the need for Google to design its own vehicle:

> *We've been bolting things into existing cars for a long time and we started to realize that it's very limiting in what we can do when you're dealing with the constraints of an existing vehicle. And so we really wanted to rethink a vehicle when you can start from a fresh sheet of paper and what that vehicle really needs to look like when it's custom-built for self-driving.*
>
> *Jaime Waydo (Video 2)*

This statement is supported with various short video segments of people collaborating on the vehicle design in front of a big screen, a moving shot of Google's workshop, Jaime Waydo's calm appearance and voice and quiet and soothing music, which all together create an ambience of comfort and safety but one that are attainable through progress. Safety is still the primary theme but it follows from improvement to the existing cars. A short pause just before the word and then emphasis while pronouncing "*limiting*" and "*rethink*" creates a causal link between the two in the, otherwise, steady and calm oration. The problem of constrains of the existing vehicles that limits the development is solved by rethinking the vehicle from a scratch. By formulating a problem and providing an immediate solution Google portraits a better future state of affairs than previously held. It is very much in the spirit of developed contemporary societies dedicated to progress, innovation and change which carry the idea that the "future can be shaped according to human will" (Adam & Groves, 2007).

The rhetorical devices of comparison and contrast are used throughout the videos to depict the passage from present reality to the future that invites imagination and inventive action. In Video 1, Chris Urmson, states:

> *If you go back to the DARPA challenges, the vehicles driving round really were robots. They would accelerate hard, they would brake hard. With our vehicles today, they have to be good for our occupants, they have to be nice and smooth and safe…*
>
> *Chris Urmson (Video 1)*

There is a moving shot of robotic vehicles (with a lot of equipment mounted on them that makes them look like a highly technical and purposeful machines – where the purpose is just being able to move around autonomously) while Chris Urmson is speaking off-camera and distinctively pronouncing "*really were robots*" which immediately creates a boundary separating the robotic vehicles from the Google self-driving car and creating a future reality where robotic vehicles are transformed into "*nice and smooth and safe*" vehicles through technological progress. The idea of having the self-driving car a reality is referred to in the same video as a "*huge opportunity*" and a "*10x kind of opportunities to save lives and make the world a better place*". The use of this narrative in the video formulates an expectation of the world as a better place (bear in mind that this is Google's vision of the "better" future) through the application of a self-driving car – an opportunity that should not be missed. According to Borup at al. (2006) formulating an expectation in this way about the usefulness of a tool or a procedure can be read by the audience as "an implied warrant that they *should*

use that tool or the procedure" (p. 289). This points out to the performative nature of the portrayed instrument used in the videos in achieving better future(s) which is used in defining the roles and the morally binding obligations and agendas between the author of the videos and the audience.

Google states that:

> *Self-driving cars is really a computer science problem and it's a huge computer-science problem that will have big impact in the world and that's... it's exactly a kind of problem that Google likes to solve.*
>
> *Chris Urmson (Video 1)*

Here, Google's Self-driving Car Project Director makes it clear that Google considers solving societal problems of the world through technological innovation something that falls exactly within its field of expertise and that they are aware of the (possible) world-wide impact of their actions. He succinctly presents a set of statements that express and reinforce a combination of collectively shared sociotechnical imaginaries and Google's vanguard visions. This vision of change actively positions Google as a member of an avant-garde collective that "possesses superior knowledge of emerging technologies and aspires to realise their desirable potential" (Hilgartner, 2015, p. 34).

The potential of the self-driving car technology, a new and exciting techno-scientific field, and all its (claimed) benefits are coherently linked to familiar socio-technical imaginaries of the future and the everyday life. A future where no one gets killed in traffic accidents, where cars are safe and comfortable place to be in and they are better drivers than humans. This is a desirable future, which is easy to imagine, and can help Google's vanguard vision to gain momentum with the wider collective.

> *When self-driving cars are a reality, it's gonna be amazing. Imagine never loosing someone to a traffic accident again. Imagine a world where you get in your car, it takes you where you wanna go and then you get out. And you don't have to search for parking, you just... know, leave it and it goes off and helps someone else get where they're going. Imagine cities where parking garages aren't there, where that land has been turned into... into homes or turned into parks... it's gonna be amazing. It's gonna be an exciting place.*
>
> *Chris Urmson (Video 1)*

It is understandable that this type of socio-technical visions is difficult to realise. There is a complex dynamic process at play in which advocates of the change need to engage with institutions and established collective imaginations and aspirations of the future (Jasanoff, 2015). That is why in this particular video segment the invocation of shared imaginaries gets even more specific. Google self-driving car is shown driving circles around the closed circuit demarcated with bicycles. Showing a moving car in a close vicinity of bicycles but never touching any of them, does two things. First, it brings this vision closer to collective experience and understanding of what safety is and what it should look like. It shows that the self-driving car is an equal participant in the traffic and does not present a danger to city cyclists. Second, it visually puts the self-driving car alongside the bicycles in the category of imaginaries of velomobility – a democratising transportation system, a tool for social justice, a way to a more inclusive and safer urban space and a sustainable alternative to the ordinary car (Horton, 2006; Lake, 2015; Lee, 2015). This is further accentuated by stressing "*reality*" and "*amazing*" in the first sentence (see quotation above) which creates anticipation and provides an understandable guide to the imagined future.

Allying with bicycles against the ordinary car is an interesting take from Google in order to inspire courses of action in support of its self-driving car. Social imaginaries contained in the bicycle, as a form of mobility, are based on the plurality of everyday life and hold desires and aspirations for new forms of urban life. In its intention to keep the expectations within the limits of the existing collective socio-technical imaginaries in order to make them familiar and not too radical, so they can be easily absorbed, Google creates an association between its vanguard visions and the aforementioned more established socio-technical imaginaries. This coalition of perspectives allows the vision of the self-driving car to develop and grow by freeloading on the shared meanings and storylines of the stabilised, and sometimes institutionalised, socially shared imaginaries of the future. The already quoted "*self-driving cars is really a computer science problem*" statement from Google's Project Director Chris Urmson is another example of building coalition with ICT imaginary that invokes collective memories about the socio-technical progress achieved by this technology which, supposedly, gives legitimacy and authority to the statement about a technological artefact that is largely based on previously accumulated computer science knowledge.

Using the ICT revolution as a vehicle for dissemination of new visions invokes recollection of two important effects of the ICT innovation – access to information and creation of new tools hence opening new opportunities. Accessing information from the present reality

through sensors and processing them in order to comprehend the certainty of present and future events gives the self-driving car a potential to appropriate decisions:

> *So think of the sensors as the car's eyes and ears. But eyes that can see far off into the distance and 360-degree around the car. And the great thing about having all these sensors is that they can talk to each other and get cross-checked information about the environment. So while we take in a ton of information using our sensors it's our software that really processes all this and differentiates between objects.*
>
> *Priscilla Knox (Video 4)*

This is a narrative that is rather present in the videos and shows the capacity of the self-driving car to gather "*tons of information*" about the surrounding and make sense of the reality. This is "objective" knowledge collected and created through "optimised" means and it is meant to be used to "structure, order and tame the insecurities of the realm beyond experience" (Adam & Groves, 2007, p. 6). This basically means that based on information from the present the future can be known and, based on that knowledge, the self-driving car can make (virtually) flawless decisions to avoid or minimise occurrence of unwanted events.

Seeing the self-driving car as a technological tool of opportunities relates closely to the previous discussion on the authority of technology. Drawing a parallel between visions of car mobility and ICT imaginaries calls upon a fiction of an empty future, "decontextualized and depersonalised" (Adam & Groves, 2007, p. 13) that is ours to populate with tools of progress, imagination and control. Tools that are both, products of imaginaries of the future and creators of the future. Future, through the visions, is imported into the present where different possibilities (opportunities) are actualised based on images of the future that create a different future once implemented. Based on the actual and imagined progress of ICT tools and its "vast" possibilities, the self-driving car is portrayed as an extension to and a realisation of those ICT efforts and a "*huge opportunity*" that can lead us to a possible future where it "*save(s) lives*" and "*make(s) the world a better place*".

This discourse coalition with ICT and engineering gets more specific by using the conceptual template of engineering sciences for imagining the process of data gathering and processing by the self-driving car. In his paper about the possible theoretical framework underlying the development of synthetic biology, Drew Endy (2005) talks about the three engineering principles that could stand behind the success of bioengineering – standardisation, decoupling and abstraction. Hilgartner (2015) argues that this vision draws on the

imaginaries on the process of engineering to help organising the collective process of building the bioengineering field. Given the novel nature of both technologies it comes as no surprise that imaginary of engineering following these three principles intertwined with visions of the self-driving car can be found in the Google videos. In this vision, standardisation refers to a process of applying equal rules to parts and procedures in order to maximise compatibility, interoperability, safety and reliability in the construction of technical artefacts. Google self-driving car has been "optimised for safety", has been designed to replace the unpredictable nature of millions of drivers with a single combination of algorithms and the spotless interconnectedness is guaranteed by "*that handshake between the data from the sensor and the software running on the computer*". Furthermore, reliability is assured by the fact that the car is "*perfectly optimized for self-driving*" so "*the sensors and the software are really doing all the work so there's no need for things like a steering wheel and a brake pedal*". Decoupling means that complex problems can be broken down to simpler ones to reduce complexity and to be tackled separately. The resulting work can eventually be combined to produce a functional whole (Endy, 2005). This is exactly how the software algorithms are described to work in the videos. Safety driver Priscilla Knox explains in video 4 the distinctions the software makes between different traffic participants by allocating different colour boxes to each category – a pedestrian, a cyclists and a vehicle. Speaking off-camera, while the video shows computer generated images of how the software sees the environment (a small square on a photo-realistic computer generated map representing a car in motion, different coloured rectangles and some additional artefacts) and a small screen in the lower left corner showing a real-time footage of the moving car, she explains the complexity of the situation:

> *Based on what the vehicle sensors and processes these objects will be represented by different colour boxes. Cyclists will be red, pedestrians yellow and the vehicles will appear either green or pink. These boxes demonstrate the processing that takes place within the software. And think about the complexity here. People are different, cars have different shapes and sizes. Yet despite these nuances the software has to classify these objects appropriately based on factors like their shape, movement pattern or location.*
>
> *Priscilla Knox (Video 4)*

The vision presented here is that it is possible to reduce an extremely complex traffic environment – "*And think about the complexity here*" (pronounced with a slightly raised

voice, emphasising the significance of the statement as an introduction to the explanation that follows, creating suspense and raising expectations) – to three categories represented by different coloured boxes and classify everything around the car based on "*shape, movement pattern or location*". Creating these categories of traffic participants allows working on them independently and assigning different attributes to each one of them.

Another way of dealing with complexity is the aforementioned abstraction based on previously created hierarchy relations. Abstraction hierarchies are a human invention designed to assist people in engineering very complex systems by ignoring "unnecessary" details. It is no surprise that an engineering project like the Self-driving car adopts this approach and separates different components of the development process and have different groups of people (developers, safety drivers) working on different aspects – software, hardware, human behaviour). Combination of their efforts will enable them to produce a car that is shaped to achieve noble human purposes and remedies the design flaws of the ordinary car.

The self-driving car is not a stand-alone idea. Rather it is embedded in an imagined future that is built around similar assumptions and previous understandings of what the future should look like. These visions of the future are loaded with myths and metaphors (discussed in the next chapter) and science-fiction imagery of hi-tech artefacts with human-like abilities and perfect utopian cities that help infuse understanding about these technology prospects with particular meaning. They are meant to provide a symbolic collateral about the probabilities of Google's promises becoming reality. The sum of these futuristic promises makes the whole self-driving car thing more believable and "real" especially when it is coupled with the appeal to the widely shared cultural notion of progress.

6.3 Metaphors and emotions

The greatest thing by far is to be a master of metaphor.

Aristotle

The power of metaphors lies in their ability to make the complex simple and the controversial palatable. It allows people to create extraordinary meaning out of the seemingly mundane. Countless communicators (including Aristotle) have harnessed the power of metaphor and appeal to emotions to effectively persuade and inform. Hence, it comes as no surprise that metaphors, myths and sentiments are heavily used in the articulation and establishment of future expectations. By using these rhetorical elements to

instantly communicate both tangible and conceptual information to appeal to “common sense narratives and taken-for-granted cultural perceptions” (Chiles, 2013, p. 515) one can influence the process of favourable reception of certain expectations about the future (Konrad, 2006; McGrail, 2010; Chiles, 2013).

6.3.1 Metaphors of progress

In the case of Google Self-driving Car, socio-technical imaginaries related to information and communication technology and progress play an important role in making this type of revolutionary change imaginable. By sharing a vision of an autonomous vehicle as a high-tech product that is, at the same time, natural in its appearance and operation, Google shapes the discourse of Self-driving Car that operates on multiple levels and provides metaphors and emotional frameworks for thinking about a variety of socio-technical issues. The analogy between replacing ordinary cars with self-driving cars and progress rest largely on the widely shared cultural notion of progress – improvements in the well-being of human beings and society which are indispensable and almost inevitable. The alternatives to progress are stagnation, deterioration, and the eventual extinction of all life (Moore, 2008). This is well illustrated in the “Behind Google Self-driving Car Project” video where Self-driving Car is one of a “10x kind of opportunities to save lives and make the world a better place” and the transportation system based on ordinary cars is “the leading cause of death for people between ages of 4 and 34” and is “more dangerous than cancer, it's more dangerous than gun violence”. Critical to progress is a life free from fear and Google embrace this notion and uses it as an important element in the discourse through which the problems and issues of road transportation are framed.

Use of this sort of analogy suggests that it is a common sense decision to replace the ordinary car with a new (self-driving) one. It was analysed before to show the technological determinism present in the videos but the following statement also shows use of particular meanings and symbolisms of progress:

> *We've been bolting things into existing cars for a long time and we started to realize that it's very limiting in what we can do when you're dealing with the constraints of an existing vehicle. And so we really wanted to rethink a vehicle when you can start from a fresh sheet of paper and what that vehicle really needs to look like when it's custom-built for self-driving.*
>
> *Jaime Waydo (Video 2)*

The above statement is reinforced by video segments of people collaborating on various parts of the car's design and a moving shot of Google's workshop. The audio-video composite infuses the narrative with the notion of progress achieved through hard work and joint effort of an innovative group of people which resonates with the Schumpeter's (1968) "storms of innovation" – an uncontained and constant surge of creativity that leads to progress and economic growth. The (neo)liberal notion of employing research & development efforts to question the existing ways of doing things (*"we started to realize that it's very limiting in what we can do when you're dealing with the constraints of an existing vehicle"*) and combine materials and forces in a new way to bring improvements ("*we really wanted to rethink a vehicle when you can start from a fresh sheet of paper and what that vehicle really needs to look like"*) builds nicely upon the metaphor of progress and strengthens further the presumed need to make this revolutionary change. Also the *"fresh sheet of paper"* designates a necessary fresh start in the design process and replacement of the existing ordinary cars since the limitations in their design render them fundamentally defective beyond repair.

The idea of progress emerged in the period of Enlightenment in the 18th century and revolves around the notion that "advances in technology, science, and social organization can produce an improvement in the human condition" (Wikipedia, 2016). This suggests that economic development and application of science and technology can lead to improved quality of life. The assumption is that the process is not foreordained but will happen once people apply their reason and skills and the result is a favourable state of affairs for humanity. In the words of J.B. Bury (1920) the desirable outcome of human development, to the minds of most people, "would be a condition of society in which all the inhabitants of the planet would enjoy a perfectly happy existence" (p. 2). The progress is the path we must follow that leads us there. This storyline is pivotal to our societal self-image and is deeply ingrained in the collective identity of the industrialised world. The narrative has gotten more complex in the past years but remains a rather triumphalist story about human achievements.

All this creates a strong link between the Google Self-driving Car and the company's understanding of innovation and progress that is rather convincingly portrayed in the videos as a sensible way forward. Equating new technologies with progress is very common in large part because they can help us to do things that were not previously possible and solve problems that have troubled humanity for centuries (Johnson & Wetmore, 2008). However, most of the technological progress is a result of interconnections of technology, society and

values and decisions about which technologies to develop, fund, market, and use usually are well weighted and lead to gradual development. This is not something what Google likes to do. They like to change the current paradigm and do things faster. Much faster. In Larry Page's words, Google "should be spending a commensurate amount with what normal types of companies spend on research and development and spend it on things that are a little more long term and a little more ambitious than people normally would. More like moon shots." (McCracken & Grossman, 2013). Its engineers and staff are encouraged to think of "science fiction-sounding solutions" and that is reflected on the name of the Google X "moon shots" projects. The X in Google X stands for 10 – making a problem 10 times better, with a timeframe of about 10 years. These visions of future and the "audacious" projects set to achieve them are closely associated with needed innovation to achieve progress in leaps in order to grasp this "10x kind of opportunities to save lives and make the world a better place". All these visions are based in the assumption that technological and mechanized newness is always a positive thing.

This "revolutionary" take on mobility by Google is constantly, throughout the videos, recreated and reinforced by use of specific discourse markers like "really" and "actually" in the discourse created to support the need for a radical change in the transportation and the automotive industry domain. Furthermore, in Video 1, the DARPA Grand Challenges are unambiguously compared to Woodstock – a ground-breaking music festival in 1969 that defined an entire generation, was described as a culmination of a dream of mass freedom (Willis, 2011) and created a particular image of certain social group who could transform the existing cultural and political order in which rules and conventions were not to be followed if they were found to be defective. The following lines from Google Self-driving Car Project Director –

> *And then along came the DARPA grand challenges in the early 2000s. I and a number of folks in the team had taken part in those and it was really exciting. It was kind of Woodstock for robotics.*
>
> *Chris Urmson (Video 1)*

– assume and communicate the significance of the Self-driving car's symbolic weight which is comparable to that of the festival and the importance and social impact of the Sixties counterculture. It is interesting to see that Google, a self-proclaimed vanguard, is using these type of progress metaphors to position its new product's distinctive and transformative characteristics within a wider field of robotics ("…kind of Woodstock for robotics"). The

intention is, most likely, to promote the idea of societal issues as “computer science problems” and serve as a motivation and guidance tools for future acceptance of similar technologies and actually create a multi-level social dynamics of expectations.

6.3.2 Appeal to emotions

Most of adult individuals are capable to interpret the moods of others and anticipate each other's emotional response. They have an “intrinsic theory of emotions” (Russell, 1980) and are able to interpret verbal descriptions of emotion (including anything from a subtle hint to an explicit declaration) and nonverbal evidence of emotional states (including facial expressions, tone of voice, slips of the tongue, overt actions, or any of a host of other possible cues). There are numerous studies showing there is an affective structure implicit in the languages including English and there are several dimensions, that are major components of the meaning of natural languages, and these dimensions have been interpreted as affective in nature (Osgood, 1969; Russell, 1980). Furthermore, the use of emotion words is usually coordinated with facial movements that appear to be perceived categorically (Etcoff & Magee, 1995). Beale and Keil (1995) argue that facial expressions naturally vary along various emotional spans (from happy to sad, angry to afraid) and people have learned to perceive them belonging to discrete categories (happy, sad, excited…).

The above introduction gives some background about the use of language and other visual elements to arouse and shape emotions. Something that was put to good use by Google in the videos about the Self-driving car. Using an easily accessible online video as a medium Google not only conveys knowledge and information about the car it designed but it also creates a certain (imagined) social reality that can make us feel frightened, excited or happy about the product and the future it creates. In the reminder of the text I analyse the use of appeal to emotion in the videos along three categories that should extend the boundaries of rational decision-making in the domain of sensibilities and get on board this socio-technical innovation.

6.3.2.1 Fear

Fear, as a discursive element, “may be defined as the pervasive communication, symbolic awareness, and expectation that danger and risk are a central feature of the effective environment, or the physical and symbolic environment as people define and experience it in everyday life” (Pfuhl & Henry, 1993, p. 53). In other words, using fear arousal to instigate

attitude and behavioural change or contribute to reactive social policies helps shaping the discursive framework of expectation and meaning within which traffic fatalities and other related issues are expressed. If we go back to the two lines from the first video – (road transportation is) “the leading cause of death for people between ages of 4 and 34” and (it is) “more dangerous than cancer, it's more dangerous than gun violence” – we can see that Google appeals to the perceived hazardousness of the use of ordinary cars by providing very selective information of the likelihood and severity of the outcome of that activity. According to DeJoy (1999) “likelihood refers to the perceived probability of experiencing some type of adverse consequence… and severity pertains to the perceived seriousness of the consequence” (p. 222). As said before it is good to note that the information provided in the video is rather selective (it refers only to age groups where death from injuries is high) and lacks credibility (according to US Centers for Disease Control and Prevention traffic accidents are the leading cause of death among people between ages 5-14 and 15-24 but only in the subcategory of Unintentional Injury Deaths (CDC, 2014) while in the overall category of Causes of Death it is surpassed by different subcategories along both age groups which, does not corresponds with Google’s claims).

Anyway, none of this matter in the intention to present driving as an extremely dangerous activity with a high likelihood of accidents with deadly consequences (it’s the leading cause) and high severity (death). Framing the fear of cars in this way is the main ingredient in the process of formation of expectations. The expectations about possible, in this case very likely, adverse consequences of driving a car coupled with the desire to avoid them provides an initial motivation for precautionary behaviour. This behaviour is usually directed towards finding a solution for removing or reducing the danger. Once this solution is presented another set of expectations is created that provides a basis for a belief that a world without a fear of dying in a car accident is possible.

Let us look, one more time, at the first segment of Chris Urmson talk in “Behind Google Self-driving Car Project” video.

> *So when you look at transportation today it's really amazing. You can get from A to B so quickly compared to, you know, a hundred years ago. But, the cost of that... in US 33,000 people are killed every year. To put that into perspective, it's the leading cause of death for people between ages of 4 and 34. Right, it's more dangerous than cancer, it's more dangerous than gun violence.*

When you look worldwide the number's even more scary. It's 1.2 million people killed every year. Ninety plus percent of that is human error. And so, if we can bring in technology that's always paying attention that can see what's going on around it, that never gets distracted... this is a huge opportunity. This is one of this 10x kind of opportunities to save lives and make the world a better place.

Chris Urmson (Video 1)

This entire paragraph reads like a warning message. Subtle, but still a warning about a devastating effect on human lives driving a car has. Job (1988) in his article argues that fear, when used as behaviour-changing element in warnings and risk communication, is most likely to be effective if the set of following conditions is met:

"1) fear onset should occur before the desired or recommended behaviour is offered; 2) the fear arousing event should appear to be likely; 3) the actions to offset the fear should be clearly specified; 4) the level of fear aroused should be commensurate with the recommended action's ability to reduce it; and 5) fear onset should occur as a reinforce for the desired action." (DeJoy, 1999, p. 221)

The opening lines of a video that talks about the reasons behind such a complex, expensive and paradigm-shifting project depict a world of traffic where death is all-present. Reference to the deaths in the US aims at creating a "drive state" (Job, 1988) that activates responding and alters expectations of the car-driving activity. The provided perspective of the "leading cause of death…" and the comparison with cancer and gun violence reflects on the likelihood and severity of the event and increasing the chances that the people will take this warnings seriously and take precautions in response to the presented high-probability danger. Now, the actions that need to be taken is not very clearly specified in this paragraph but it is well elaborated in other chapters of the thesis, the remaining of the video and the other videos in the Google Self-driving car series. To put it simply the recommended course of action is to give up driving and let the car do it for us in order to lower or eliminate the danger. Concerning the fourth recommendation, arousing high level of fear (death) is only useful if recommended precautionary actions are perceived as offering huge and boundless benefits (DeJoy, 1999). The following lines from the same video (Video 1) give good grounds to expect exactly that – "imagine never loosing someone to a traffic accident again" and "imagine cities where parking garages aren't there, where that land has been turned into... into homes or turned into parks". And finally, the fifth condition is met by presenting the precaution measures of behavioural change (giving-up driving) and replacement (self-driving

car) as being effective in removing the source of danger (the human) and hence reducing the fear.

The last couple of lines also stimulate self-protecting behaviour by adding personal relevance to the picture. It is logical to assume that people will not take warnings about traffic dangers like this seriously if they do not consider them to be of personal importance. That is why appealing to people that one holds dear and to things that matter tends to transfer these visions into some sort of imagined personal experience that enhances the perception of likelihood and severity of hazards that Self-driving car is designed to prevent. Furthermore, the formulation "never loosing someone to a traffic accident again" implies absolute effectiveness of the Self-driving car concept potential in annihilating the likelihood of traffic accidents ever take place which makes the entire vision immensely appealing and personally relevant.

This type of fear-based communication present in Google videos aims at informing and emotionally involving the audience in the storyline that bad things are happening and will continue to happen if they do not share the vision of a future where human-operated vehicles are replaced by robots. This type of message framing assumes that the expectations of threatening consequences arouses fear which in turn increases the probability of some type of a response that will reduce that fear (DeJoy, 1999). It also stimulates another set of expectations of a future free from fear of traffic accidents by engaging the audience in imagining a future very different from the present and, at the same time, creating a sense of shared responsibility for the likelihood of that future to become a reality. The combination of fear and hope appeals conveyed through a language stressing the high possibility of desired (imagined) outcomes are strategically used to alter some and reinforce other beliefs and behaviours of the recipients of the message in this subtle persuasion process.

6.3.2.2 Nature

Over recent decades there is a considerable shift of normative emphasis and the emergence of a plethora of nature-endorsing discourses motivated by the urge to "save the nature from people" and preserving it from changes that socialisation of nature brings. These changes (and the announcements of those yet to come) have created "unprecedented forms of unease in virtue of our new found powers to control and even create 'nature'" (Soper, 2009, p. 222). Reasons for these global anxieties are plentiful and range from inability of mankind to control climate change, through fear of new technologies to the ambiguous ways in which

global economic relations work and deny millions of less privileged individuals the minimum of self-realization. Most of these are nature-endorsing discourses that mourn the loss or erosion of nature, emphasize human dependency on the planetary eco-system and appeal to obeying the confines that natural limits impose. The conceptions of the traits of nature shared by the supporters of these ideas are sometimes overtly normative and metaphysical and rely on some "intrinsic values" of nature that are not in line with the recent demands from technological development. Consequently, there is a growing tendency to refer to social/cultural activities and products as "natural" in an attempt to delineate anything that is unaffected and uncontaminated by human nature.

There is no clear definition what is natural and there are no parameters to measure it. There is a traditional ground for distinguishing natural from artificial constructions that is founded in Immanuel Kant's criterion that assumes "lack of deliberate intention to create it" (Kant, 1914, p. 170). This is very loose definition and one that is difficult to adhere to because everything that humans have created and achieved, our entire civilisation is artificial on these grounds. However, this is not a reason for people not to cling to the idea of "naturality" and use the concept as a critique for technological advancement.

As you can see from the above there is a strong conflict between the "nature-endorsing" discourses and the development of human societies as understood by western liberal democracies. As a company involved in development practices, Google is aware of the impact its visions and technologies (can) have on people's lives and societies at large and how important is the public acceptance of said technologies to the success of the company and their visions of the future. In Sachs words development is much more than just a socio-economic endeavour, "it is a perception which models reality, a myth which comforts societies, and a fantasy which unleashes passions" (Sachs, 1992, p. 1). Hence, it is of vast importance to communicate those developments and shape the perceptions in a way to convey a promise of a better future – one that does not conflict with nature.

Google Self-driving car is promoted as a car that drives "naturally" and it is not an afterthought but this features is well embedded in the car designing process. As Chris Urmson put it in Video 1 "today, one of the things we're most focused on is making the car drive naturally". Let us take a look at a couple of segments from the videos:

> *With our vehicles today, they have to be good for our occupants, they have to be nice and smooth and safe and that has to be very, kind of, naturalistic. As a human, it's really easy to get uncomfortable. You've probably have experienced this when*

somebody else drives for you and you sit in the passenger seat, and they hit the brakes late or they hit the brakes too early, and you get a little... huh, tense about that. The other is from the outside of the car, we want it to feel natural for the other drivers because when it's natural, it's safe.

Chris Urmson (Video 1)

The same narrative continues in the Video 4:

Another thing that's really important is for the vehicle to drive in a naturalistic way, because when it's natural and the car abides by social norms on the road, it's also safer.

Priscilla Knox (Video 4)

By using “naturalistic” and “natural” as buzzwords Google aims at shaping and reshaping our practices and guide public acceptance and use of its technology. It creates metaphors that suggests a possible alliance between nature and the self-driving car. This metaphor evokes similar fantasies and imaginaries like “responsible technology” or “green technology” that bring the realms of nature and ethics to those of technology. Buzzwords, like metaphors and hyperboles do not base its existence on reason or facts but they “gain their purchase and power through their vague and euphemistic qualities, their capacity to embrace a multitude of possible meanings, and their normative resonance” (Cornwall, 2007, p. 472). In other words, using “natural” in promoting a new self-driving car aims at current concerns of (non-) acceptance and possible controversy and focuses on creating a short or medium-term state of affairs that points towards a desirable future and in turn shapes the present. Its metaphorical dimension describes the world-in-the-making that Self-driving-car-driven development would create and has all the “warmly persuasive qualities” (Williams, 1976) of something universally good that no one could possibly disagree with.

Allusions of naturality of Self-driving car aside, Google makes very unambiguous claim about the benefits of something that is natural. The statement “when it’s natural, it’s safe” (Video 1) is repeated, with a supplement, in Video 4 – “…when it's natural and the car abides by social norms on the road, it's also safer”. This type of “appeal to nature” is an informal fallacy called "begging the question", a circular reasoning that starts with a premise that requires, and does not provide, proof (RationalWiki, 2016). That is, we are supposed to assume natural implies beneficial. In logic this is an inductive argument that is judged by its

strength, or its likelihood to be true if the premises are true. It implies that for every natural event (when it's natural) there is a beneficial outcome (it's safe) and that there is an indisputable correlation between the two.

Let A(x) mean "x is natural"

Let B(x) mean "x is safe"

The premise that if something is natural, then it is safe, is denoted as $A(x) \Rightarrow B(x)$

In this scenario Google is claiming that, generally, $A(x) \Rightarrow B(x)$, no matter what x is. It is really difficult to show that this is true for every case there is but there are too many counterexamples for this implication connective to be believable. Some of them are:

"Earthquakes are natural. Therefore earthquakes are safe."

"Starvation is natural. Therefore starvation is safe."

"Encountering a bear in the woods is natural. Therefore encountering a bear in the woods is safe."

If the above claim was even remotely true, then we would benefit much more from living in caves without technology than we would as we do now. It does not even sound plausible, because houses are not natural, education is not natural, medicine is not natural, the entire concept of driving is not natural, etc.

As said before, the use of this naturalistic narrative in the videos through metaphors and buzzwords does not have an intention to convey facts or stimulate reasonable thinking about the Self-driving car. Their underlying purpose, As Wilson (1992) noted in her book about the language of the development "is not to lay bare or be unequivocal but to mediate in the interests of political consensus while at the same time allowing for the existence of several internal agendas" (p. 10). It is, in short, a smart framing of the issue of acceptance of a robotised car that aims to undermine reactionary attempts of a large group of people in the society that are keen to invoke 'nature' to provide some kind of policing role over technical advancements. The Self-driving car is a radically new concept and Google needs to secure the endorsement of diverse potential actors and audiences. Appeal to nature, fallacious as it may be, provides a concept that is free of concrete references, and can be filled with meaning by the users. Ambiguity allows for interpretation and in the struggles for interpretive power that characterise the negotiation of the language of public

communication and policy, use of buzzwords helps successfully traverse very diverse and ideologically opposed terrain between technology and nature and eases up the adoption process of (possibly) contested technologies.

6.3.2.3 Excitement

In the introductory chapter of The Development Dictionary: A Guide to Knowledge as Power Sachs (1992) argues that the notion of development has one very important aspect that goes beyond its socio-technical achievements – a development as a particular "cast of mind". It is the promise of human advancement and the expectations it creates that occupy people's mental space and have an impact on the outcomes of endeavours in the social, technological and economic domain. Expectations influence the development path of a technology and are therefore the subject of strategic behaviour by technology companies and other stakeholders.

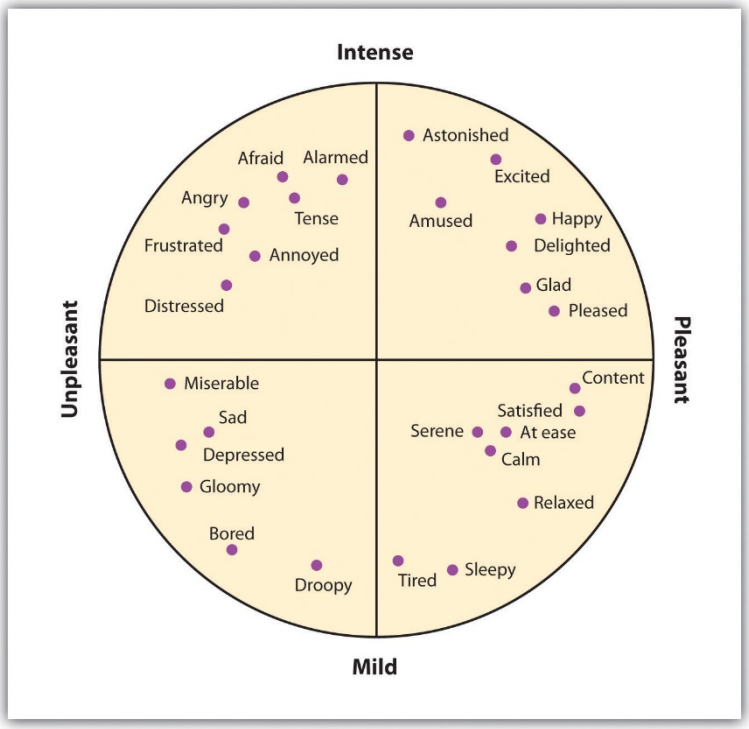
Google, as being one of the most innovative technological establishments in the business is relying heavily on managing expectations in its public communication about new innovations and Self-driving car videos are no exception. As any other emotional connection, excitement works more on a psychological than logical level. By appealing to these emotions Google develops distinct personas in people's minds by projecting an image of a future that people want to buy into. By doing so it makes its visions of the future more consistent with people's positive, or aspirational, image of themselves and the world they (want to) live in.

The figure bellow is adapted from Russell's (1980) and shows a number of different emotions that have a major cognitive component. According to Introduction to Psychology (2010) authors who decided not to be attributed for their work "the emotions are determined by both their level of arousal (low to high) and their valence (pleasant to unpleasant)" (Anonymous, 2010). You can see that excitement is very high on both levels – it is intense and pleasant emotion. This is probably the main reason why psychology of excitement is used heavily in marketing to help companies engage better with their audience.

Excitement is a state that makes the individual more susceptible to the effect of messages as it affects the decision-making abilities. Excited people are more likely to make a decision - any decision (even a bad one). This knowledge of human emotions, and excitement in particular, is reflected in the production of the analysed videos. Google relies on people's learnt emotions and on the way they have organised and summarised their knowledge into a

cognitive structure. In turn, that cognitive structure helps to shape the perception and interpretation of specific (imaginary) events.

Figure 6: A circumplex model of affect



Source: Adapted from Russel (1980)

Let us look at the last segment of Video 1:

> *When self-driving cars are a reality, it's gonna be amazing. Imagine never loosing someone to a traffic accident again. Imagine a world where you get in your car, it takes you where you wanna go and then you get out. And you don't have to search for parking, you just... you know, leave it and it goes off and helps someone else get where they're going. Imagine cities where parking garages aren't there, where that land has been turned into... into homes or turned into parks... it's gonna be amazing. It's gonna be an exciting place.*
>
> *Chris Urmson (Video 1)*

The entire paragraph is an exercise in creating imaginaries and encouraging excitement from said constructions. The audience is guided through the process of coproduced images (narrator's instructions of what should be imagined combined with widely shared imaginaries of better life) of the future where people do not die in traffic accidents, cars help

people (anthropomorphism in action) and where those cars do not need to be parked anywhere which results in a city full of greenery instead of concrete. Then it is led to have specific feelings about the entire idea of a self-driving car as an epitomisation of a better future. The excitement rooted in this expectation process is what shapes the perception and guides the interpretation of a specific reality where self-driving car is a superior choice over a regular car. On a more personal level these expectations in the videos are leaning towards creating anticipation, a more emotionally-intense and enthusiastic feeling. Wikipedia article on anticipation defines it as a "an emotion involving pleasure, excitement, and sometimes anxiety in considering some expected or longed-for good event" (Wikipedia, 2015). Therefore, it can be defined "as a cognitive process of projecting information that is available in the present into the near future to accommodate possible choices and action" (Project Anticipation, 2015). It is also central to the field of sociology of expectations in order to interpret and study the flexible and variable futures and understand their plausibility.

This verbal display of excitement is reinforced with complementing visual elements – fixed close-up and medium close-up of Chris Urmson in office environment (his orange shirt provides excellent contrast to the grey/black background that keeps focus of the audience to his face) with strong facial expressions (open-mouthed smile, eyes wide open, and raised eyebrows – typical adult manifestations of excitement) and evident body language – shrugging, hand gestures, nodding... There is also strong accentuation of words that belong to opposite realms – present and future (imagine – accident, cities and parking garages – homes and parks) and thus creating a nice contrast between present reality and imagined "better" future. There are corresponding gestures and facial expressions supporting the statements and presenting it as something that is easy to imagine and comes naturally from the progress that we are all entitled to enjoy.

Another interesting observation regarding excitement in the analysed videos is that it is a feeling that is not just assumed and implied to be possessed by the audience but is also presented as a shared emotion among the Google Self-driving Car Project staff throughout the car's development process. Indications of this are present in all the videos in a verbal form or displayed in different video shots. Here are some examples:

> *And then along came the DARPA grand challenges in the early 2000s. I and a number of folks in the team had taken part in those...and it was really exciting. It was kind of Woodstock for robotics.*
>
> *Chris Urmson (Video 1)*

But in the small amount of time we've been working on it, we have functional prototypes and that's exciting.

Chris Urmson (Video 1)

There's a lot of thought going into custom building your (very calm and soft vice and almost patronising intonation, like talking to a child) prototype vehicle and the team's really excited and we're learning a lot about safety and how to push the technology of self-driving cars forward while still having you know ,... something that's nice to look at.

Jaime Waydo (Video 2)

Expectation dynamics have a strong and sometimes decisive impact on the pace and direction of innovation processes. They serve as a sort of coordination devices at various levels of networking between wider actors and groups in the society. So it comes as no surprise that Google likes to extend the concept of excitement and anticipation to the people responsible for the design of the Self-driving car. Through excitement about the functioning prototype, the reference to importance of DARPA Challenge to social live (and possible allusion to the social changes it will bring) by comparing it to Woodstock and the excitement and enthusiasm displayed by the protagonists in the videos it all points out to an ordering attempt to achieve somewhat stable order of acceptance among various actors that inhabit the social space of precompetitive technologies like this one. In this perspective, this social space is performed in the language, practices and shared excitement through which people govern the expectations from and their relations to the Self-driving car. It is a car made by enthusiasts for enthusiasts.

7. Conclusion

In this research, I explored the narrative presented by Google through their Self-driving Car promotional videos and tackled some potential grounds of future debate over autonomous vehicles. This was done by means of illustrating the critical interconnections between the assumed traffic safety and trust in technology, created futures and use of metaphors and emotions in generating the needed discourse for the technology to gain momentum. Despite the sluggish start a decade ago and technical setbacks of the early prototypes, and without the controversial legacy of previous similar technologies and unobstructed by the lack of widespread cultural scepticism, the self-driving car has reached a point in its development cycle where stories about safety and progress have generated enough positive hype to support the technology through rough discursive waters.

The story of the self-driving car as portrayed by Google is one of technological determinism, of a company in possession of an objective truth, knowledge and experience in digital technologies, of a company dedicated to use science for saving lives and overall progress of mankind, of a caring industry that has the best interest of mankind in mind and of a technological artefact that will make our future wonderful and an exciting time (and place) to live in. This is the story that has been told through the creation, recreation and the use of a safety discourse (and several minor ones as parts of the interdiscursive mix) as a vehicle to convey specific visions of the future. Contemporary images of the future such as those associated with the Google Self-driving Car in this research overwhelmingly emphasise the benefits of the autonomous vehicle technology and downplay any possible uncertainty of technological innovation. Focusing on visions and expectations, this study revealed the co-evolution of complex socio-technical relations between different actors (human and non-human) in the realm of the Self-driving Car. However, it must be pointed out that this is not a critique of the effectiveness of the self-driving car in saving lives but a deconstruction of a expectations-laden communication strategy that has a goal to advocate a vision of the future radically different from the present we live in; a storyline that subtly invites the audience (the citizens) to participate in the construction of this imaginary.

The analysed Google self-driving Car videos create and present a coherent narrative that serves to (pre-emptively) evade any possible doubts or social, legal or ethical consequences of broader acceptance of the idea of a self-driving car roaming the streets of our cities. In this narrative Google frames itself as a socially conscious actor and the Self-driving Car as a

socially sensible product that will greatly benefit mankind by saving lives, aligning one very "dirty" industry with environmental conservation, the rationale of science, and the principles of human progress. It is worth noting, though, that this research neither generalises nor reflects the (in all probability) multitude of diverse views and perception of various industry actors and only focuses on Google Self-driving Car videos as a small representative collection of promotional material presented by, what appears to be, the most advanced company in the autonomous vehicle field. Nonetheless, this research offers an important contribution to acknowledging the power of visual and verbal rhetorical elements and generated expectations used by innovation technology companies in building new sociotechnical futures typically grounded in positive visions of social progress. Praising technological advancements' benefits, constructing visions of appealing futures and creating exciting expectations are all actions carried out simultaneously to "perfect" human future, save lives and discredit any potential opposition to the technological progress of automatizing road transportation. The answer to the research question builds around several topics (addressed in the sub-questions) which will be discussed in turn in the remainder of the chapter.

The role of technology in Google's narrative is a dominant one. By presenting technological developments in the autonomous vehicle field as automatically reliable and with in-build positive outcomes Google shifts the concept of technology from merely solving technical problems and exploiting concepts and tangibles in an effective way into the realm of technological determinism where technology is actively (re)creating social structure and values. The explicit and implicit perception of autonomous cars solely as a computer science problem reflects Winner's fears of "unstoppable, strongly deterministic, technology-centred processes" (Winner, 1997b, p. 985) that rule our times and shape our futures.

The discursive narrative in the videos revolves around Google's efforts to solve the issue of road traffic safety by completely removing the erroneous and cognitively inferior human from behind the wheel of the car and replacing him/her with an autonomous robot. The problem is identified and a solution is presented. The legitimisation and the acceptance of the self-driving car as a worthy successor of a human driver is advocated through a plethora of rhetorical devices that should convince the audience of the truthfulness of Google's imagined digital future. A future where data are elemental and given and are praised to be knowledge's fundamental building blocks and its universal unit of measure. The anthropomorphised self-driving car, the main protagonist in the videos, that can see far in the distance and has eyes and ears that allow it to gather "tons of information" and process it with lightning speed shows an obvious tendency towards naturalisation of data. These

data are a product of scientific rigour, are endowed with inherently "objective" qualities and are capable of speaking the truth. This is very much in line with Google's worldview of the present and the future where every action on every level automatically produces digital trace – data which are incapable of lying, that are waiting to be harvested and used to predict future events. This control over near-future events is achieved by the self-driving car's ability to gather data about the environment and use various algorithms to analyse it, recognise patterns, act accordingly and even learn over time. Google tries hard to convince us that we should turn all of our decisions, anticipations and judgements, both the trivial and the consequential, over to the algorithms while being passengers in our cars. Doing so is also considered to be a much more reasonable and safer way to move around. These images of safety are supplied with rhetoric of progress and use of objective knowledge in creation of desirable and convincing future. The storytelling is further reinforced by, as Jasanoff (2015) points out, the imagined future's created dichotomy between positive and negative imaginaries by tacitly summoning shared fears of the failure to innovate that further societal commitments for realising this techno-scientific innovation.

What lies in the vanguard part of Google's vanguard visions is the fact that there is a radical move, a big step forward, from using technology to assist the driver in navigating the streets to using technology to override the driver. Until recently, robots were used mainly for automating certain processes during driving but now Google is leading the way for their application in a more complex and unstructured domain where the human was an undisputed ruler. Furthermore, the notion of driver in the traditional sense is being replaced with a wider description that allows inclusion of Google's "self-driving system". According to the response letter by the National Highway Traffic Safety Administration sent to Google's Self-driving Car Project Director, Google's software on board the self-driving car is synonymous to a driver given that sensors on the self-driving car provide enough information to ensure that the system is as well informed about the conditions around the car as human drivers are (NHTSA, 2016).

These visions of the future promote a conception of personalised mobility system that is in essence a technocratic fiction: "one where data and software seem to suffice and where, as a consequence, knowledge, interpretation and specific thematic expertise appear as superfluous" (Söderström at al., 2014, p. 308). However, the narrative in the videos connects these concepts nicely to the widely shared (in western societies) imaginaries of progress, innovation and change. In today's dynamic, fast-paced world, where change is the order of the day, standing still means falling behind (Adam & Groves, 2007). The narrative builds on

the engineering dream of building machines that can move and act autonomously in complex and unstructured traffic environments and are capable of making moral decision. Using this technology in saving lives is in line with universal human values and also evokes the liberal-democratic paradigm that innovation is central to long and prosperous life and long-term economic growth. It also presents the self-driving car as a natural extension of information technology effort to better all aspects of human life. Appealing to the collective memories about the socio-technical progress achieved by IT technology Google trusts it will provide legitimacy and acceptance of its technological artefact that is largely based on previously accumulated computer science knowledge.

This linear, scientistic conception of innovation presents a strong form of justification by aligning its tenets with the socially stabilised and sometimes institutionalised socio-technical imaginaries without giving much ground to more plural, socially situated understandings of autonomous cars. By further promoting its deterministic notions of technological progress as part of its techno-scientific visions Google reinforces its position as a visionary leader and, at the same time, creates an atmosphere of confidence and trust in scientific practices in the domain of automation and artificial intelligence. The (re)created discourse of safety, on the other hand, serve as a motivation and guidance tools for future acceptance of similar technologies and may actually create a multi-level social dynamics of expectations.

The Google Self-driving Car videos have been designed to provide the company's strategy and the self-driving car with a global visibility. It makes abundant use of video statements, dialogues and testimonies, car development video materials, computer generated images and non-technical language as its targets are not technological experts but an audience on the lay person level, which, if convinced by the arguments presented, will be able to decide on the implementation of the self-driving car technology. Since the stakes are high in terms of acceptance and justification of this technology Google is relying heavily on managing expectations in its public communication efforts. The use of metaphors, appeals to emotions and especially the car's alleged alliance with nature aims at shaping and reshaping our perception about car safety and guide public acceptance and the future use of the self-driving car.

All these elements together construct a strong and unidirectional link between the present and the imagined future in a form of authentic expectations. Expectations play a key role in the self-driving car narrative. They can be defined as a "social mechanism" (Merton, 1968) that link pre-defined initial conditions to a specific outcome which makes the visions of the

future more consistent with people's positive, or aspirational, image of the world they want to live in. Expectation dynamics have a strong and sometimes decisive impact on the pace and direction of innovation processes. They serve as a sort of coordination devices at various levels of networking between wider actors and groups in the society. The sociology of expectations teaches us that expectations are capable to "mobilise the future into the present" (Brown, Rip, & Lente, 2003, p. 3) and can become a self-fulfilling prophecy if adopted as an obligatory measure of success and progress of the self-driving car technology. This possible scenario favours Google's intentions to advance its visions of digital future. They are reinforced by the plethora of co-produced mental and visual images in the videos of a future safe from traffic accidents where the responsibility for the likelihood of that future to become a reality is implicitly shared with the audience.

As said before, the importance of expectations lies in its power to influence the direction of technological change and acceptance or demise of a technological innovation. Several authors indicate that expectations are the subject of strategic behaviour by entrepreneurs and other stakeholders in the socio-technical innovation arena (Borup at al., 2006; Brown, Rip, & Lente, 2003). Having in mind the necessary rallying of a wide-ranging support for the self-driving car to succeed and counting on the fact that these inflated expectations of the car's attributes will most likely be accepted and interlaced with other socio-technical imaginaries of the future, Google uses its expertise and competence in development of new digital technologies and its authoritative claim to policy-relevant knowledge to integrate its techno-scientific visions in the collectively held imaginaries of the future.

On the surface the dominant self-driving car narrative is about saving lives from human-caused traffic accidents and creating an efficient and convenient product that is also natural in its appearance and operation. Underneath it is primarily a strategic tool for providing Google with a tool to advance its visions of digital future even further and to gain dominant position in the data gathering and processing market. The analysis of the Google Self-driving car videos has provided this research with some central specificities of the discourse of safety as it is presented in the public sphere.

The safety discourse, dominantly present in the narrative, promotes an informational and technocratic understanding of road traffic, the driver and everything in between. It relies heavily on scientific rigour, objectivity and optimisation. In a nutshell, the self-driving car involves the creation of new relations between technology and society. According to this vision urban mobility and part of everyday life in the cities will be optimized through

technologies provided (mainly) by Google. This company is the main producer of the discourse about the safety benefits (and several others) of the self-driving car that it produces both to describe its activity in the domain of mobility robotics and automation and to stage itself as a central actor of this traffic management model.

Future visions and expectations for what is attainable through technological innovation and progress almost always include implicit shared understanding of what is considered good or desirable and how technological artefacts could meet public needs (Jasanoff & Kim, 2009). Integrity of human life is one of those values that have virtually the same meaning across the globe. The know-how that Google possess, the knowledge to structure and order the realm beyond experience creates a bubble of trust and expectations around the Google Self-driving Car that this integrity will remain intact while being passenger in this vehicle. By decontextualizing the future of road transportation, emptying it from social interactions and genuine human experience and presenting the traffic safety issue as a "computer science problem", Google paints a picture of the future where imagination, creative skills and technological prowess (things Google is good at) are the only boundaries to what we can achieve. That makes the future open to "choice and efforts to colonise and control" (Adam & Groves, 2007, p. 30) by following the techno-scientific vision of an innovation technology company. This myth-making process creates a "narrative environment" for the self-driving car in which the technology on display becomes a natural part of the landscape of created future. The self-driving car's ability to optimise all aspects of car's operations, from navigating busy city streets to finding closest parking space completes the narrative with needed metrics and "scientific" facts.

Self-driving car, as a possible future, ticks all the right boxes when it comes to expectations. As an object it is inseparable from the social networks it was inspired by and its everyday use is easily imaginable. As a concept it builds on previous technologies and, at the same time, makes a radical step forward. That makes it appear intriguing, desirable and safe. And finally, the vision Google Self-driving car is a part of is inseparable from the life and landscapes in which it was imagined and can still be used to inspire new futures. That makes it an excellent innovation to attract commitments to this shared conception and establish the need for political decision to justify this particular technological pathway.

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APPENDICES

APPENDIX 1 – Abstract

The car based mobility system has been providing considerable personal freedom for over a century now. However, it is also associated with serious side effects in terms of safety, environmental impacts, and energy consumption. Regarding safety, it is commonly accepted that human error is the dominant cause of car accidents. Despite the plethora of driver aid systems already installed in cars, innovation technology companies are using the advancements in the robotics and automation field to address this issue by developing completely autonomous cars were humans are just passengers. One such car is Google Self-driving Car that has been extensively tested in the past few years. Google is promising their car to be "safer, easier and more enjoyable" than the regular, human-operated car and is stirring quite an increase of promotional and lobbying activity surrounding the autonomous vehicle industry. However, these promises come with the risk of questioning and redefining social, legal and ethical realities so that they are aligned with the advocated future imaginaries. In the face of potential opposition to social disruption and creation of possible alliances with other actors in the field in order to provide legitimation, attract interest and foster investment in this new technology, Google has taken on a series of promotional activities to frame the self-driving car in a positive light to the public and potential stakeholders. This research investigates one such promotional effort in the form of series of videos posted on Self-driving Car Project Google+ account. Through multimodal and qualitative content analysis of four Google Self-driving Car videos this study examines the way in which safety discourse is (re)created and used to push certain visions of the future. From empirical point of view, the focus of the research was placed on in-depth consideration of three major categories of rhetorical devices identified in the videos: appeal to technology as an inherently good thing, creation of attractive and desirable futures and use of metaphors and emotions to create excitement in anticipation of these technology-optimised visions of the future. It shows that the dominant self-driving car safety narrative is coupled with Google's intentions to advocate a vision of the future radically different from the present we live in by interacting with the collectively held socio-technical imaginaries. In essence, this conception of a personalised mobility system is a technocratic fiction where software seems to be a worthy replacement for human knowledge and experience, an idea that is skilfully linked throughout the material with liberal-democratic imaginaries of progress, innovation and change. By means of promoting technological determinism, creating exciting futures and use of metaphors and sentiments Google frames the "inherent" safety features of the Self-driving Car in a positive light and positions its vanguard visions of the future at the pinnacle of implementation of autonomous vehicle technologies.

APPENDIX 2 – Zusammenfassung

Das Fahrzeug-basierte Mobilitätssystem bietet nun über ein Jahrhundert eine wesentliche persönliche Freiheit. Es ist jedoch auch mit schweren Nebenwirkungen in Bezug auf Sicherheit, Umweltauswirkungen und Energieverbrauch verbunden. Was die Sicherheit betrifft, ist es allgemein anerkannt, dass der menschliche Faktor die Hauptursache von Verkehrsunfällen ist. Trotz des Überflusses von diversen Hilfssystemen die bereits in Fahrzeugen eingesetzt werden, versuchen innovative Technologie-Unternehmen den Fortschritt in der Robotik und dem Feld der Automation einzusetzen, indem sie völlig autonome Fahrzeuge entwickeln bei denen Menschen nur Passagiere sind. Ein solches Fahrzeug ist das Google selbstfahrende Fahrzeug, das in den letzten Jahren ausführlich getestet wurde. Google verspricht ihr Fahrzeug ist "sicherer, einfacher und angenehmer" als das normale, durch den Mensch betriebene Fahrzeug und bring gleichzeitig viel Bewegung bei der Werbe-und Lobbyaktivitäten rund um die autonome Fahrzeugindustrie. Allerdings kommen diese Versprechen mit dem Risiko, die sozialen, rechtlichen und ethischen Realitäten in Frage zu stellen und sie neu zu definieren, somit werden sie mit den verfechteten Imaginären der Zukunft abgestimmt. Angesichts der möglichen Opposition bezüglich sozialer Betroffenheit und der Schaffung von möglichen Gegen-Allianzen mit anderen Akteuren in diesem Bereich, hat Google auf einer Reihe von Werbemaßnahmen ergriffen um das selbstfahrende Fahrzeug in einem positiven Licht der Öffentlichkeit und potentiellen Stakeholder zu bringen und sie zu legitimieren, das Interesse zu ziehen und Investitionen in dieser neuen Technologie zu fördern. Diese Forschungsarbeit untersucht eine solche Werbe-Aktivität in Form von einer Reihe von Videos, die auf dem Google+ Konto von dem Selbstfahrendes Fahrzeug Projekt veröffentlicht wurden. Durch multimodale und qualitative Inhaltsanalyse von vier Google Selbstfahrendes Fahrzeug-Videos, untersucht diese Forschungsarbeit die Art und Weise, in welcher der Sicherheitsdiskurs (wieder)erstellt und eingesetzt wird um bestimmte Zukunftsvisionen zu etablieren. Aus empirischer Sicht wurde der Schwerpunkt der Forschungsarbeit auf eingehende Betrachtung von drei Hauptkategorien eingesetzt, die in den Videos identifiziert wurden: Anziehungskraft der Technologie als anhaftend gute Sache, Herstellung von reizvollen und gewünschten Zukunftsvisionen und Verwendung von Metaphern und Emotionen um Aufgeregtheit in Erwartung dieser Technologie-optimierten Zukunftsvisionen zu erzielen. Es zeigt, dass die dominante Erzählung mit Googles Absichten gekoppelt ist, durch eine Interaktion mit den allgemein vertretenen sozio-technischen Imaginäre, eine Zukunftsvision zu verfechten, die radikal anders als die Gegenwart ist. Im Wesentlichen, die Vorstellung der personalisierten Mobilitätssysteme ist eine technokratische Vorstellung, in der Software ein würdiger Ersatz für das menschliche Wissen und die Erfahrung zu

sein scheint, eine Vorstellung, die in dem analysierten Inhalt mit liberal-demokratischen Imaginäre des Fortschritts, der Innovation und Veränderung geschickt verknüpft ist. Durch Förderung des technologischen Determinismus, die Schaffung einer spannenden Zukunft und Verwendung von Metaphern und Gefühlen, rahmt Google die "inhärente" Sicherheitsmerkmale des Selbstfahrenden Fahrzeugs in einem positiven Licht ein und positioniert seine Vorreiter-Visionen der Zukunft an der Spitze der Umsetzung der Technologie des autonomen Fahrzeugs.

APPENDIX 3 – Code Families

HU: Self-driving cars
File: [C:\Users\Emil\Desktop\Master STS\Master Thesis\Project\Self-driving cars.hpr7]
Edited by: Super
Date/Time: 2015-07-09 13:04:24

Code Family: AMAZEMENT
Created: 2015-06-03 19:34:37 (Super)
Codes (3): [Amazement with technology] [Excitement] [Impressive technology]
Quotation(s): 12

Code Family: APPEAL TO EMOTIONS
Created: 2015-05-28 21:22:03 (Super)
Codes (12): [Appeal to fears] [Appeal to risks] [Appeal to science (learning process)] [Disbelieve (sort of)] [Doubtful as humans, but...] [Emotional involvement with technology] [Good look matters] [Impressive technology] [Passion] [Patronisation] [Playing the girl card] [Worrylessness]
Quotation(s): 11

Code Family: BOUNDARY DRAWING
Created: 2015-05-28 21:22:16 (Super)
Codes (7): [A fresh start] [Boundary drawing] [Categorisation] [Normativity] [Simplification] [Stereotyping] [Technology now is better]
Quotation(s): 23

Code Family: CREATING EXPECTATIONS
Created: 2015-06-03 19:04:28 (Super)
Codes (14): [A fresh start] [Amazement with technology] [Better future] [Creating expectations] [Done with the past] [Excitement] [Google cars - Immanent reality] [Improve quality of live] [Improvement] [It's something people want] [Opportunity] [Opportunity to save lives] [Solution to the problem] [Worrylessness]
Quotation(s): 23

Code Family: CREATING VERSIONS OF REALITY
Created: 2015-05-28 21:24:48 (Super)
Codes (7): [Absolute safety] [Creating facts] [Creating reality] [Emphasising urgency] [Google cars - Immanent reality] [Safety made possible by technology] [Seamless blending of technology in human life]
Quotation(s): 11

Code Family: ERRONEOUS HUMAN DRIVER
Created: 2015-06-03 19:49:12 (Super)
Codes (7): [Better than humans] [Humans as erroneous beings] [Humans unable to learn] [Replacing human] [Root of the problem] [Something that needs to be fixed] [You can engineer human behaviour]
Quotation(s): 5

Code Family: FEELING OF BEEING IN CONTROL
Created: 2015-05-28 20:47:20 (Super)
Codes (6): [Being in control without control] [Feeling of being in control] [Feeling of full control (360 degrees)] [Feling comfortable] [Redundant elements of control] [The car performs as it should (as designed)]
Quotation(s): 8

Code Family: FEELING SAFE
Created: 2015-05-28 20:42:15 (Super)
Codes (8): [Absence of threat] [Absolute safety] [Car is not safe enough yet] [Comfort] [Creationism 2] [Feeling safe] [Feeling unease but trust wins] [Feeling comfortable]
Quotation(s): 10

Code Family: HUMAN DRIVER - A PROBLEM
Created: 2015-06-03 20:04:11 (Super)
Codes (5): [Advocating replacement] [Death] [Humans as erroneous beings] [Root of the problem] [Something that needs to be fixed]
Quotation(s): 3

Code Family: HUMANISED TECHNOLOGY
Created: 2015-05-28 21:31:53 (Super)
Codes (9): [Technology mimics human behaviour] [Technology that can be felt] [Technology that is aware of the environment] [Technology that makes decisions] [Technology that sees] [Technology that talks] [Technology that works] [Vehicle as human being] [You can engineer human behaviour]
Quotation(s): 12

Code Family: IMPORTANCE OF PROGRESS
Created: 2015-05-28 22:51:58 (Super)
Codes (12): [Advocating replacement] [Car is not safe enough yet] [Done with the past] [History of development] [Importance to designing new vehicle] [Improvement over previous vehicles] [Improvement] [New frontiers] [Progress] [Pushing the limits] [Taking challenges] [Technology now is better]
Quotation(s): 11

Code Family: MAKING THINGS BETTER
Created: 2015-05-28 22:43:44 (Super)
Codes (9): [Better future] [Better than humans] [Corrective measures to adjust to human behaviour] [Improve quality of live] [Improvement] [Opportunity to save lives] [Replacing human] [Something that needs to be fixed] [Technology now is better]
Quotation(s): 11

Code Family: METRICS AS BASIS FOR DECISSION MAKING
Created: 2015-06-04 11:19:34 (Super)
Codes (16): [Calculating future events] [Categorisation] [Feeling of full control (360 degrees)] [Importance of technology to safety] [Linear development] [Linking safety with technology] [M2M communication] [Mastering complexity] [Normativity] [Objective truth] [Objectivity] [Reductionism] [Simplification] [Statistics] [Technology that makes decisions] [With technology you can "know"]
Quotation(s): 27

Code Family: NATURAL IS GOOD
Created: 2015-06-03 20:12:49 (Super)
Codes (3): [Equating technology with nature] [Natural = Safe] [Naturalistic discourse]
Quotation(s): 7

Code Family: OPTIMISATION
Created: 2015-06-04 11:04:53 (Super)
Codes (7): [Categorisation] [Confirmation of possibilities] [Design dictated by the function] [Importance to designing new vehicle] [Optimisation] [Optimisation leads to safety] [Tested, proven, safe technology]
Quotation(s): 12

Code Family: PREDICTING FUTURE EVENTS

Created: 2015-06-03 19:39:29 (Super)
Codes (7): [All-knowing vehicle] [Better future] [Calculating future events] [Feeling of full control (360 degrees)] [Technology that anticipates] [Technology that is in control of the situation] [With technology you can "know"]
Quotation(s): 8

Code Family: SAFETY
Created: 2015-06-03 19:20:40 (Super)
Codes (17): [Absence of threat] [Absolute safety] [Added safety] [Car is not safe enough yet] [Demonstration of safety] [Feeling safe] [Importance of technology to safety] [Linking safety with technology] [Natural = Safe] [Optimisation leads to safety] [Safety] [Safety as priority] [Safety driver] [Safety made possible by technology] [Technology as solution to traffic accidents] [Technology saves lives] [Tested, proven, safe technology]
Quotation(s): 25

Code Family: SMART TECHNOLOGY
Created: 2015-05-28 20:55:58 (Super)
Codes (16): [All-knowing vehicle] [Feeling of full control (360 degrees)] [Flawless technology] [M2M communication] [Smart technology] [Technology that anticipates] [Technology that can be controlled] [Technology that can be felt] [Technology that doesn't get distracted] [Technology that is aware of the environment] [Technology that is in control of the situation] [Technology that makes decisions] [Technology that sees] [Technology that talks] [Technology that works] [With technology you can "know"]
Quotation(s): 15

Code Family: TECHNOLOGY IS BETTER THAN HUMAN (RELATIONAL)
Created: 2015-06-03 19:56:51 (Super)
Codes (10): [All-knowing vehicle] [Better than humans] [Feeling of full control (360 degrees)] [Flawless technology] [Replacing human] [Solution to the problem] [Technology as solution to traffic accidents] [Technology better than normal human drivers] [Technology that doesn't get distracted] [Technology that is in control of the situation]
Quotation(s): 13

Code Family: TRUSTED TECHNOLOGY
Created: 2015-05-28 21:00:48 (Super)
Codes (19): [Feeling of full control (360 degrees)] [Flawless technology] [Importance of technology to safety] [Predictive technology] [Reliability] [Reliance on technology] [Technological determinism] [Technology mimics human behaviour] [Technology now is better] [Technology that doesn't get distracted] [Technology that is aware of the environment] [Technology that is in control of the situation] [Technology that makes decisions] [Technology that sees] [Technology that works] [Technology with human attributes] [Tested, proven, safe technology] [Trust in technology] [Trustworthiness]
Quotation(s): 30

Code Family: VALUE OF EFFORT
Created: 2015-06-03 19:01:45 (Super)
Codes (15): [Appeal to science (learning process)] [Collaborative effort] [Commitment] [Complexity] [Experience] [Expertise] [History of development] [Mastering complexity] [Mastering complexity of driving] [Ownership] [Perfection] [Persistence & hard work] [Pushing the limits] [Taking challenges] [Trustworthiness]
Quotation(s): 21

APPENDIX 4 – Curriculum Vitae

Emil Angelov

Project Management Specialist

Career summary

A capable and committed professional with extensive experience in project management with internationally funded development projects. Skilled expert with first class analytical and communication skills with pro-active approach to problem solving and capable of providing research and analysis, project management, coordination and integration activities, drafting grant and project proposals and monitoring and evaluating project implementation.

Academic qualifications

University of London – London School of Economics and Political Science (2006 – 2010)
BSc in Information Systems and Management

University of Vienna (2013 – 2016)
MA in Science and Technology Studies

Publications

- Session Summary – New Approaches for Evaluating STI Policies and Instruments - fteval Journal for Research and Technology Policy Evaluation 39 (Sep 2014)

Research-specific work experience

- Developing research methodology design and performing data analysis on local strategies for social inclusion – Research Coordinator for Ludwig Boltzmann Institute of Human Rights (Sep 2012 – Feb 2013)
- Research and comparative analysis of ICT history of UK and Ukraine – Project Coordinator for OSCE Project Coordinator in Ukraine (Jun 2012 – Aug 2012)
- Research and analysis on electoral practices – Project Officer for OSCE Mission to Skopje (Sep 2010 – Sep 2011)

Key skills

AREAS OF EXPERTISE

- Project management (PMP)
- Grant & project proposal writing
- Research & analysis
- Monitoring & evaluation
- Information systems

PROFESSIONAL ABILITIES

- Extensive experience in project management across multiple industries and disciplines
- Extensive knowledge of the EU funding opportunities (CARDS, IPA) and procurement procedures and sound understanding of FP7 and Horizon 2020 research & innovation programmes
- Highly skilled in identifying areas of programmatic and project interest and drafting grant/project proposals
- Experience in developing research methodologies and training designs
- Experience in transfer of knowledge, developing communication capacities and consensus-building
- Highly skilled in designing and implementing project and business plans
- Experience in developing e- services and practices on a local level

MANAGERIAL ABILITIES

- An understanding and appreciation of the project cycle and effective planning
- Excellent ability to identify threats and opportunities and see the “big picture”
- Excellent ability to present complex information in a clear and compelling manner
- Strong research and analytical skills
- Outstanding capacity to translate qualitative and quantitative research results into clear reports and recommendations
- Balanced combination of hard and soft skills, functional competencies and personal traits