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Look Both Ways: Intersections Of Past And Present In The Shaping Of Relations Between Cyclists, Pedestrians, And Driverless Cars

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LOOK BOTH WAYS:

INTERSECTIONS OF PAST AND PRESENT IN THE SHAPING OF RELATIONS BETWEEN CYCLISTS, PEDESTRIANS, AND DRIVERLESS CARS

By

Davi Aragão Rocha

A Thesis

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Windsor, Ontario, Canada

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ABSTRACT

Driverless cars are expected to transform society in many ways. Since nowadays most collisions are due to human error, safety is among the most anticipated benefits of the technology. The promise of near zero fatalities on roads appears in many industry statements and government reports. Because of that, every collision, especially involving fatalities, receives much attention from the media and public. That kind of scrutiny resembles the early days of the conventional automobiles. In those days, automobiles – also called "horseless carriages" – were not well received by the majority of the population. Cars brought conflicts and fatalities on roads to a level never seen before. The automobile industry, using public relations, shifted society's perception about who belongs to the roads, and who should be blamed for the rise of fatalities. That shift influenced legislation and tort law in motor-vehicle centric ways. It also created cities with infrastructure focused on the automobile at the expense of other means of transportation. Today, one of the most difficult challenges for driverless cars is the unpredictability of pedestrian and cyclist behaviour. To accelerate the deployment of the technology, some are considering the necessity of law enforcement against pedestrians and other street users. Centred on urban environments, pedestrians and cyclists, and with an interdisciplinary and advocacy-oriented approach, this thesis seeks to contribute to the debate about the safety and deployment of driverless cars, its influence on law and legislation, and how a car-centred view of the technology may limit its potentialities.

DEDICATION

Para Valentina.
Para Emilly.
Para meus pais e meu irmão.

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Of course, a distinctive thanks to my parents, whom I miss every day, remembering the coffees with "flavour of good conversation."

Thank you, Emilly - my wife, partner, friend - for being helpful, supportive and patient, especially during the last few months. And the most special thanks of all: to my daughter Valentina. I know it was not easy for you. Thank you for your comprehensiveness and maturity. Thank you for your smiles and hugs.

TABLE OF CONTENTS

INTRODUCTION

Right now, in Canada and throughout the world, academics, lawmakers and companies are debating a technology that is expected to revolutionize our lives and our cities. The driverless car comes with the promise of solving many of today's problems on our roads and cities. The most proclaimed promise is the safety it can bring to streets, with the expectation of reducing deaths on roads to numbers close to zero.

We have been using the conventional automobile in our cities now for more than a century. It is a central piece of the urban architecture not only in the way our cities were and are built. With time, it became the central object and concern of the legal framework about mobility. This work proposes a critical observation of elements from the past and the present as a form to understand possible ways driverless cars may be used in the pursuit of safer roads and urban environments that respects the rights of pedestrians and cyclists, helping to create cities where equity and accessibility are priorities.

This work, rather than seek closed answers, proposes a search for questions that benefits that pursuit. It is divided into three chapters. After this introduction, chapter 1 investigates the changes that occurred in the last century that made possible the centrality of the automobile in our cities. The new technology of driverless cars is presented in chapter two. Initially, it is argued that driverless cars must be defined as

robots. The perspectives for deployment, the governmental and legislative debates are also presented. By the end of the chapter, a brief discussion about the first fatalities involving self-driving cars is made. The centrality of the safety argument in the deployment of the technology is debated in the last chapter. From that point, driverless cars' difficulty in dealing with the unpredictability of pedestrians and cyclists will be discussed. It will be argued that challenge must not be an excuse to develop more law enforcement against pedestrians and cyclists. It will be also argued that to achieve the objectives of the safety argument, the robot-car must be part of a complex system where it may be integrated as one of the many solutions for better cities. It will be also questioned if framing this technology within the values of the automobile era is a way of limiting its potential to help us to achieve more equity.

Throughout the work, many names are used to designate the technology of the robot-cars: autonomous cars, driverless, self-driving. The terminology that must be used for the technology is debated in academia, companies and government. Despite the importance of those debates, that is not, however, the focus of this work. It was decided, therefore, for the most used terms to be employed without entering in the details of the significance of each of the names used.

The focus of this study is driverless cars of level 4 and 5 of autonomy.[1] In some moments, however, conventional cars with Advanced Driver Assistance Systems

[1] See section 2.2.

(ADAS) are part of the discussion. Also, it should be noted that the focus of the work is the relation between these cars and active transportation in urban environments.

CHAPTER 1

FROM KILLER MACHINE TO FUTURAMA

Conflicts between people moving within the cities have always existed. The advent of the automobile, however, elevated those conflicts and the number of fatalities on streets to a new stage.

In this chapter, the early days of the automobile will be presented as a way of understanding how it became a symbol of desire and freedom. The history of the automobile helps us to understand changes in the aspects of our cities and also shifts in some perspectives of court decisions and legislation. The chapter starts with the early cyclists and how they paved the movements that would help spread the centrality of the automobile throughout the last century. Then it moves to the opposition that part of the population had against the new machine, how the manufacturers diminished hostility against their product, and how they created perspectives for a future constructed by and for cars.

1.1 – Before motorists: the wheelmen

Nowadays, if one turns on the television in any news report on some "controversy" surrounding the creation of bike lanes, or if one reads some debates on social media, it seems that cyclists and motorists are on complete opposite sides of an urban war. Historically, however, that was not always the reality. Cyclists from

the late 19th century and early 20th century had a central role in the spread of the motor culture and dominance of automobiles. Motorists and cycling aficionados were not only side by side in most of their claims and objectives: they were usually the same people. As Reid wrote: "If a paternity test were possible, it could be shown that the first motor cars had much more cycle DNA in them than carriage DNA. The cycle was a vital part of the trunk of the automobile's family tree."[2]

The founder and editor of *The Autocar* - the world's first weekly motoring magazine - Henry Sturmey, for example, wrote a classic book on cycling and was a cycling journalist until his last day. During the 1890s he was at the same time editor of both *The Autocar* and *The Cyclist*.[3] Another example, Frederick Simms, founder of the Automobile Club, was in his youth member of the Cyclists' Touring Club.[4] Many of the inventors pursuing the creation of the automobile were cycling aficionados and bicycle workshop owners, or, at least, used the bicycle as the base of their experiments. No fewer than 64 of the early motor companies - like GMC, Chevrolet and Cadillac - had their origins as bicycle factories and workshops. It was a common fact that motor companies owners, like Dodge and the founders of Aston Martin - proud of their motor engines - were also passionate cyclists.[5] To build a quadricycle

[2] Carlton Reid, *Roads Were Not Built For Cars: How Cyclists were the First to Push for Good Roads & Became the Pioneers of Motoring*, 1st ed (Washington, DC: Island Press, 2015) at xiv.
[3] *Ibid*.
[4] *Ibid* at xix.
[5] *Ibid* at xiv.

for his experiments, Ford used bicycle elements; and Benz constructed his first self-propelled vehicle - a tricycle - with bicycle parts.

A perfect example of that connection between bicycles and automobiles was the Canadian company - with a self-explanatory name - *The National Cycle & Automobile Co. Limited*. In *The Canadian Magazine*, one could read ads of this company selling automobiles and bicycles as if they were from the same "family" of vehicles, almost if the ads were one, as we can observe in image 1 below.

xxxvi CANADIAN MAGAZINE ADVERTISER

A Self-Contained Carriage

The Locomobile is Canada's only horseless carriage. It is the only carriage made in Canada. It is steam-driven.

The Locomobile

may be ridden anywhere, over the roughest roads, up the steepest grades, at the highest speeds.

There is no dependence on delicate electrical connections, no heavy storage batteries, no smell of exploded gasoline.

The weight is only five hundred pounds. You may have a catalogue for the asking. Call and see the carriage. Get a ride on it.

The National Cycle and Automobile Company, Limited,

34 King Street West, Toronto. 122 Peel Street, Montreal.

154 Princess Street, Winnipeg. 46 Barrington Street, Halifax. 50 King Street, St. John, N.B.

THE 4-POINT E. & D.

E. & D. SPECIAL, $70. E. & D. LADIES' ROADSTER, $60.

The left cut shows the 1900 E. & D. Special with gear case, keeping chain clean. This gear case is the lightest chain protector manufactured.

The right cut shows the E. & D. Ladies' Roadster with low drop frame, allowing the use of an ordinary skirt

LOCALLY GUARANTEED.

The E. & D. Bicycle is the only bicycle with four-point bearings, which run with less effort than any other, and with less strain on the rider. Everything about the E. & D. is good. E. & D. quality satisfies. Get catalogue.

The National Cycle & Automobile Co., Limited.

34 King Street West, Toronto. 122 Peel Street, Montreal.

154 Princess St., Winnipeg. 46 Barrington St., Halifax. 50 King St., St. John, N. B.

Image 1. Canadian Magazine Advertiser, Vol. 15, no. 1, May 1900 at XXXVI.

It should not be a surprise that cyclists - also known as "wheelmen" - would become the first automobile enthusiasts. Only in the 1930s, when automobiles sales outpaced bicycles sales for the first time in the United States, did bicycles start to be

related to lower economic classes. The initial history of the bicycle is remarkably elitist, metropolitan, militarist, sexist and racist. The bicycle clubs took years before accepting women and black members.[6] Bicycles were toys of the elite, especially white men that used them to show strength and "masculinity." It was perceived not only as a revolutionary and libertarian transportation but also as a symbol of a rich, adventurous, free and healthy life, just like the automobile would be seen decades later. By reason of bicycles, for the first time, people were travelling the road for pleasure.[7]

For the majority of society, however, just like the motorists a few years later, the first cyclists were seen as dangerous and egocentric men that would cross the roads with no care for whoever was in their way, causing accidents and confusion.

1.2 – Paving the way to a motor society - the good roads movement

Although the bicycle industry began in France in the 1860s, it became widespread only around the mid-1880s, especially in North America and Great Britain, with the introduction of a more affordable, modern geared and safer model.[8] In Canada, the first bicycle club was formed in 1876 in Montreal. In September of 1882 in Ontario, to protect cyclists' rights and organize championships, The Canadian

[6] *Ibid* at 3.
[7] James J Flink, *The Automobile Age.* (Cambridge: MIT Press, 1990) at 4.
[8] *Ibid*.

Wheelmen's Association (CWA) was formed,[9] and one year later, the first volume of its magazine was published[10] (image 2). In the United States, the League of American Wheelmen (LAW) was organized in 1880. In France and Great Britain, many magazines for cyclists were in circulation. Some, like the French *Le Vélo*, founded in 1891, were published daily.[11]

THE
Canadian Wheelman.

VOL. I. LONDON, SEPTEMBER, 1883. NO. 1.

PROSPECTUS.

TO THE WHEELMEN OF CANADA:—

In presenting to you this, the initial number of our journal, which we hope will fill a great want among our wheeling friends in Canada, we take great pleasure in stating that we intend it to rank with the best of this class of periodicals published, and it lies entirely within the power of all of you to make it so.

From the growing popularity of this sport our time of commencing is opportune, and many circumstances combine to present a fair outlook toward a prosperous career for our publication:

Firstly, as it is, at the present time, the only paper of its kind published in Canada; this alone should recommend it to everyone at all interested in bicycling.

Secondly, in commencing the paper, we have secured the best talent, possible, both in writing and engraving.

Thirdly, as often as possible we hope to publish the portrait of one of our prominent Canadian wheelmen, a specimen of which will appear next month, in the person of Mr. Percy Doolittle, who is well known to all our readers.

Fourthly and lastly, we hope to keep increasing our circulation till the paper reaches every person who is, at all, an admirer of the manly sport, and to that end we would respectfully ask that all our wheeling friends heartily respond by subscribing as soon as possible, and thereby help us to accomplish our aim.

We have been sadly disappointed by the engravers, in not having our heading, and portrait of Doolittle finished in time for this issue, but we hope to have everything complete for our next number.

In reply to several enquiries received, we might say that we have no connection whatever with the late Hamilton Bicycle, which, we are led to believe is now a thing of the past.

OTTAWA NEWS.

OTTAWA, Sept. '83

MR. EDITOR:

I am glad to see the appearance of a journal in the interest of cycling in Canada, which speaks well for the progress of this sport. Ottawa Club wishes you success.

The first meeting in Ottawa, in the interest of cycling was held on Aug. 4th, 1882, when a club was regularly formed, called the "Ottawa Bi-cycle Club," with the following officers:—President, Mr. G. A. Mothersill, (now a member of the C. W. A. Board); Captain, Mr. M. Bayly; 1st Lieut., Mr. J. A. Seybold, and Mr. F. H. S. Jenkins, Hon. Sec-Treas. At a later meeting Mr. F. W. Harrison was appointed 2nd Lieut., and the Club color and uniform decided upon, the former cardinal and the latter dark blue pedal jackets, knee breeches and ribbed stockings, with a gray hair-cloth helmet. The rules of the Toronto Bicycle Club were, with some modifications, adopted at this meeting.

On the 15th of the same month the "inaugural meet" took place at the Bank street toll-gate nearest the city and about half a mile beyond the city limit. There were about ten members present. That on distant a point of starting should have been selected was due to a feeling of consideration for the city horses to a certain extent, but chiefly to the existence of a slight feeling of uncertainty on the part of some of the riders, and an anxiety to be as far as possible from the public gaze. If I recollect rightly the hour was very early, perhaps for the same reason.

During the balance of the season of '82 the Club fleeted, adding several new members to its roll, and "meets" were held regularly every Saturday.

At a meeting held in September the Club badge was decided upon. It consists of a silver shield with "OTTAWA," in relief diagonally across the face, and the letters "B, and "C" above and below also in relief, the shield being worn on a rosette of cardinal ribbon. This year the badges of officers were somewhat changed, a silver bar on which is engraved the office of the wearer having the shield suspended from it by a little silver chain.

At the second annual meeting, held on the 19th of April this year, the officers for '83-4 were elected, Mr. Mothersill being re-elected President; Mr. Jenkins, Captain, in place of Mr. Bayly who resigned upon leaving Ottawa; Mr. W. C. Young, Hon. Sec-Treas; Mr. E. Woodburn, 1st Lieut., and Mr. Blythe 2nd Lieut.; the latter two in place of Messrs. Seybold and Harrison, resigned.

The Club now numbers about twenty-one members, and is constantly increasing. It also belongs to the C. W. A to the extent of fifteen, and will shortly add five more to the list.

Club "meets" are held regularly twice each month, (one afternoon and one evening) and they are for the most part successful in every respect.

At two large public demonstrations held here this season bicycle races were decidedly the feature. We possess some very stout and fast riders, though a member of the Ottawa Club succeeded in carrying off second prize in a three mile at the Grand Lodge of Odd Fellows' sports here. Mr. G. A. Wilkins, of the O.B.C. taking first easily in 12:56, the track being eight laps to a mile, and partly sod, in fact, most of it.

The City Fathers are considering our prayer for a quarter mile cinder path in Dominion Park. We "hope we may get it."

Touring is decidedly the preferable phase of this sport indulged in by our members. Our roads are very good and scenery unsurpassed in Canada. Chelsea, high up among the Laurentian Hills, on the River Gatineau, Aylmer, on Lake Deschene; Cumberland, on the Ottawa, and Richmond, away inland, are all capital objective points, being distant from nine to twenty miles. Aylmer is, perhaps, our favorite run, distant about ten miles. This road is decidedly our best, and the town possesses accomodation (in the shape of Mrs. Ritchie's hotel) not often met with in small places.

Next Saturday about six of our members start off on a Western tour, Kingston being the objective point; but some intend pushing through to Toronto. If the weather is fine, they will have a delightful time, as they possess within themselves the means of making the halting periods as pleasant as when on the wheel.

Our Captain plays well, and does his duty in accompanying the songs of the boys, among whom good voices seem to rule.

Messrs. Hillman, Herbert & Co., the well-known manufacturing firm of Coventry, England, are well represented in the O.B.C., there being no less than twelve of their machines in it, nine "D. H. F. Premiers," and two "No. 0's," the former give the best of satisfaction. Besides Messrs. H. H. & C. we have machines of the Challenge, Sanspariel, Florentine and Royal Canadian type, nearly all good machines.

YOURS,
"OTTAWA."

Image 2. The Canadian Wheelman Magazine, Vol. 1, nº 1, September 1883.

[9] Kenneth V Smith, "Competitive Cycling in Canada", (2012), online: *Canadian Encyclopedia* <https://www.thecanadianencyclopedia.ca/en/article/cycling>.

[10] The Canandian Wheelmen's Association, "The Canadian wheelman" (1883) 1:1 Can Wheel Mag.

[11] Flink, *supra* note 7.

The motor companies have much to thank those leagues, associations and their magazines. Much of their efforts and objectives directly helped to turn the automobile into a real transport alternative at the beginning of the century.

Horse-drawn traffic did not need smooth surfaces, and although there were techniques for better constructions since the beginning of the nineteenth century, the competition with the steam locomotive delayed interest in better roads until the "bicycle craze" of the 1880s and 1890s.[12] In that century, many country roads "were rutted in winter, dust-bowls in the summer and churned with deep mud at most other times. Urban areas fared better, with macadam roads capped with layers of dust-bound crushed stone. Major thoroughfares in cities were often topped not with setts – don't call 'em cobbles – but with wood."[13] In the 1880s, cyclists started to promote highway reforms, culminating in the Good Roads movement.

The lobby of Britain's Roads Improvement Association, created by cyclists, served as inspiration for the Good Roads movement in North America.[14] The League of American Wheelmen (LAW) had as one of its primary goals "the improvement of public roads and highways."[15] The leading bicycles manufacturer in the U.S, Colonel Albert Pope was one of the most prominent leaders of the movement and helped found the LAW Good Roads Magazine. The lobby made by the League resulted in the creation of the Office of the Road Inquiry in 1893, that then became the Office of

[12] *Ibid* at 3-4.
[13] Reid, *supra* note 2 at 1.
[14] *Ibid* at 2.
[15] Flink, *supra* note 7.

Public Roads.[16] With magazines and associations created with the purpose of spreading the idea of the movement, this topic became a constant feature in the newspapers of North America.

Proposing that, for economic matters, farmers should take the lead of the movement for the improvement of the roads in Canada, two articles under the "The Road Question" from *The Western Advertiser*, in January 27th of 1893, make explicit the leadership of the Canadian Wheelmen's Association and the connection with the American movement influencing the debates in Canada. Interestingly, in just a few words – and probably inadvertently, and without even mentioning automobiles – the articles anticipated the influence that the horseless carriages would have a few years later over rural life, and suburbanization. They also punctuated how the competition with the railroads undermined the condition of the roads. One article, noted:

> Mention is frequently made in the columns of the daily press commending the Wheelmen's Association for having forced the road question upon the public in a way to result, possibly, in great good. But this matter of good roads should not be left to bicycles riders, who of course, are somewhat interested. It should be a farmer's movement, for they are the class most interested. If they produce crops, those crops must be sent to market from the farms. Manufacturers, merchants and mechanics can, and do congregate about the railroad stations or points of water transportation, and to them the matter of roads is a secondary consideration.[17]

Also, in the other article titled "The Good Roads Movement"[18]:

> The speakers at the Iowa convention have emphasized the necessity of a radical change. [...] Another [speaker] showed how freedom of social intercourse over good roads improves the individual and the community, helps to enliven the social life, and thereby 'arrests the regrettable tendency

[16] *Ibid* at 5.
[17] "The Farmers Are More Interested Than Are Bicycle Riders", *West Advert* (1893) 6.
[18] "The Good Roads Movement", *West Advert* (1893) 6.

> of many people to rush to the cities.' And he said that if life was made bright on the farm there would be fewer inmates of insane asylums, which doubtless is true.

The New Brunswick Good Roads Association, in the report of its convention of 1897, also informs about the influence of the American movement. It stated that "since the agitation for better roads commenced in the United States some years ago a vast fund of information had been gathered from all sources, and this information was available to us,"[19] and one of its members suggested distributing a pamphlet with positive arguments for good roads published by the League of American Wheelmen.

In the *Hamilton Evening Times* from March 5th of 1896, an article detailing debates and speeches during the annual meeting and banquet of the Hamilton Bicycle Club gives another example of the leadership of cyclists in the Good Roads movement:

> The bicycle is no longer a toy, but a means of getting around in business, and that must be its ultimate purpose. The C.W.A. must, he [a member of Hamilton Bicycle Club] said, keep its grip on the wheelmen, however, and agitate for good roads. The farmers of today in many places oppose the good roads movement, considering it something that the wheelmen are trying to shove down their throats, but the boys on the farms will soon ride wheels; in a few years they will be voters; then good roads will be assured. (Applause).[20]

Despite some conclusions we may have from that speech, farmers were not blind to the poor quality of the roads. As stated by The New York Times on

[19] *Good Roads Convention for the Province of New Brunswick (1897: Saint John, N.B.)* (Saint John, 1897) at 60.

[20] "The H.B.C. Fully Organized With a Very Strong Executive - The Annual Banquet a Success in Every Way" (1896) Hamilt Times 5.

November 13th of 1892: "The great majority of the farmers of the United States never saw a good road and do not know what it is. […] A road that is a morass in Spring, a Sahara in Summer, a series of ruts and ridges frozen stuff in later Autumn, and a slough whenever there is a thaw in Winter is to them the normal means of rural communication."[21] They worried about the costs of the improvement demanded by the wheelmen. That was the main reason for their opposition. Since products of farms were transported by horse-drawn vehicles, which did not need smooth and hard roads; they did not wish to support a movement that could mean increasing taxes and that, in their understanding, farmers were not the real beneficiaries. Besides that, farmers themselves did the local roads maintenance, which was far from the ideal, but at least they were in charge of the costs and the work.[22] They did not trust paying for a centralized system, which was required for large scale improvements. The urban-elitist aspect of cycling also played a role in their suspiciousness about the wheelmen intentions: "farmers most certainly mistrusted the 'peacocks' on their bicycles, riding out from cities and lecturing country people on what was good for them."[23]

In disregard of the hope of that speaker in the Hamilton Bicycle Club about young future farmers becoming cyclists and adhering to their cause, in fact, farmers became one of the first occupations to use cars. They became motorists and only

[21] Reid, *supra* note 2 at 5.
[22] *Ibid*.
[23] *Ibid*.

then started to support the movement. As will be seen in the next section, the automobile was greatly responsible for their support. That does not take, of course, the credit from wheelmen – for better and worse – for the beginning of the huge transformation in the cities and the country. As the New York Tribune, cited by Carlton Reid, said in 1900, when there were already thousands of cars on the streets: "the part which the bicycle has taken in the promotion of highway improvement is acknowledged to be important. Perhaps it might not be an exaggeration to say that the influence exerted by wheelmen in support of that work has been stronger than that proceeding from any other source."[24]

1.3 – Beyond good roads

The Good Roads Movement was not the only impact cyclists had on society. Bicyclists pushed for key innovations in "mass production, repair shops, road building, traffic laws, and legal precedents."[25] These transformations impacted society economically, technologically and legally, creating central features that paved car's dominance beyond the physical infrastructure. The development of mass marketing, the modernization of the labour process, the vertical integration of production, the creation of machines with interchangeable parts, and the construction of mass markets for transportation technologies, all crucial for the development of the auto

[24] *Ibid*.
[25] Zack Furness, *One less car: bicycling and the politics of automobility* (Philadelphia: Temple University Press, 2010).

industry, were influenced or created by the bicycle industry, especially by ideas of Colonel Albert Pope for his factories.[26]

About the impact of the bicycle industry and the cyclists' movements to motoring's rise, Carlton Reid declares that:

> Without cycles and cyclists, motoring would have evolved very differently, and perhaps in a far inferior form. Cyclists became the first and staunchest evangelisers of motoring because they had been the first to awaken to the possibilities afforded by self-determined mobility – free from fodder, free from timetables, free from rails. And, as they were intimately aware of the benefits that came from the provision of smoother surfaces upon which to glide, pushy Victorian cyclists agitated for highway reforms.[27]

Furness argues that the legacy of the bicycle's origin was "the construction of a mobile subjectivity, the development of an entire meaning system around personal mobility, and the disciplining of bodies and the environment in service of autonomous mobility."[28] The author tries to not simply validate the popular vision of the bicycle as a "freedom machine," arguing that there was a constant tension between the emancipatory potential of the bicycle and its simultaneous use in the construction of a "consumerist, individualist, and disciplinary paradigm of mobility."[29]

Although technological innovation and falling prices played a role in increased sales during the 1890s, there was an obvious correlation with the increase in expenditures on advertisement in that decade.[30] The advertisements, however, in opposition to what was common at that time, did not focus on the use of the bicycle

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[26] *Ibid*.
[27] Reid, *supra* note 2.
[28] Furness, *supra* note 25 at 17.
[29] *Ibid*.
[30] *Ibid*.

nor its innovative technology. The advertisements sold the *image of the cyclist*, creating a *system of meaning* around the bicycle. The subject of many ads was not really the vehicle and its functionality, but the consumer itself: *the cyclist was the subject of consumption*. Of course, there were still many ads in the traditional format, trying to convince through logical arguments about the utility and technical aspects of the product, but many companies, including the most successful ones, adhered to an alternative and new aesthetic of advertisement. With the use of skilled artists to construct visual narratives, the companies made images and emotion, not texts and reason, the central appeal for the consumption of bicycles. Relating bicycles to visual symbols of astronomy and astrology; wings and sky; sexualized women images and goddesses; ads tried (with success) to make bicycles the symbol of elevation, freedom, and desire.[31]

With this use of emotion and meaning by advertisers, the act of consumption itself was included in the practice of cycling. That opened the possibility to create a wide range of products not related to the act of cycling itself but with the *aura* of cycling and with the *identity* of cyclists.[32] To be a wheelman had the significance of being a person of the modern era, a participant of a modern culture. To gain this identity, however, it was not sufficient to simply own a bicycle but also a range of accessories and specific outfits.

[31] *Ibid* at 17-18.
[32] *Ibid* at 18-19.

1.4 – The rise of the "horseless carriage"

Cars are an antique dream. It dates from the 13th-century predictions of the philosopher Roger Bacon about its possibility. Some drawings by Leonardo da Vinci and Albrecht Dürer, during the Renaissance, are interpreted as prototypes of the motor cars.[33] There are some reports about the creation, in China, of a self-propelled vehicle around 1665 by two French Jesuit missionaries, but it was only during the last half of the 18th century and the very beginning of the 19th century, that governments, moved by militaristic purposes, and private individuals started to subsidize some projects and experiments with steam-powered vehicles.[34] Nonetheless these first projects did not succeed in creating a road vehicle more reliable and affordable than horse-drawn vehicles; they served as a demonstration of what was yet to come.[35]

Beside the fact that before the last century roads were horrible for self-propelled vehicles, the enterprise in the pursuit for a vehicle to long distance travels on roads had the uneasy task of creating something able to compete not only with horses, but with railroads that were, in the 19th century, a much cheaper mode of transport for long travels, and had a far superior technology. Within that competition, there was the lobby of the horse-drawn carriages and railroad companies that

[33] Brian Ladd, *Autophobia: love and hate in the automotive age* (Chicago: The University of Chicago Press, 2008) 14.
[34] Flink, *supra* note 7 at 1.
[35] *Ibid* at 2.

influenced the creation of legislation limiting the use of steam road vehicles like, for example, the *Locomotive Act* that the English Parliament passed in 1865.[36]

The Locomotive Act – also known as "The Red Flag Act – influenced greatly against the automotive idea in England. It limited the speed of the self-propelled road vehicles to 2 mph (3.2 km/h) in towns, and to 4 mph (6.4 km/h) on open highways. The most impressive - even picturesque – aspect of this act, though, was its requirement that someone waving a red flag (or carrying a red light during the night) should be walking about 5 meters ahead of the vehicle so the citizens could be aware of the "dangerous machine" that was passing.[37]

Despite the lobby of companies that saw the development of self-propelled road vehicles as a threat to their business, during the nineteenth century, the evolution of a modern urban-industrial social order in Western Europe and North America made the chase for such a vehicle a multinational quest.[38] In many countries, especially France and the United States, inventors were at the same time trying to succeed in the automotive project. Because so many experiments and inventions were in testing in the same period, there is no conclusion about who and when the automobile was invented.[39]

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[36] *Ibid*.
[37] Kenneth R Schneider, *Autokind vs. Mankind*, first ed (New York: W. W. Norton & Company Inc., 1971) at 32.
[38] Flink, *supra* note 7.
[39] Cotten Seiler, *Republic of Drivers: a cultural history of automobility in America* (Chicago: The University of Chicago Press, 2008) at 16.

Carlton Reid says that some praise Carl Benz as the father of the modern motor car.[40] With parts bought from Germany's most prominent bicycle shop, Benz's *Patent-Motorwagen*, from 1886, was in fact, not a "horseless carriage," but a tricycle with a motor attached. Some, however, claim that Siegfried Marcus, an Austrian engineer had a working gasoline automobile at least ten years before Benz's invention.[41] Marcus, though, for being Jewish, had his name erased from history by the Nazi government. The Nazis, on exalting Benz as the creator of modern motoring, also erased the obvious and direct connection of his invention with the bicycle. In the 1930s, the bicycle had lost its elite and progressive aura; it became a vehicle for the poor and the face of the past century. These characteristics, for the Nazis, should not be linked with the machine that symbolized a new modern era.[42]

Independently of when and by whom the automobile was invented, the fact is that only in the last decade of the 19th century, with the creation of the combustion motor, the "horseless carriage" came out of the inventor's circles and began to be more widely commercialized and occupy the streets and highways.

On December 19th of 1895, a small note in the Ontarian newspaper *The Glencoe Transcript* claimed that "the horseless carriage is now a reality, although it has not yet reached the state of perfection which it is hoped it will attain within the next year or two." It also announced that "before the end of the century the horses

[40] Reid, *supra* note 2 at 8-9.
[41] *Ibid*.
[42] *Ibid*.

will cease to be used for locomotion purposes."[43] Between 1895 and 1896, other Ontarian newspapers, like *The London Advertiser* and *Watford Guide-Advocate*, gave attention to "horseless carriages contests"[44] and announced that within one or two years they should have the "perfect machine."[45] On June 18th of 1896, The Glencoe Transcript also announced that:

> the bicycle fever will not have spent its fury before another craze has developed and taken hold of the community. The horseless vehicle is the coming sensation. [...] It is predicted that the fever will be due in this country in two years and that before five years have elapsed every city will be turned into a veritable pandemonium of wheels [bicycles] and automobiles. The horse will soon become a memory of the past and the street car's days seem to be numbered too.[46]

Indeed, by 1900, although horses were still in heavy use, the number of registered automobiles in the United States was already eight thousand; by 1910, 458.500, and by 1929, the number had jumped to 23.1 million. By 1913, the automobile outproduced buggies and wagons.[47] By 1922, "some 135,000 suburban homes in 60 cities were already wholly dependent on automobile transportation."[48] Canada, by January of 1925, was the third country in number of registered automobiles - 636,489 - outnumbered only by the United States and Great Britain.[49] A survey from 1927 showed that 55.7% of the American families owned at least one automobile, and the industry statistics show that, at that same year, for the first time,

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[43] "The Glencoe Transcript: January 4, 1894-December 31, 1896", online: *Canadiana* <http://www.canadiana.ca/view/oocihm.N_00227_189401/840?r=0&s=1>.
[44] "A Horseless Carriage Contest", *London Advert* (1896).
[45] "The Horseless Vehicle", *Watford Guid* (1895).
[46] "The Horseless Vehicle the Next Craze", *Glencoe Transcr* (1896).
[47] Schneider, *supra* note 37 at 34.
[48] James J Flink, "The Metropolis in the Horseless Age" (1984) 424:1 Ann N Y Acad Sci 289 at 294.
[49] "News of the Automotive Industry", *Free Press* (1925) at 18.

there were more sales of new automobiles for replacement demand than for first time owners.[50]

What was the reason for that growth in the first decades? For some, posing this question in 2019 may sound naive. After all, for most contemporary citizens, the superiority of cars is obvious. Yet, this alleged superiority was not that obvious for most people in the late 1800s. For the masses, what was evident was the link between cars, deaths and chaos.

1.5 – The utility thesis

From the beginning of the 1920s to the 1940s, there was a transition in the perception of the general population about the importance, necessity and symbolic value of the automobile. This move includes the transference of the responsibility for injuries and deaths from motorists to pedestrians. In the words of Schneider: "Ever so subtly Americans ceased to judge the motor car, and the motor car began to judge America."[51]

For some historians, this was a natural consequence of the battle between different technologies, the best one winning; for others, it was a construction of social actors, pushing society to a path that suited their interests.

[50] Flink, *supra* note 46 at 292.
[51] Schneider, *supra* note 37 at 37.

The main reason most historical researchers put for that evolution of motor car sales during the 1910s and 1920s was the increasing knowledge of the utility of the automobile in the context of *work*[52] - making the transport of people and goods easier – allied to the efficient production and falling prices since 1906, and specially with the introduction of the low-priced Ford Model T in 1908, produced in Windsor (Canada) and Detroit (United States).[53]

One of the arguments commonly used by the proponents of this *utility* thesis[54] is that the early adoption of automobiles by doctors and farmers - two professional categories usually associated with work and practicality - helped to weaken the early popular condemnation of automobiles and to spread the vision of the motor vehicle as a machinery useful for the context of work. Moreover, the wide adoption of motor vehicles by farmers visibly broke the isolation of the rural life, made easier the farm labour and reduced enormously the cost of products transportation, resulting in more profit for the producers and lower prices for the consumers in the cities.[55]

One of the most critical writers on the motor-centred society, Kenneth Schneider summarizes:

> [...] doctors found the car superb on missions of mercy. San Francisco discovered in 1906 that, unlike the horse, the automobile never tired during the emergency of the Great Fire. Men then began to realize that it could *work* for them. After 1910 the farmer was awed to find he could get to town

[52] Seiler, *supra* note 39 at 38.
[53] Flink, *supra* note 46 at 291.
[54] Seiler, *supra* note 39.
[55] Flink, *supra* note 48.

> in fifteen minutes instead of an hour and a half. But when the city man concluded that the Colt Runabout he used for Sunday outings was wasting away when it might just as well carry him to the office, the automobile was in.[56]

As explained in the previous section of this work, the automobile had the opposition of many groups. On the other hand, it also had many enthusiasts, inventors and manufacturers praising the new machine as responsible for many potential benefits for society and individuals. Like bicycles in the late 19th century, cars were held by enthusiasts as responsible for the promotion of healthier social relationships and well-balanced life, the break down of the class distinctions and even the strengthen of the character. The automobile was, for some, the cure for the problems of modern life.[57]

Cities in North America from the turn of the nineteenth century were not as idyllic as many like to imagine. For thousands of urban citizens, "modern life" brought by the Industrial Revolution meant living in crowded slums with lack of sanitation and privacy.[58] In addition to that, try to imagine living in a city where you would smell manure almost all the time you were outdoors and could step over horses' waste almost in every street you would walk. Imagine during the rainy seasons those excrements turning into a syrupy mass entering homes.[59] That unpleasant scenario was true in major cities. It is estimated that around 1,135 tons of manure and 227,125

[56] Schneider, *supra* note 37 at 28.
[57] *Ibid* at 30.
[58] Mark S Foster, *From Streetcar to Superhighway: American City Planners and Urban Transportation, 1900 - 1940* (Philadelphia: Temple University Press, 1981) at 9-10.
[59] Flink, *supra* note 48.

litres of urine were deposited by horses on the streets of New York City each day.[60] Especially in the urban context, where the great number of people gathered is the perfect environment to boost the spread of diseases, that image gives a good sight of how horses were related to many health public problems. Flies used the manure - always present on the streets - to breed and could carry more than thirty diseases. Typhoid fever, tetanus, diarrhea - one of the main health problems of children of that time - and other diseases were connected to the horse population in the cities.[61] In addition to all that, it was common to have carcasses of horses on the streets. It is estimated that about 15,000 dead horses were removed from the streets of New York every year.[62]

The automobile appeared for some groups as a "clean" alternative and could be a way out of that dirty environment. That may sound odd for us as we are about to face a climate change calamity, caused in great part by car dependence.

The emphasis in the publicity pieces of the quality and the practical benefits of the motor vehicle are used as an argument that cars were bought not because of their invisible enchantments, but because of their practical use.[63] In opposition to this argument, some say that, actually, the industry was willing to take the fear off of the popular imaginary and to turn automobiles into mundane useful objects, into something that could be used routinely. That was the explanation for the effort to

[60] Foster, *supra* note 56 at 10.
[61] Flink, *supra* note 46 at 290.
[62] Foster, *supra* note 56 at 10.
[63] Seiler, *supra* note 39 at 39.

demonstrate its quality, safety and facility.[64] There was no need to demonstrate the excitement, the thrill or the adventurous nature of the automobile since those emotions were evident and "had been established during its earliest years by a myriad of literary and visual artists, journalists, philosophers and commentators."[65] These sources, however, usually described this thrill in the form of accidents, lack of safety and poor performance.

1.6 – From "king of the killers" to "king of the roads": the construction of the jaywalker

Writing about court decisions from the nineteenth century involving cyclists, Waters demonstrates that, "as is the case today, cycling was a contested activity."[66] The rise of the bicycle and the wheelmen did not come without incompatibilities with the current social order. Transgressions and disagreements could be evident with the "macho" aspect embedded in some cyclists' practices like "scorching,"[67] a way to show masculinity and "status by riding fast and recklessly."[68] Conflicts between cyclists and other street or sidewalk users were common and "disputes sometimes ended up in injury or court or both."[69]

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[64] *Ibid*.
[65] *Ibid*.
[66] Christopher Waters, "The Rebirth of Bicycling Law?" (2013) 91 Can Bar Rev 395 at 398.
[67] Glen Norcliffe, *Critical Geographies of Cycling: History, Political Economy and Culture* (Farnham: Ashgate, 2015) at 159.
[68] Celso Minoru Sakuraba, *Who Pays for Road Violence? Rethinking Roads, Cycling, and Tort Law* University of Windsor, 2018) at 9.
[69] Waters, *supra* note 64 at 398.

As disruptive as the bicycle was — and still can be — the changes and conflicts it caused during that time were in no way comparable to the ways the automobile's emergence destabilized the dominant social constructions of the street. Cars were uninvited guests, unwelcome and incompatible with old street uses.[70] Children commonly played on the streets, and pedestrians could walk anywhere they wanted. The most dangerous vehicles in the cities were bicycles and streetcars. Despite a few changes in the view about the streets with the advent of the bicycle, the use of this public space was still stable and similar to the use it had for centuries: it was a space for meetings and walking.[71] With automobiles, the street became visibly a terrain of dispute.[72]

The most significant change that came with the arrival of automobiles was the rise of deaths on roads to levels never seen before. Children were the main victims. As the number of cars increased, pedestrians could not walk as safely as before. In Berlin, during 1906 and 1907, more than 90% of the two thousand cars registered were involved in collisions in which often the victims were pedestrians.[73] This reality brought by the presence of the new machine, made groups of the North America society initiate movements against it.[74] Sometimes, the streets became almost literally battle fields, with angry pedestrians creating riots and throwing rocks

[70] Peter D Norton, *Fighting Traffic: the dawn of the motor age in the American city*, The MIT Press, ed. (Cambridge, 2011) at 1-2.
[71] Sakuraba, *supra* note 66 at 15.
[72] *Ibid* at 2.
[73] Ladd, *supra* note 33 at 73.
[74] Norton, *supra* note 70.

against motorists and their machines, specially when a pedestrian was killed or injured.[75]

Peter Norton affirms that there were several distinct, but relevant, social groups that were concerned with changes and fatalities brought by the automobile. Parents and authorities were astonished by the rise of deaths and injuries caused by automobiles. Business owners worried about the chaos in the streets. Legislators and judges were troubled by the lack of control over the new machine. Some could not stand the noise and disturbance.[76] Although these groups had different concerns and interests, the consequences of the increasing number of automobiles tended to make them more cohesive in the fight against "motor doom," trying to preserve the streets they knew.[77]

Until the 1920s, in case of an injury or death involving a pedestrian and an automobile, the prevailing public opinion was to blame the motorist entirely. It was not in question whether the pedestrian had or not the right to be on the street. Automobiles, on the opposite, were constantly questioned over their right to the street, and were even legally banished from roads.

In Marin County, California, for example, a motorist was imprisoned for driving after the sunset, which was prohibited. The Supreme Court of California denied *Habeas Corpus*, deciding his imprisonment was reasonable. The court,

[75] Ladd, *supra* note 33 at 32.
[76] *Ibid* at 31.
[77] Norton, *supra* note 68 at 3.

however, stated that "if the use of automobiles gradually becomes more common, there may come a time an ordinance like the one in question would be unreasonable."[78]

Cars were not seen as a necessity, but simply as a toy for their owner's pleasure. Also, they were believed to be inherently dangerous. Since walking was an obvious necessity and pedestrians could not cause injury or deaths on roads, accidents were was self-evidently the complete responsibility of motorists.[79]

That vision about cars and motorists could be seen in many newspapers and artworks from the first decades of the last century. For example, the painting "And The Prize is Death," by Albert Levering, from 1910, shows a gloomy representation of Hermes carrying a trophy made of a skull leading motor racers through a path of destruction (Image 3). One cover of the New York Times from 1924 reports the national concern on the increase of motor killing, depicting the image of motorists as Death itself speeding over children (Image 4). *The Toronto Telegram*, from 1934, gives to the automobile the title of "king of the killers" among calamities like war and fire, stating that cars are "the greatest menace to human life." The image in the newspaper shows a reckless motorist in high speed, careless about children and leaving a trail of dead pedestrians behind (Image 5).

[78] Xenophon P Huddy, *The Law of Automobiles* (Albany, N.Y.: Matthew Bender & Company, 1906) at 32.
[79] *Ibid* at 30.

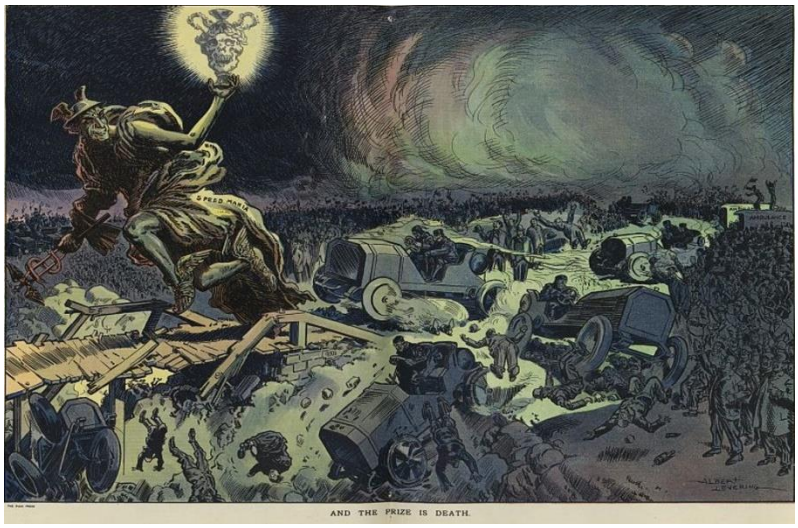
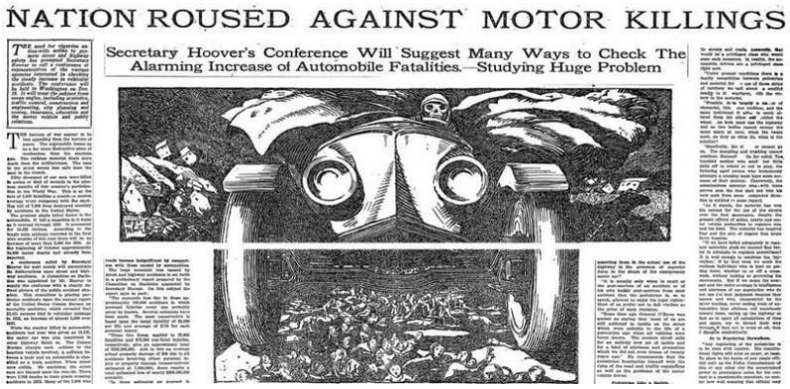


Image 3


NATION ROUSED AGAINST MOTOR KILLINGS

Secretary Hoover's Conference Will Suggest Many Ways to Check The Alarming Increase of Automobile Fatalities.—Studying Huge Problem

Image 4

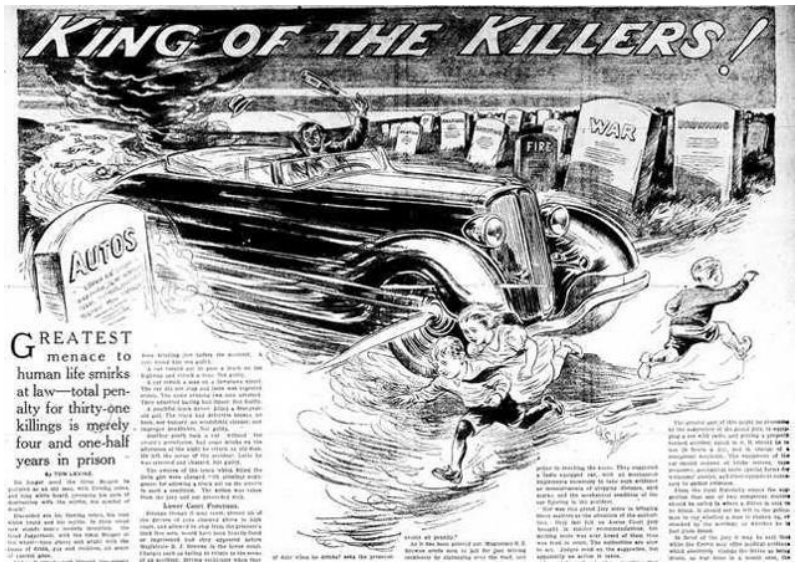


Image 5

What was the reason, then, for a shift in the popular opinion about cars and the causes of the deaths on the streets? There are a few explanations that will be developed below.

Besides the organized groups battling against the automobile, believing and demonstrating that it was far from being the most efficient and safe means of transportation, during the 1920s, the economy was recovering from the recession of 1921. Automobile sales continued to fall, having a slump in 1923.[80] The motor companies were alarmed with the possibility of a market saturation. Industry insiders considered that soon the demand for cars would get to its limit.

The industry became aware that changing the perception about its product was an urgent task. Simply announcing its utility was not sufficient to battle the justifiable fear and to reach a larger market share: the city was not yet designed for cars, and daily reports of deaths and severe injuries made very clear that it was not a safe vehicle. Logic was against the use of automobiles. Cars were not so useful and efficient to the point to become a real necessity to the overall urban population and to be prioritized by the authorities. The manufacturers needed a better plan.

[80] Peter D Norton, "Of Love Affairs and Other Stories" in Stephen Zavestoski & Julian Agyeman, eds, *Incomplete Streets Process Pract possibilities* (New York: Routledge, 2015) 17 at 23.

1.7 – The shift

In 1927, the banker Paul Mazur said that "we must shift America from a needs- to a desire-culture. People must be trained to desire, to want new things, even before the old have been entirely consumed. Man's desires must overshadow his needs."[81] New public relations techniques were the perfect match to help to make this shift and transform citizenship into the synonym of consumerism.

During the First World War, the American government hired Edward Bernays – the "father of public relations"[82] – to make war propaganda domestically and abroad. For his task, Bernays used the theories of his uncle - Sigmund Freud - to shape public opinion. For the first time, psychoanalysis theories were applied for a mass of people instead of only one individual in a clinical situation.[83] The view of masses as inherently irrational and desire-driven was at the core of Bernays' strategy. His propaganda campaign was tremendously successful. He believed he could apply the same techniques in times of peace to promote democracy, peace and products. For this, after the war, he created an agency - the first public relations agency.[84]

Until the 1920s, the motor industry did not have a coordinated national public relations effort.[85] The increasingly bad reputation of their product and

[81] Adam Curtis, *The Century of the Self: Happines Machines* (England: BBC, 2002).
[82] "Edward Bernays, 'Father of the Public Relations' and Leader in Opinion Making, Dies at 103", *New York Times* (1995).
[83] Curtis, *supra* note 81.
[84] *Ibid*.
[85] Norton, *supra* note 78 at 24.

dropping sales changed this. Automobiles companies like Dort Motor, Dodge Brothers, and General Motors hired Edward Bernays, and during the 1930's, he was also hired by the Automobile Manufacturers Association.[86] At the same time, the National Automobile Chamber of Commerce (NACC) and the American Automobile Association also hired public relations professionals.[87]

Under the direction of those professionals, the industry changed profoundly the way they sold its product. Instead of rational persuasion, the advertisements appealed to the subconscious and primitive desires. To provoke the irrational behaviour of acquiring an automobile by whom it was not needed or a new one by who had a still perfectly usable version, they had to link it to a major value of the society. This value could be used as a trigger to consumerism and affection for the product and the companies' brands. That could save the industry from the public backlash and dropping sales. With this objective, the automobile started to be announced as the symbol of one of the core values of North America: *freedom*.[88]

This was not entirely new. As we saw in a previous section, by the 1890's, bicycle manufacturers innovated in this direction. Because of the scientific and sociological aspects, however, modern techniques of public relations were much more sophisticated and effective. And there was one new important and powerful

[86] Library of Congress, "Edward L. Bernays Papers", (1996), online: <http://memory.loc.gov/service/mss/eadxmlmss/eadpdfmss/uploaded_pdf/ead_pdf_batch_01_November_2004/2003.2/wrpz/ms003016.pdf>.
[87] Norton, *supra* note 78 at 24.
[88] Norton, *supra* note 70.

component: the deliberate manipulation through the media and personalities trusted by the targeted public.

Bernays wrote that:

> People accept the facts which come to them through existing channels. They like to hear new things in accustomed ways. They have neither the time nor the inclination to search for facts that are not readily available to them. The expert, therefore, must advise first upon the form of action desirable for his client and secondly must utilize the established mediums of communication, in order to present to the public a point of view. This is true whether it is that of a majority or minority, old or new personality, institution or group which desires to change by modification or intensification the store of knowledge and the opinion of the public.[89]

To reach their goals, car producers knew the stories told in the newspapers about automobiles had to change. Using that Bernays' premise, NACC subverted the prevailing way newspapers used to tell the stories of traffic safety, switching the responsibility from drivers to pedestrians. To make this change happen, NACC offered to newspapers a service to "help" them in their work of reporting traffic accidents. NACC would give blank forms to newspaper editors whom would fill it with the accidents details. NACC would provide the editors with their own experts' interpretation of the data and conclusions about the causes of the accidents.[90] Within one year, newspapers in more than 300 cities were filling these forms and using NACC's conclusions as the basis for their reports.

Pedestrians, once reported as victims, were transformed into the ones to blame for their own deaths and injuries. Parents started to be labeled as irresponsible

[89] Edward L Bernays, *Crystalizing Public Opinion* (New York: Liveright Publishing Corporation, 1923) at 137-138.
[90] Norton, *supra* note 78 at 25.

for letting their children play on the streets. Under that new traffic safety logic, the solution to reduce deaths and injuries was to spread a clear message: streets are for cars, pedestrians must not jaywalk, and children must not play on streets.

Although the term jaywalker was in use since 1913, only with the public relations efforts of the auto industry during the mid-1920's did it became widely known and used.[91] Those efforts were not reduced to the reports. Massive "safety" campaigns were created to "educate" the population about their responsibilities as parents and pedestrians, and the risks of jaywalking and playing on the streets. Following Bernays' techniques, those campaigns used movie stars, radio celebrities, and known experts to give the necessary credibility. In 1929, the Canadian Automobile Association launched in Ontario its School Safety Patrols program. AAA also had its own program, and throughout North America, local auto clubs created and sponsored school safety patrols, promoting educational safety campaigns. Children learned that streets are not for playing or walking. They are for cars.

As a demonstration of the novelty that the word "jaywalker" was in the 1910s, we have the following words in a speech during a meeting of the Central Railway and Engineering Club of Canada held in 1914:

> I want to acquaint the members with a new term which has been coined and introduced in Houston, Texas, and some of the other cities in the States, as applicable to people walking across a crowded thoroughfare between the regular crossings without observing where they are going or what is

[91] *Ibid at 25*.

> coming. The term is "jaywalking." This is, of course, in connection with Safety First. Nobody wants to be a 'jaywalker.'[92]

Two years later, the London Advertiser reported the complaint of a "well-known automobile man" about the lack of attention Canadian society was giving to the dangerous "habit of jaywalking":

> In most of the European cities the pedestrian 'jay walker' would be arrested and fined, and should the temerity lead to the breaking of his bones he would be fined just the same, and if killed, death would close the incident. [...] The persons afoot need to be controlled, [...] and the largest number of children killed and injured ranged in age from two to eight years. If the parents and children were taught to exercise the same caution as automobile drivers are expected to use, I firmly believe that in time the number of accidents in all of our larger cities will be reduced to a minimum.[93]

In November of 1922, under the title "Jay-Walking Greatest Menace to Safety", the Ontarian newspaper The Free Press reported an interview with the executive chairman of the AAA, in which he argues, using statistics of the causes of accidents in New York, that the drivers are not the ones to blame in the majority of the cases, and that it is necessary to legislate penalties for jaywalking. In his words:

> The first cry that goes up, as a rule, when such an accident occurs, is that the driver of the car was at fault when, as a matter of fact, in a large majority of the cases the person injured was to blame. [...] These figures serve to emphasize the contention of the A. A. A. That no traffic regulation is complete until it provides a penalty for jay-walking. The jay-walker in my opinion is the most serious menace to traffic safety in the United States to-day. [...] we feel that if a motorist is to be fined for disobedience of a traffic signal, then the pedestrian should be fined for jay-walking across the street, putting himself, as well as every motorist [...], in danger. [...] The automobile driver is entitled to much more consideration than he now receives.[94]

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[92] "Central Railway and Engineering Club of Canada. Official Proceedings. Volume 8 n. 5, 1914", online: *Canadiana* <http://online.canadiana.ca/view/oocihm.8_05004_68>.
[93] "Says Jaywalking causes accidents", *London Advert* (1916) 10.
[94] "Jay-Walking Greatest Menace to Safety", *Free Press* (1922) 15.

Almost a year later, The Free Press reported Los Angeles had tested a jaywalker ban, placing signs warning jaywalking was prohibited.[95]

Imprisonment of jaywalkers could raise the risk of judges using common-law precedents to question the legality of pedestrian control. Aware of that, the Automobile Club of Southern California and authorities of Los Angeles preferred to not take a hard approach. Instead, they made a massive "education" campaign in the days before the enforcement of the new rules against jaywalkers using printed publicity and every radio station. The objective was to create a "motor-minded" population, and, therefore, easier to accept the pedestrian control. The idea was to create a ridicule the image of the jaywalker. The public embarrassment caused by a whistle and a pointed finger of the police was more affective than fines, and less likely to be questioned before a judge. As a member of the auto club said: "The ridicule of their fellow citizens is far more effective than any other means which might be adopted."[96]

That kind of strategy and the Los Angeles' city traffic code created the basis for reconstructing traffic safety in favour of automobile and drivers. It was replicated through North America and set the support for cities planned for cars.

Before those campaigns and laws against jaywalking, the rights of pedestrians to be on the road were self-evident. In 1906, Xenophon Huddy, even

[95] "Jay Walker Ban Put to Test in Los Angeles", *Free Press* (1923) 14.
[96] Norton, *supra* note 68 at 221.

though arguing in favor of drivers' right to the road, did not argue against pedestrians' rights to the same space. He wrote in his book *The Law of Automobile* that "primarily the general purpose of streets and highways is that of travel either on foot by a pedestrian or in a vehicle propelled by power. [...] The rights of footmen and drivers in the highway are equal and both must exercise such care as circumstances demand."[97]

Contributory negligence was a powerful reason for pedestrians to not litigate against drivers.[98] During this era, "In an action by a pedestrian to recover damages for an injury from an automobile, there [could] be, as a general proposition, no recovery unless the plaintiff was free from negligence which contributed to the injury."[99]

In relation to responsibility and contributory negligence of parents, in a case involving the death of a six year old boy, the N.Y. Supreme Court decided the parent (plaintiff) should prove they had no contributory absence.

> CONTRIBUTORY NEGLIGENCE-BURDEN OF PROOF-AUTOMOBILES.-THIES V. THOMAS, 77 N. Y. SUPP. 276. - A boy of six, while playing between blocks, was run over by an automobile and killed. In an action by administrator, *held*, that the burden of proof, to show absence of contributory negligence, was on plaintiff.[100]

[97] Huddy, *supra* note 78.
[98] Kyle Graham, "Of Frightened Horses and Autonomous Vehicles: Tort Law and its Assimilation of Innovations" (2012) 52 Santa Clara Law Rev 101.
[99] *Ibid* citing Huddy.
[100] "Recent Cases" (1902) 12:2 Yale Law J 106.

Xenophon Huddy uses that case to explain the rights in cases of children harmed in automobile collisions:

> the fact that a six-year-old boy, run over by a motor car, is found in the street, and played on the street, is not *per se* negligence on the part of his parents, but whether his parents were negligent is a question for the jury. [...] the death of a boy run over by a motor car, the fact that the accident did not happen at a street crossing, but at a point between blocks, may be considered by the jury on the issue of negligence. [...] In an action to recover for the death of a six-year-old boy, it is a question for the jury whether his playing on the street was contributory negligence.[101]

A similar case in 1945 in the Ontario Court of Appeal, but involving a motorbus instead of an automobile, gives a glimpse over the understanding of the rights of pedestrians on that time, after years of campaigns against jaywalking. The appellants were the father and mother of a nine year old boy that was killed by a motorbus while crossing the street running. The trial jury decided that the boy had been negligent for "running across the street between intersections, and not looking both ways for oncoming traffic."[102] They also decided "the driver and Public Utilities Commission are in no way responsible, but we are agreed that the City of Kitchener is lax with regard to the enforcement of the parking laws pertaining to the east side of Queen Street South."[103] The trial Judge later dismissed the action, holding the fault assigned by the jury to the defendant Corporation was not available.

With two votes against one, the Court of Appeal ordered a new trial. The dissenting justice agreed with the thoughts of the majority about the lack of

[101] Huddy, *supra* note 78.
[102] 1945 CanLII 371 (ON CA).
[103] *Ibid*.

importance in the fact the motorbus was faster than it should be and about the rights of the boy that, even though he had legally the right to cross the street, was jaywalking. The justice said in his decision:

> The learned Judge stated:
>
> "There is no prohibition in law, unfortunately, against a pedestrian crossing at any place but an intersection. Nobody in authority has made it a law and therefore legally the boy was entitled to do what he did, but he could not expect, or a person who `Jaywalks' can not expect to find traffic conditions as safe going across the street at a place not, an intersection as he can at intersections which are protected for people who intend to go across the street.
>
> "Section 39 (2) (e) of the Highway Traffic Act, again, provides that the driver of a vehicle is permitted to proceed across an intersection or to turn to the right or left but that such permission shall always be subject to the safety of pedestrians and other traffic. The law, however, does not make the proviso in favour of those who are crossing at unauthorized places."
>
> Reading this passage as part of the whole charge, I think a reasonable construction is that the learned Judge was instructing the jury that it was not unlawful for the boy to cross in the middle of the block, but when he undertook to do so he was not subject to the same legal safeguards as when he crosses at an intersection. In other words, that there was a greater degree of care required of one who enters the traffic which might reasonably be expected on the roadway between intersections, than one who crosses at an intersection.[104]

Waters asserts that before cars, rules of traffic were dictated mainly by Common Law. The main subject of jurisprudential debates was the Cycling Law.[105] With the arrival of the automobile, traffic regulation and jurisprudence moved its attention to the new machine and courts internalized the protection of the automobile.

[104] *Ibid*.
[105] Waters, *supra* note 64 at 395.

Today there are cases where victims of collisions are blamed, and the driver is considered not negligent at all.[106] *Ormiston (Litigation guardian of) v Insurance Corp. of British Columbia*,[107] is a recent example of that. In that case, a teenage cyclist decided to pass a van on the right. The van was stopped in the right line close to the centre line. The driver, for no apparent reason abruptly accelerated moving to the right making the cyclist lose balance and fall. The court decided that, even if the driver had seen the cyclist in the mirror, he had the right to move in that way, because it was in the vehicle's lane. The court also decided that the cyclist did a "foolish thing" and was "the sole author of his misfortune."[108]

1.8 – Futurama: a look into the future

By the 1930s, with the idea that "selling cars was less important than a public relations campaign advocating transformation of the American landscape,"[109] motor companies engaged more directly with urbanism, promoting, through public expositions, a vision of a technological future driven by a world connected by large highways and cities built around motor traffic needs.[110] The pinnacle of the success of those exhibitions was a diorama sponsored by GM and created by the theatre and

[106] Sakuraba, *supra* note 68.
[107] 2014 BCCA 276 [Ormiston].
[108] *Ibid*.
[109] Dolores Hayden, "'I HAVE SEEN THE FUTURE': Selling the Unsustainable City" (2012) 38:1 J Urban Hist 3.
[110] Nathaniel Robert Walker, "American crossroads: General Motors' Midcentury Campaign to Promote Modernist Urban Design in Hometown U.S.A." (2016) 23:2 Build Landscapes 89.

industrial designer Norman Bel Geddes: *Futurama*, "the most popular exhibit of the 1939-40 New York World's Fair."[111] Until the end of the exposition, that cost the equivalent of US$ 100 million today,[112] more than five million people had seen the exposition that modeled a utopian United States of 1960 constructed by and for the automobile. Professor Dolores Hayden describes it:

> the model represented many parts of the American landscape —rural, suburban, and urban — from Yosemite to Saint Louis. The builders worked with aerial photographs by Sherman Fairchild, who had made a successful business out of supplying aerial images to developers and planners. The model included over 35,780 square feet, with mountains, hills, and plains adorned with a million trees and half a million buildings representing different kinds of housing, a farm, a steel mill, an amusement park, an airport, a monastery, a resort, and a dam with hydroelectric plant, as well as stores and office buildings. The scale varied (from one inch to ten feet, to one inch to three hundred feet). The skyscrapers were almost as tall as the workers who hefted them into place.[113]

Geddes himself in his book *Magic Motorways* describes what the public experienced:

> As each spectator rode around the model in his comfortable, upholstered armchair, he listened to a description of it in a voice which came from a small speaker built into the back of the chair. This recorded description synchronized with the movement of the chairs and explained the main features of what was passing before the spectator's eyes. It directed his attention to the great arterial highways which were segregated into different speed lanes and which looked so different from the roads of today. It pointed out the over-passes, high-speed intersections and wide bridges over which tear-drop motor cars whisked by at a hundred miles an hour. It commented in passing on the surrounding scenery, the planned cities, decentralized communities and experimental farms. But it did not describe in detail how any of this was to accomplished.
>
> [...] They saw the world of tomorrow lying there invitingly before them – a world that looked like Utopia and that did not seem to have a very close relation to the world they knew.[114]

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[111] *Ibid*.
[112] Hayden, *supra* note 109.
[113] *Ibid*.
[114] Norman Bel Geddes, *Magic Motorways* (New York: Random house, 1940) at 6-8.

Futurama is the most known part of a "large-scale, sustained marketing campaign by General Motors to promote highway-centric urban reforms directly to citizens of North America."[115] From 1936 to 1956, roadshows entitled *The Parade of Progress* have taken "miniature world's fair on wheels"[116] to more than 20 million people in more than 250 cities and towns[117] across the continent.[118] The mission of the campaign was to capture the imagination with sensational demonstrations of a futuristic view of "automotive functionality for towns and cities."[119]

Hayden uses anthropologist Setha Low's theory of "embodied space" to suggest the whole experience in Futurama – from the fatigue of waiting outside in line to the disorientation through sounds, lights and infrastructure inside – intended to embed Geddes' landscape vision for the future in the minds and bodies of Futurama's visitors. She also argues that through souvenirs, like postcards mailed by the visitors to relatives or friends, allied to radio and news coverage, the fair was expended to minds and bodies of those who could not be physically present, paving way to a national program of highways and modifications in the legislation in the next decade.

Via geographic analysis, Hayden also claims that Geddes created an inevitable and uncontested view for the future. In his vision and images, he refused any inequity and exclusions of race, gender, age or disabilities that were – and still are in many

[115] Walker, *supra* note 110.
[116] *Ibid*.
[117] GM Heritage Center, "1936 Parade of Progress", online: <https://www.gmheritagecenter.com/gm-heritage-archive/Featured_Innovations/1936_Parade_of_Progress.html>.
[118] Walker, *supra* note 110.
[119] *Ibid*.

cases – related to a society of consumerism and an infrastructure dedicated to cars and speed.

> Geographers often argue that landscape has the power to make seem inevitable what is really contested. Geddes was careful to construct a model of landscape with what he defined as "a future which retains enough of 1939 to keep it from being fantastic," while he left out any contestation. In 1939 automobile technology excluded those too old, too young, too poor, or those unable to see well enough to drive. The majority of Americans who held drivers' licenses were white men. Women were often ridiculed as bad drivers and most cars were bought by men. The small minority of African Americans who did own cars were discriminated against by segregated gas stations and motels. Americans knew gritty streets and cluttered arterials, they drove through slums, on "buyways" (roads lined with billboards), and through ribbon development (strip malls). They passed tire dumps, auto graveyards, and hot-dog trails, but Geddes encouraged them to imagine that by 1960, on a "Magic Motorway," a man could speed between skyscrapers with God, progress, and government on his side.[120]

Citing ideas of Stuart Rockefeller, Setha Low wrote that places exist "simultaneously in the land, people's minds, customs, and bodily practices."[121] Through campaigns against jaywalking and with exhibitions like Futurama and The Parade of Progress, the construction of the automobile era was created not only in and through the physical structure of the cities, but in the minds, the customs and the bodies of the masses and authorities. In this interconnection of influences between physical space and space created in the mind, is present the shift of the legal and judicial paradigm influencing and being influenced by the infrastructure and the perceived roles of the bodies inside that special configuration. While being modeled by that construction,

[120] Hayden, *supra* note 109.

[121] Setha M Low, "Embodied Space(s): Anthropological Theories of Body, Space, and Culture" (2003) 6:1 Sp Cult 9 at 15.

courts and lawmakers also modeled the new roles for pedestrians, cyclists and drivers, mutating the practices on the streets, the perceptions and beliefs about who owns that space.

The legal geographer Milton Santos, in his book *The Nature of Space* – while discussing about the relation between space, objects and action – cites some thoughts of Jean Baudrillard that may summarize the influence of the aspects posed in this section and throughout the chapter:

> The automobile is, for Baudrillard, one of the most important signs of our time and its role in the production of the imagination has profound repercussions on the whole of man's life, including the redefinition of society and space. Cities would not be what they are today if the automobile did not exist. Men end up considering the automobile as indispensable and this psychological data becomes a data of the lived reality. Illusion or certainty, the automobile strengthens in its owner the idea of freedom of movement, giving it the feeling of buying time, not wasting a minute, in this century of speed and hurriedness. With the individual vehicle, man imagines himself more fully realized, thus responding to the demands of status and narcissism characteristic of the postmodern era. The automobile is an element of the wardrobe, a quasi-garment. Used on the street, it seems to extend the man's body as an extra prosthesis, just as other utensils indoors are within reach.[122] [unofficial translation]

[122] Milton Santos, *A Natureza do Espaço: Técnica e Tempo, Razão e Emoção.*, 4th ed (São Paulo: Editora da Universidade de São Paulo, 2006) [unofficial translation] at 41.

CHAPTER 2

DRIVERLESS TECHNOLOGY: CONCEPTS AND GOVERNMENT DEBATES

In the first chapter, the discussion was centred in the past and how the upsurge of two new technologies – the bicycle and the automobile – and the policy decisions guided by automakers' advertisements and propaganda influenced the shaping of our cities and our minds. In this chapter and the next one, the focus will be on the present with a glimpse into the future.

Glen Hiemstra wrote, in 2000 [and reproduced in the 2007 book *Cities and Cars*][123], that "we are at the beginning of the second automobile era," and that

> the shift to environmentally friendly automobiles will keep mass transit marginal. In a certain sense, we might actually witness the morphing of autos into quasi-trains. Intelligent, self-driving cars on a guideway, moving at high speeds and within inches of each other, form a kind of train. But this train is flexible, private, and personal, all of which Americans prefer.[124]

Right now we see the rise of that new technology in transportation described by many as "disruptive" and probably the greatest transformer of our society for the next decades.[125] It is believed that it will "reshape" the urban environment.[126] The changes expected to happen are on traffic volume, average speed, travel time reliability, safety, mode mix, congestion, parking, land use, travel cost, emissions,

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[123] Glen Hiemstra, "Cars of the Future" in Roger L Kemp, *Cities and Cars: a handbook of best practices* (North Carolin: McFarland & Company, 2007).
[124] *Ibid* at 240.
[125] National Association of City Transportation Officials, *NACTO Policy Statement on Automated Vehicles* (New York, 2016).
[126] Toronto Transportation Services Division, "Preparing the City of Toronto for Automated Vehicles", (2018), online: *City Toronto* <https://www.toronto.ca/wp-content/uploads/2018/01/8f04-AVs-TS-Workplan.pdf>.

energy consumption, and other environmental and social effects[127]. There is not, however, a consensus on how, when and which of these changes will really ever come.[128]

This second chapter is a presentation of some of today's views and expectations about the technology and serves as an introduction to the debate in the third chapter, where some challenges that may jeopardize some promises and expectations are discussed. This chapter is divided in seven sections. In the first section, there is a discussion of what defines robots and if driverless cars may be considered robots. The second section shows the most used classification for self-driving cars, and the promises and expectations of the companies. The third and fourth sections present the governmental approach and debates for the deployment of driverless cars in the United States and Canada. The fifth section displays some efforts governments and lawmakers around the world are making in the debate about the liability of the new technology. A brief discussion of the first fatal crashes and lawsuits involving cars with some level of automation appears in the sixth section. Finally, in the last section, it is proposed that framing this new technology as a mere advance of the automobile, though obvious, may constrain the way we use it and limit our vision for the future possibilities and consequences of the technology.

[127] Bern Grush, John Niles & Edgar Baum, *Driverless Cars Ahead: Ontario Must Prepare for Vehicle Automation* (Vaughan, 2016) at 12.
[128] Karlyn Stanley et al, *Autonomous Vehicle Technology: A Guide for Policymakers* (Santa Monica: RAND Corporation, 2016).

2.1 – Are driverless cars robots?

In 1918, in the section *"New and Interesting Facts from Science and Life"* of the *Oakland Tribune*, a columnist wondered about the future of the technology: "The new car will be all glass-enclosed and controlled entirely by a set of push buttons. It will have no clutch, gears or transmission, will sit low, have small clearance and punctureless tires"[129]. Geddes, about the future modeled in Futurama, wrote:

> These cars of 1960 and the highways on which they drive will have in the devices which will correct the faults of human beings as drivers. They will prevent the driver from committing errors. They will prevent his turning out into traffic except when he should. They will aid him in passing through intersections without slowing down or causing anyone else to do so and without endangering himself or others.[130]

A century after the columnist of Oakland Tribune, in his book *Autonomy*, Lawrence Burns also described a new car in a quite similar way:

> [...] a ride will happen with the touch of an app. The vehicle that arrives won't have a steering wheel or gas and brake pedals. Most trips will happen in electric vehicles tailored to comfortably seat two people, since most trips we make happen solo or with just one other person. All this – and transportation is going to cost us just a fraction of what it ever did before.[131]

The idea and desire for driverless cars is not new.[132] The difference of Burns' words to Geddes description of the "cars of 1960" is that never before were those cars

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[129] Alisson Arieff, "Driving Sideways", (2013), online: *New York Times* <https://opinionator.blogs.nytimes.com/2013/07/23/driving-sideways/?module=ArrowsNav&contentCollection=Opinion&action=keypress&region=FixedLeft&pgtype=Blogs>.

[130] Geddes, *supra* note 114.

[131] Lawrence Burns, *Autonomy: the quest to build the driverless car and how it will reshape our world*, first ed (New York, NY: Ecco, 2018).

[132] Bloomberg Institute, *Taming the Autonomous Vehicle - A Primer for Cities* (Long Island City, 2017).

so close of becoming part of the reality: the technology is already being tested on our roads.

This technology, however, despite the obvious characteristics that makes it a car, is something else: it is robotic, and therefore it "blurs the very line between people and instrument."[133]

On defining what is a robot, Professor Ryan Calo wrote:

> few complex technologies have a single, stable, uncontested definition. Robots are no exception. There is some measure of consensus, however, around the idea that robots are mechanical objects that take the world in, process what they sense, and in turn act upon the world.
>
> [...] To sum up, robots are best thought of as artificial objects or systems that sense, process, and act upon the world to at least some degree. [...] What turns out to be important for legal and policy discourse is not the precise architecture, but the possibilities and experiences the architecture generates and circumscribes.[134]

Richards and Smart, in the same sense, say that "move about and manipulate things in its world [are] two features that we expect of a robot."[135] But "even professional roboticists do not have a single clear definition."[136]

Calo combines three characteristics to define what is a robot: the capacity to cause physical harm; emergent behavior; and social valence.

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[133] Ryan Calo, "Robotics and the Lessons of Cyberlaw" (2015) 103:3 Calif Law Rev 513.
[134] *Ibid* at 529.
[135] Neil M Richards & William D Smart, "How should the law think about robots?" in Ryan Calo, A Michael Froomkin & Ian Kerr, eds, *Robot Law* (Cheltenham, UK: Edward Elgar Publishing Limited, 2016) 3 at 6.
[136] *Ibid*.

Calo calls "embodiment" the possibility of causing physical harm. This characteristic generally requires a physical presence.[137] The second characteristic is the one of not only executing commands, but original action through the robots' capabilities of processing. Rather than call this "true learning" or "autonomy," Calo prefers to call this "emergence," referring to "unpredictably useful behavior.[138] Finally, because of "a physical embodiment coupled with apparently spontaneous action leads people to lend robots social valence."[139] They, "more so than other technology in our lives, [...] *feel* different to us, more like living agents."[140]

Balkin, commenting on those three characteristics suggested by Calo, writes:

> The first two characteristics of robotics that Calo identified— the capacity to cause physical harm and emergent behavior—create obvious problems for assigning liability in tort and criminal law.
>
> [...]
>
> What Calo calls "social valence," however, is a far more complex phenomenon. It is not limited to the question of legal liability but concerns every way that robots and AI agents might intervene in social relations.
>
> [...]
>
> I've argued against essentialism in law's encounter with technology, advocating instead that we should always keep the social aspects of technology in mind. Because we innovate in social relations along with technology, we cannot always tell what will be most important about technology in the years to come.[141]

Richard and Smart also propose a working definition of a robot as:

> *a constructed system that displays both physical and mental agency but is not alive in the biological sense*. That is to say, a robot is something

[137] *Ibid* at 532.
[138] *Ibid*.
[139] *Ibid*.
[140] *Ibid*.
[141] Jack M Balkin, "The Path of Robotics Law The Path of Robotics Law" (2015) 6 Calif Law Rev Circuit 45.

> manufactured that moves about the world, seems to make rational decisions about what to do, and is a machine. It is important to note that the ascription of agency is subjective: the system must only *appear* to have agency to an external observer to meet our cri- teria.9 In addition, our definition excludes wholly software- based artificial intelligences that exert no agency in the physical world.[142] [italic from the original]

By both proposed definitions, we may see self-driving cars as robot-cars. They are machines that move about the world and seem to make rational decisions, or even have "original action;"[143] they can cause harm, and give us a sense that they are like "living agents."[144] This definition is important, because, as Balkin said, it creates concerns in relation to not only liability and criminal law, but also because of new social relations that may come along with the technology in the coming years. This aspect will be particularly important for the debates proposed in the third chapter.

2.2 – Levels of autonomy, and deployment predictions

The most used classification for driverless cars comes from a Society of Automotive Engineers International's (SAE International) Information Report[145] that provides a taxonomy describing the full range of levels of automation in on-road motor vehicles. The report specifies six levels of automation ranging from level 0 (no driving automation) to level 5 (full driving automation). From levels 0 to 3, there is always the need for steering wheels. In level 4 (high driving automation), depending

[142] Richards & Smart, *supra* note 135.
[143] Calo, *supra* note 133 at 532.
[144] *Ibid*.
[145] SAE International, *Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles* (2018).

on the use of the car (e.g. if used only in a particular urban area) the steering wheel may not be required. In the 5th level of automation, the steering wheel is entirely unnecessary; the car must perform all the tasks in any condition, and in any region of the world without human intervention. In the highest level of automation, therefore, there are no drivers, only passengers.

Right now, the technology has not reached the 5th level, and the 4th level is still in testing. Although many of those tests are currently on real streets and roads, enabling the industry to collect data and analyze the cars in real environment situations, there is a lack of certainty of when the industry will be able to deliver 4th level cars in large scale.[146]

Despite that lack of certainty, the industry is constantly announcing predictions about the deployment of high level of autonomy for the general public. During the research for this work, for example, in August 2018, Ford Motors Company announced its objective to produce driverless cars (level 4) in large scale by 2021.[147] On April 2019, though, the company's CEO – who previously ran the Ford's autonomous-driving division – lowered the expectations around this launch, saying "we overestimated the arrival of autonomous vehicles."[148]The company still intends to

[146] Stanley et al, *supra* note 128.

[147] Ford Motor Company, "A Matter of Trust: Ford's Approach to developing self-driving vehicles", (2018), online: *Ford Media Center* <https://media.ford.com/content/dam/fordmedia/pdf/Ford_AV_LLC_FINAL_HR_2.pdf>.

[148] Stephen Edelstein, "Ford CEO Dials Back Expectations for Autonomous Cars Due to 'Complex Problems'", (2019), online: *The Drive* <https://www.thedrive.com/tech/27382/ford-overestimated-capabilities-of-first-gen-self-driving-cars-ceo-insists>.

deliver an autonomous car by 2021, but "its applications will be narrow, [...] because the problem is so complex."[149]Two months later, in July, Ford announced a partnership with Volkswagen to achieve that deadline. Using start-up Argo AI's technology, the two automakers intend to release a ride-sharing service in a few urban areas.[150]

Cruise Automation, a company acquired by General Motors in 2016, expected to launch its ride-hailing service by 2018. Technological issues (see chapter 3), however, made it delay the service debut to 2019.[151] To date, the company had not offered the service, and in July of 2019 it declined to answer to the New York Times if they were still pursuing that deadline to start a ride service in "at scale"[152] this year.

Elon Musk, the chief executive of Tesla Company, during a Tesla event in April 2019,[153] showed a video of a Tesla car, in a non-heavily urban environment, driving in autonomous mode all the way from the garage to a parking lot miles away without the need of the motorist touching the steering wheel. It was the image of what a "driverless world" would be. During the event, Musk announced that the company

[149] Keith Naughton, "Ford CEO Tamps Down Expectations for First Autonomous Vehicles", online: *Bloomberg.com* <https://www.bloomberg.com/news/articles/2019-04-09/ford-ceo-tamps-down-expectations-for-first-autonomous-vehicles>.
[150] Neal Boudette, "For Self-Driving Cars, No Green Light Soon.", *New York Times* (2019) Section BU 1.
[151] Mark Matousek, "The GM-backed robo-taxi startup Cruise Automation is reportedly struggling to refine its self-driving car technology", (2019), online: *Business Insider* <https://www.businessinsider.com/cruise-automation-reportedly-struggling-refine-self-driving-tech-2019-6?utm_source=Triggermail&utm_medium=email&utm_campaign=Post Blast %28bii-transportation-and-logistics%29: Waymo approved to carry passengers in Californi>.
[152] Boudette, *supra* note 150.
[153] Edward Niedermeyer, "Tesla's Autonomy Day Presentation Leaves Biggest Questions Unanswered", (2019), online: *The Drive* <https://www.thedrive.com/tech/27600/teslas-autonomy-day-presentation-leaves-biggest-questions-unanswered>.

intends to deploy a car with "full autonomous mode" as soon as 2020[154] and that Tesla would have around a million "robot taxis" by the end of 2020.[155] This statement produced much criticism in specialized media,[156] that has been treating this kind of prediction with more carefulness and skepticism than a couple of years ago when expectations were on the rise. Another source of doubt is the lack of clarity of what Tesla means by "full autonomous mode," because the company has, in the recent past, used these terms in a different meaning than the SAE International's autonomy scale. Critics say that, in creating this confusion of definition, Tesla misleads the general public that may take less care when driving, because they may think they are using a more advanced technology - one that permits to not have any attention on the task of driving - than the one they are really using (that still needs attention from the driver).

In January of 2019, Waymo - a Google subsidiary company - made public its partnership with Canadian company Magna to create the "world's first factory 100%-dedicated to the mass production of L4 [level 4] autonomous vehicles"[157] in Michigan, "the heart of American automotive industry." In April, the company announced their choice for a facility in Detroit, aiming to start the production in mid-2019.[158] One of

[154] *Ibid*.
[155] Boudette, *supra* note 150.
[156] Niedermeyer, *supra* note 153.
[157] Waymo Team, "Growing our team and business in Michigan", (2019), online: *Medium* <https://medium.com/waymo/growing-our-team-and-business-in-michigan-932f75addb45>.
[158] Waymo Team, "Making Waymos in Motor City", (2019), online: *Medium* <https://medium.com/waymo/making-waymos-in-motor-city-76c2af165165>.

the reasons for choosing Detroit is the possibility of testing the cars in different weather conditions, like snow.

2.3 – Debates in the United States

In the United States, cities and states are in the forefront of regulation and experimentation of self-driving vehicles. At least fifty percent of American large cities are studying how to integrate these vehicles in their transport systems.[159] Many of them are allowing real-world tests.

States and municipalities' leadership is happening not only because they will be the most affected by the transformations the technology is promising, but also because Congress is struggling to agree about Federal legislation over the topic.[160] In 2017, the House of Representatives passed the *Self Drive Act,*[161] desiring to accelerate the adoption of self-driving cars and to block states from creating their own performance standards.[162] The bill, however stopped in the Senate. Because of safety concerns raised by some senators, a complimentary bill — the *AV START Act*[163] — failed to pass. Some hopes have been raised that a new bill will be drafted addressing

[159] Brooks Rainwater & Nicole DuPuis, "Cities Have Taken the Lead in Regulating Driverless Vehicles", (2018), online: *CityLab* <https://www.citylab.com/perspective/2018/10/cities-lead-regulation-driverless-vehicles/573325/>.
[160] Andrew J Hawkins, "Congress takes another stab at passing self-driving car legislation", (2019), online: *The Verge* <https://www.theverge.com/2019/7/28/8931726/congress-self-driving-car-bill-redo-2019>.
[161] "SELF DRIVE Act", online: *Congress* <https://www.congress.gov/bill/115th-congress/house-bill/3388/text>.
[162] David Shepardson, "U.S. Congress will not pass self-driving car bill in 2018: senators", (2018), online: *Reuters* <https://www.reuters.com/article/us-autos-selfdriving/u-s-congress-will-not-pass-self-driving-car-bill-in-2018-senators-idUSKCN1OI2CV>.
[163] "S.1885 - AV START Act", online: *Congress* <https://www.congress.gov/bill/115th-congress/senate-bill/1885/text>.

the objections of those legislators.[164] Representatives of states that already have rules over self-driving cars also opposed to the bill concerned that it could make USDOT the only body responsible for setting construction and performance standards.[165] To a smaller degree, there was also influence of interest groups like the League of American Bicyclists, who questioned the lack of requirements for the deployment of these cars and affirmed the Act would "drastically increase the number of vehicles on our streets which are exempted from federal safety standards."[166]

While Congress has not yet acted, the federal response to the emerging technology is being promoted by the National Highway Transportation Safety Administration (NHTSA) and the U.S. Department of Transportation (USDOT). The USDOT is "partnering with a broad coalition of industry, academic, states and local, safety advocacy, and transportation stakeholders to support the safe development, testing, and deployment of automated vehicle technology,"[167] and in 2018, released a new set of non-prescriptive and entirely voluntary guidelines on how to approach the deployment of self-driving cars, especially with respect to concerns about safety.

In the absence of federal standards, states are advancing regulations and directives, contributing to a fragmented legislation. Until mid-March of 2019, at least

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[164] Hawkins, *supra* note 160.
[165] Edward Niedermeyer, "What Are The Regulatory Barriers To Full Self-Driving?", (2019), online: *The Drive* <https://www.thedrive.com/tech/29338/what-are-the-regulatory-barriers-to-full-self-driving>.
[166] Caron Whitaker, "Why the League is Opposed to the AV START Act", (2018), online: *Leag Am Bicycl* <https://bikeleague.org/content/why-league-opposed-av-start-act>.
[167] "USDOT Automated Vehicles Activities", (2019), online: *US Dep Transp* <https://www.transportation.gov/AV>.

41 states and D.C. have considered legislation related to autonomous vehicles.[168] That absence makes it difficult to deploy cars with unconventional designs without a steering wheel or brake pedals for example. If the car, however, follows current conventional design, there is no federal regulatory impediment for the use of a "full self-driving" software.[169] Since the driverless car meets the requirements imposed by states' regulations on autonomous vehicles, the deployment is possible. In other words, if the full autonomy technology was ready, it could be already legally used in many states.[170]

2.4 – Debates in Canada

In Canada, there is also no specific federal regulation over autonomous vehicles. A new bill that can, however, influence that matter received Royal Assent in March of 2018 and amended the *Motor Vehicle Safety Act*. Although, the Bill S-2 — *Strengthening Motor Vehicle Safety for Canadians Act* — did not mention the driverless technology, it gave to authorities in the area of road safety "greater flexibility to keep pace with the development of new safety features or new kinds of vehicles,

[168] "Autonomous Vehicles | Self-Driving Vehicles Enacted Legislation", (2019), online: *National Conference of State Legislatures* <http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx>.
[169] US Department of Transportation, "Federal Motor Vehicle Safety Standards and Regulations", (1999), online: *Natl Highw Traffic Saf Adm* <https://one.nhtsa.gov/cars/rules/import/FMVSS/index.html>.
[170] Edward Niedermeyer, "How PAVE Can Make A Difference in Autonomous Car Education", (2019), online: *The Drive* <https://www.thedrive.com/tech/26011/how-pave-can-make-a-difference-in-autonomous-car-education>.

technologies, systems or components."[171] The federal government has adopted the posture of navigator, providing guidelines and reports through Transport Canada. Since 2018, it has published reports and guidelines for governments, manufacturers and academia, trying to avoid a fragmented safety and legal framework for the nation that may permit tests and deployment across the country in a coherent way.

In January 2018, the Council of Ministers of Transportation and Highway Safety endorsed the report *The Future of Automated Vehicles in Canada* which encourages governments to work together with to objective to get the most beneficial outcomes of the technology. With this objective the report establishes different roles and responsibilities for each level of government:

> [...] the federal government is responsible for establishing a national AV policy and regulatory framework. Transport Canada is responsible for keeping vehicle manufacturers accountable for safety standards compliance and emissions requirements. A national framework on AVs can promote the standardization and harmonization of AV technology across the country. The federal government also acts as the facilitator for international harmonization of technology standards, particularly with the US and Mexico.
>
> Provincial and territorial governments are responsible for creating the legislative framework for AV testing and deployment within their own jurisdictions. Provincial and territorial legislation incorporates federal vehicle safety requirements. Provincial and territorial governments are also responsible for driver licensing, vehicle registration and insurance, rules of the road and any changes to highway infrastructure that might be needed to support AV deployment.
>
> Municipalities execute the legislative and regulatory framework created by provinces and territories, including AV safety enforcement. They also make land use decisions and operate transit systems; both could be profoundly affected by widespread availability of AVs. [172]

[171] PPSC Working Group on Connected and Automated Vehicles, *Automated and Connected Vehicles Policy Framework for Canada* (2019).
[172] PPSC Working Group on Connected and Automated Vehicles, *The Future of Automated Vehicles in Canada* (2018) at 6.

In June of that same year, two other reports were published. One by the Department of Transport Canada, the *Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations*; and the other by the Canadian Council of Motor Transport Administrators, *The Canadian Jurisdictional Guidelines for the Testing and Deployment of Highly Automated Vehicles*. The publications provide recommendations as support for Canadian jurisdictions in their planning, and establish sets of voluntary safety requirements. Both recommend that they must be read and used together as complimentary work.

In January and February of 2019, as one more step in the construction of a coherent national policy and regulatory framework, the Policy and Planning Support Committee (PPSC) Working group on Automated and Connected Vehicles released the report *Automated and Connected Vehicles Policy Framework for Canada*; and Transport Canada published *Canada's Safety Framework for Automated and Connected Vehicles*. Both reports reaffirm the roles of governments.[173] PPSC's report gives a list of six "foundational principles" that must guide governments, industry and academia to create shared objectives; find ways to collaborate; and prepare proactively for when Canada deploys and adopts automated and connected vehicles on our roads.[174] The principles establish that safety is the number one priority.[175]

[173] Vehicles, *supra* note 167 at 5.
[174] *Ibid* at 4.
[175] Transports Canada, *Canada's Safety Framework for Automated and Connected Vehicles* (2019) at 8.

Also in the beginning of 2019, Transport Canada published the *Safety Assessment for Automated Driving Systems in Canada*, "a voluntary tool [developed] to help ADS developers review the safety of vehicles equipped with SAE level 3 to 5 ADS features, which they intend to manufacture, import, operate and/or sell in Canada."[176] Aiming for a dialogue between industry and government, it provides a list of 13 performance-based outcomes the vehicles are expected to achieve, trying to create an environment where developers feel invited to innovate while "ensuring they take responsibility for the safety of the technologies they deploy on Canadian roads."[177] By the end of the document, those 13 expected outcomes are broken in more than 60 questions that must guide the assessment.[178] Like the other federal reports and publications on this subject, this tool searches for an alignment with the safety policies of the United States, looking for an integration of the motor vehicle market in North America.[179]

The first and only regulation in effect right now in Canada that specifically addresses self-driving vehicles is the *Ontario Regulation 306/15: Pilot Project — Automated Vehicles*.[180] In effect since January of 2016, it created a ten-year pilot program to evaluate the use of automated vehicles on highways and allowed tests on

[176] Transports Canada, *Safety Assessment for Automated Driving Systems in Canada* (2019) at 6.
[177] *Ibid*.
[178] *Ibid* at 23-26.
[179] *Ibid*.
[180] O. Reg. 306/15, s. 18.

Ontario roads under certain conditions. Currently, the program has nine participants testing ten vehicles.

Through *Ontario Regulation 517/18*[181] that made enhancements to that regulation, since January of 2019, it became permissible for the public to buy and use on Ontario roads vehicles with automated driving system operating at level 3 (SAE) if the vehicle complies with the federal current regulation for and, therefore, is approved by the federal government. At this moment, though, there are no level 3 vehicles approved for sale in Canada. The amendment also made it possible to test high level of automation (level 4) on public roads under strict conditions, and opens the possibility of testing vehicles without a person in the driver-seat.

2.5 – Liability around the world

Because in the majority of conventional car crashes the driver has the control over the vehicle, he or she assumes the primary liability for what happens. In cases involving robot-cars, however, it is not clear how liability will be divided between the driverless car's autonomous system and the human driver.[182] In some cars L4 and in all (future) cars L5, the responsibility for physically driving shifts from the humans inside

[181] *Ibid*.

[182] Araz Taeihagh & Hazel Si Min Lim, "Governing autonomous vehicles: emerging responses for safety, liability, privacy, cybersecurity, and industry risks" (2019) 39:1 Transp Rev 103.

it to the vehicle itself.[183] That is important from a legal perspective. In the UK, the case R v MacDonagh, [1974] 2 All ER 257 (Eng CA) established that the test of whether a person is physically driving a vehicle[184] is whether he or she is "in a substantial sense controlling the movement and direction of the car."[185] Commenting about the possibility of this case influencing future cases involving driverless vehicles, Collingwood writes:

> the activity must also fall within the ordinary meaning of the word "drive" and although the word meant, essentially, to use the driver's controls for the purpose of directing the movement of the car, it did not extend to the activity of a person (such as MacDonagh) who was not in the car, had both feet in the road, and was making no use of the controls apart from an occasional adjustment of the steering wheel.
>
> The point is that, with a fully autonomous vehicle, it is difficult to argue that any persons being carried in the vehicle could be described as driving. [186]

This uncertainty is recognized by the U.S. DOT in the third principle it established for the Federal approach to shaping policy for automated vehicles:

> 3. We will modernize regulations.
>
> […] As a starting point and going forward, the Department will interpret and, consistent with all applicable notice and comment requirements, adapt the definitions of "driver" and "operator" to recognize that such terms do not refer exclusively to a human, but may in fact include an automated system.[187]

With this, the Department of Transport is accepting the term "driver" as a less clear concept in the context of driverless cars.[188] Additionally to that, it is difficult to

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[183] Lisa Collingwood, "Privacy implications and liability issues of autonomous vehicles" (2017) 26:1 Inf Commun Technol Law 32.
[184] *Ibid*.
[185] R v MacDonagh, [1974] 2 All ER 257 (Eng CA).
[186] Collingwood, *supra* note 180 at 41.
[187] US Department of Transportation, *Preparing For The future of Transportation: Automated Vehicles 3.0* (2018).
[188] Collingwood, *supra* note 183.

identify and separate the various components that may cause a malfunction because, right now, there is no framework clearly outlining the proportionality of liability between the third parties responsible for the design of the self-driving systems (the manufacturer, supplier, software provider or the software operator).[189]

Trying to mitigate some of those uncertainties, but at the same time creating privacy concerns[190], in 2017 Germany enacted a law demanding that all autonomous vehicles must install a black box to record the travel's data and determine liability during collisions.[191] In Japan, "manufacturers will be liable for defects in the system, but this does not include the software designer or other third parties involved in the initial design of the vehicle."[192] The National Police Agency of Japan also recommends the use of black boxes in the cars in test, and in December of 2018 it unveiled a draft bill, expected to implement the legislation in the first half of 2020, allowing the use of level 3 automation on Japan's roads under certain circumstances. The draft bill demands the installation of data recorders.[193] In 2017, the government of UK passed a bill addressing the liability of insurers and owners of automated vehicles. Under the Bill HC 143[194], when the owner is considered at fault the insurer's liability can be limited. The bill also "resolves ambiguity regarding the apportioning of liability between

[189] Taeihagh & Lim, *supra* note 182.
[190] Collingwood, *supra* note 183.
[191] Taeihagh & Lim, *supra* note 182.
[192] *Ibid*.
[193] "Police agency unveils draft bill to allow self-driving vehicles on Japan's roads", (2018), online: *The Japan Times* <https://www.japantimes.co.jp/news/2018/12/20/national/national-police-agency-unveils-draft-bill-legalize-vehicles-high-level-autonomous-features/#.XUszbnt7nIV>.
[194] No Vehicle Technology and Aviation Bill (HC Bill 143).

insurers and the insured victims involved in AV accidents [...] providing accident victims faster access to compensation."[195] About that, in 2016, the European Parliament Members made a recommendation[196] to the Commission on Civil Law Rules on Robotics saying "a mandatory insurance scheme and an accompanying fund to safeguard full compensation for victims of AV accidents" should be created.[197]

In Canada, debates about changes over liability in the expectation of driverless cars are already happening at federal level. The report *Driving Change: Technology and Future of Autonomous Vehicles*[198] of the Standing Senate Committee on Transport and Communications published in January of 2018 has a section dedicated to liability where it expresses concerns about the changes the new technology may create in the auto insurance market.

> witnesses also discussed potential shifts in accident liability. As explained by the Insurance Institute of Canada, human error has been the predominant cause of collisions since motor vehicles were first introduced. Accordingly, both legislation and insurance procedures have developed around "an expectation of driver error." However, as automation increases, insurers and the legal system will also have to consider the role of software errors and equipment failure in collisions. In the long term, this raises questions about whether liability will shift entirely from drivers to manufacturers when fully automated vehicles become the predominant means of transport.[199]

[195] Taeihagh & Lim, *supra* note 182.
[196] Committee on Legal Affairs, "(2015/2103(INL))", (2015), online: *Eur Parliam* <http://www.europarl.europa.eu/doceo/document/JURI-PR-582443_EN.pdf?redirect>.
[197] Taeihagh & Lim, *supra* note 179 at 112.
[198] Standing Senate Committee on Transport and Communications Senate, *Driving Change: Technology and Future of Autonomous Vehicles* (Ottawa, 2018).
[199] *Ibid*.

2.6 – Fatal crashes and lawsuits involving driverless cars

About the future of liability in the courts, Calo is correct when he writes that he is

> reasonably convinced U.S. common law is going to adapt to driverless cars just fine. […]
>
> When someone creates a product that is supposed to move people around safely and instead crashes, judges assign liability to whoever built the vehicle or vehicles involved in the accident.
>
> There are some difficult cases on the horizon. Policymakers will have to determine just how much safer driverless cars will need to be compared to human-operated cars before they are allowed — or even mandated — on public roads.
>
> Courts will have to determine who is responsible in situations where a human or a vehicle could have intervened but did not. On the one hand, courts tend to avoid questions of machine liability if they can find a human operator to blame.[200]

Indeed, when in 2016 a Tesla car-owner died in a crash while using the Autopilot mode[201], the company was not charged because "the deceased driver seemingly assumed the risk of engaging the autopilot."[202] The report of the crash investigation concluded that:

> (5) The Tesla's multiple ADAS and CA technologies, including Autopilot and FCW, were functional at the time of the crash. Although these technologies had limitations, the ADAS system did not respond to an impending crash event.
>
> (6) Regardless of the operational status of the Tesla's ADAS technologies, the driver was still responsible for maintaining ultimate control of the vehicle.

[200] Ryan Calo, "Is the law ready for driverless cars?" (2018) 61:5 Commun ACM 34.
[201] Patrick Lin, "Tesla Autopilot Crash: Why We Should Worry About a Single Death", (2016), online: *IEEE Spectr* <https://spectrum.ieee.org/cars-that-think/transportation/self-driving/tesla-autopilot-crash-why-we-should-worry-about-a-single-death>.
[202] Calo, *supra* note 200.

> All evidence and data gathered concluded that the driver neglected to maintain complete control of the Tesla leading up to the crash.[203]

In April of 2019, a family of another Tesla car-owner, deceased in March of 2018 while the car was engaged in the Autopilot mode, filed a lawsuit against the manufacturer. The family claims Tesla was negligent and that their product is defective.

> 24. As the vehicle approached the US-101/State Highway (SH-85) interchange, it traveled in the second lane from the left, a lane for continued travel on southbound US-101. WALTER HUANG used the autopilot features of the Model X Tesla which had been designed, tested and incorporated by the Defendants, and each of them, and which such features included "traffic-aware cruise control" and "autosteer lane-keeping assistance".
>
> 25. As WALTER HUANG approached the paved gore area dividing the main travel lanes of US-101 from the SH-85 exit ramp, the autopilot feature of the Tesla turned the vehicle left, out of the designated travel lane, and drove it straight into a concrete highway median.
>
> 26. The above-described Tesla Model X struck and collided with the median structure with sufficient force and velocity to cause fatal injuries to WALTER HUANG, who was pulled from the car and pronounced dead several hours later.
>
> 27. At all relevant times herein, Defendants TESLA and DOES 1 through 20, were negligent and careless in their design, manufacture, testing, marketing, sale, and maintenance of the 2017 Tesla Model X, and Defendants were negligent and careless in failing and omitting to provide adequate instructions and warnings to protect against injuries occurring as a result of vehicle malfunction and the absence of an effective automatic emergency braking system, as occurred here.[204]

Also in March of 2018, the first fatal crash happened involving a pedestrian and a driverless car. In Tempe, Arizona, an Uber's Volvo collided and killed Elaine Herzberg, while she was crossing a road holding her bicycle.[205] The company settled an agreement with her family. The terms of the agreement are unknown. The safe-

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[203] Incorporated Crash Research & Analysis, *Special Crash Investigations: On-Site Automated Driver Assistance System Crash of the 2015 Tesla Model S 70D* (Washington, DC, 2018).
[204] *Sz Hua Huang, et al v Tesla Inc, et al, No 19-346663, Calif Super, Santa Clara Co*.
[205] Angie Schmitt, "Video of the Fatal Uber Self-Driving Car Crash Upends the Victim-Blaming Narrative", (2018), online: *Streetsblog USA* <https://usa.streetsblog.org/2018/03/22/video-of-the-fatal-uber-self-driving-car-crash-upends-the-victim-blaming-narrative/>.

driver – who was watching a video during the collision – may be charged criminally. The company, however, will not be charged criminally,[206] which caused some criticism,[207] because Uber had disabled the manufacturer's emergency braking system that could have possibly saved Herzberg's life.[208] Uber disabled that system to avoid conflict with the Uber's own self-driving system, which could cause "jerky" behaviour of the car.[209]

There are not yet enough cases to establish patterns or trends. In relation to what will be discussed in the next chapter, it is important to note, however, especially in the case of the Herzberg death, that the debates on the media were centralized on the doubts if the sensors were functioning, if the car detected the pedestrian, and even if the pedestrian was not to blame[210] since she was not crossing in a dedicated cross point. Debates around the role of the speed of the car, the speed limits of the road and the road design or the car design were rare.

[206] Kristin Houser, "Prosecutors: Uber Isn't Criminally Liable for Self-Driving Car Death - But the safety driver might face criminal charges.", (2019), online: *Futurism* <https://futurism.com/uber-not-criminally-liable-self-driving-car-death>.
[207] Angie Schmitt, "Uber Got Off the Hook for Killing a Pedestrian with its Self-Driving Car", (2019), online: *Streetsblog USA* <https://usa.streetsblog.org/2019/03/08/uber-got-off-the-hook-for-killing-a-pedestrian-with-its-self-driving-car/>.
[208] Houser, *supra* note 206.
[209] Schmitt, *supra* note 207.
[210] Schmitt, *supra* note 205.

2.7 – Automobile as a metaphorical choice

Richards and Smart assert that when law confronts new technology, the metaphors we use to understand the technology are important.[211] "The metaphorical choice (either implicit or explicit) to design a technology as a new version of an existing thing has real effects on how research questions are framed and pursued, expanding or limiting the range of possible results that can be tested and engineered."[212] Calo says Judges "rely on metaphor and analogy when reasoning through new technologies"[213] and also litigants "often deploy metaphor and analogy strategically in an effort to channel the law's application to a new technology."[214] One simple example is when e-mails are seen as letters or postcards.[215]

In the case of robot-cars, the metaphor is clear and explicit. What is less evident is the consequences for the fact that we think about, understand, and conceptualize those robots as automobiles. This fact is important for concepts, engineering, legal, and consumer stages. "Particularly in the context of changing technologies, the law almost always considers new technology as merely a new form of something else."[216]

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[211] Richards & Smart, *supra* note 135 at 16.
[212] *Ibid*.
[213] Ryan Calo, "Robots as Legal Metaphors" (2016) 30:1 Harv J Law Technol 209.
[214] *Ibid*.
[215] *Ibid*.
[216] Richards & Smart, *supra* note 135.

The debates at the governmental level and before courts signal the technology is and will be treated as an improvement and advancement of the conventional car. This is self-evident, and may sound trite because it is obvious, and we cannot escape of framing that new technology in that form. That is not, however, an irrelevant observation in the sense that "metaphors can constrain thinking, sometimes in an unnecessarily limiting way (if they rest on old social norms or technical limitations that are no longer applicable), and sometimes in a way that reflects the enduring wisdom of the past."[217]

The idea around self-driving cars is that they will revolutionize our cities in many ways. One of the most claimed aspects of that revolution is the end of road deaths. How can that revolution be limited if this new technology is not seen by the masses, judges, engineers and lawmakers as really new, but merely as an old technology with super improvements? Additionally, at the same time, can this technology be more transformative if we see it as a new object with new forms of interaction and relations within society and the space it moves about?

This has no answer for now. Maybe - and just maybe – in the future, looking in hindsight, we may be able to understand the limitations and constraints, and the consequences of the visions we have today.

[217] *Ibid*.

CHAPTER 3

LOOK BOTH WAYS: THE SAFETY ARGUMENT AND THE CONSTRUCTION OF A DRIVERLESS FUTURE

Can we imagine a world without road deaths? Cities where parents would not fear letting a 4-year old cross a street not holding hands? The driverless future is promised as the solution to many of our problems. The most prominent, expected and advertised promise is the clearance of road statistics from road deaths. The safety argument, stating that self-driving cars will be safer than human drivers, is the main selling point toward a driverless future. The car industry, however, sold its product throughout the last century advertising attributes that in many aspects are opposed to the idea of safety, like speed and power that allied with a sense of control and individuality helped to couple the automobile with freedom. How can these attributes fit into the safety argument? Can the self-driving technology flaws of the present undermine or delay the achievement of those promises? How may those promises and flaws shape the space and relations in our cities streets?

Those questions are the basis for the discussion in this last chapter, that is divided in four main sections. The safety argument is presented in the first one, with some studies related to the safety of self-driving cars and if they are already in a stage that allows their deployment. Since it is crucial for the industry to gain public confidence, this section also present studies that analyse the public opinion about autonomous vehicles. In the second and third part, we have two opposite perspectives

for a driverless future. Starting from difficulties faced nowadays by robot-cars in dealing with unpredictable situations and the unpredictability of human behaviour, two futures are foreseen: one where pedestrians and cyclists have great access to the streets, using the flaws of the technology to their advantage; and another one where, to prevent pedestrians from disturbing the driverless cars traffic flow, old measures against pedestrianized spaces and access of people to streets are taken. The last part proposes the necessity of enlarging the debate around robot-cars including other aspects – like studies about relations within public space, and what are other already existing answers for safety problems – that could help reaching the full potential of the technology as part of a solution for safe and accessible cities.

3.1 - The safety argument

The most used argument for the development and widespread use of autonomous cars is the *safety argument*.[218] The word "safety," for example, appears 318 times in the last (2018) U.S Transportation's report about automated vehicles.[219] In the Canadian publications from federal entities about driverless cars, safety is also the main concern and the first item to appear in lists of guidance principles.

[218] Daniel J Hicks, "The Safety of Autonomous Vehicles: Lessons from Philosophy of Science", *IEEE Technol Soc Mag* (2018) 62 at 63.
[219] U.S. Department of Transportation, *supra* note 187.

It is no controversy that deaths and injuries caused by automobiles crashes are one of the leading problems and challenges of contemporary society. Road collisions are responsible for more than 1.35 million deaths annually and the leading cause of deaths in children and young adults from 5 to 29 years old around the world.[220] In 2017, there were 1,841 fatalities and at least 9,960 serious injuries on Canadian roads.[221] In the U.S., the champion of road deaths among high-income countries,[222] cars were responsible for estimated 37,133 deaths in 2017,[223] and motor vehicle crashes can be responsible for more than US$800 million in economic and social costs each year[224].

The autonomous car, for many, is a solution with the significant potential to mitigate this problem. This reasoning is appealing since we have statistics showing that 94% of severe motor vehicles crashes on U.S. roads are caused by driver-related factors[225]. These statistics are often used by companies on their websites and by their representatives in presentations and interviews about the significance and importance of driverless cars to our society.

Even though companies and governments are betting on the fast development and extensive use of cars with a high level of automation, some recent

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[220] World Health Organization, *Global status report on road safety 2018* (Geneva, 2018) at 3.
[221] Government of Canada, "Canadian Motor Vehicle Traffic Collision Statistics: 2017", (2019), online: <https://www.tc.gc.ca/eng/motorvehiclesafety/canadian-motor-vehicle-traffic-collision-statistics-2017.html>.
[222] World Health Organization, *supra* note 220.
[223] U.S. Department of Transportation, *supra* note 187.
[224] Nidhi Kalra & Susan M Paddock, "Driving to safety: How many miles of driving would it take to demonstrate autonomous vehicle reliability?" (2016) 94 Transp Res Part A 182.
[225] U.S. Department of Transportation, *supra* note 187.

studies question if, right now, it is possible to affirm that, in the current state of the technology, driverless cars are at least as safe as human drivers.

One study from 2016 concludes that there is not enough data to derive any conclusion yet[226]. Americans drive nearly 3 trillion miles every year with a rate of 77 reported injuries per 100 million miles, and a rate of 1.09 fatalities per 100 million miles (data from 2013). From 2009 to 2015, Google's autonomous vehicles fleet, in autonomous mode, was test-driven only 1.3 million miles.[227] The researchers conclude that:

> autonomous vehicles would have to be driven hundreds of millions of miles and sometimes hundreds of billions of miles to demonstrate their reliability in terms of fatalities and injuries. Under even aggressive testing assumptions, existing fleets would take tens and sometimes hundreds of years to drive these miles — an impossible proposition if the aim is to demonstrate their performance prior to releasing them on the roads. Only crash performance seems possible to assess through statistical comparisons of this kind, but this also may take years. Moreover, as autonomous vehicles improve, it will require many millions of miles of driving to statistically verify changes in their performance."[228]

The researchers also write that there are alternative methods – like virtual testing and simulations, and mathematical modelling and analysis – that could supplement real-world testing, but "even with these methods, it may not be possible

[226] Kalra, Nidhi & Susan M Paddock. "Driving to safety: How many miles of driving would it take to demonstrate autonomous vehicle reliability?" (2016) 94 Transp Res Part A at 182.
[227] Kalra & Paddock, *supra* note 221 at 183.
[228] *Ibid* at 191.

to establish the safety of autonomous vehicles prior to making them available for public use. Uncertainty will remain."[229]

It is important to observe that the data about Google's fleet used for that study dates from 2015. The Google Self-Driving Car Project in 2016 became a new company itself: Waymo. Nowadays, Waymo's fleet is bigger than the fleet from the time of the study, and it has been put to test under real environment conditions in more than 25 American cities, accumulating over 5 million miles of real-world experience and over 5 billion miles in simulation.[230] Yet, those numbers are still far below what the study concludes to be necessary to demonstrate the reliability of the technology.

In August of 2018, *The Information*,[231] a known website specialized in technology, reported issues with Waymo's cars currently in test on public roads. It informed that the company's vehicles were having "difficulty making unprotected left turns, distinguishing between individuals in a large group, and merging into turn lanes and highway traffic, among other trouble areas."[232]

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[229] *Ibid*.

[230] Waymo, *Waymo Safety Report - On the road to Fully Self-driving* (2018) at 7.

[231] Amir Efrati, "Waymo's Big Ambitions Slowed by Tech Trouble", (2018), online: *Inf* <https://www.theinformation.com/articles/waymos-big-ambitions-slowed-by-tech-trouble>.

[232] Mark Matousek, "The GM-backed robo-taxi startup Cruise Automation is reportedly struggling to refine its self-driving car technology", (2019), online: *Bus Insid* <https://www.businessinsider.com/cruise-automation-reportedly-struggling-refine-self-driving-tech-2019-6>.

Recently released by that same website,[233] a report on the driverless industry raised setbacks that Waymo's most prominent adversary — Cruiser Automation — is having with its cars. The report shows that the number of crashes, random brakes and erratic steering — causing not only discomfort to the passengers, but real near-collision events — are much more frequent than the company expected to deal with by this time. There are too many problems. That takes from the company the confidence to launch a ride-hailing service. The vehicles were taking 80% longer to complete a trip than a human driver, and "several months" before the release of the report, they were close to having a collision around once every 450 miles. The company's goal was to reduce that rate to once every 1,000 miles by the end of 2018. During that year, Cruiser Automation's vehicles had a rate between 6 and 12 incidents every 10 miles. By the end of 2019, the company expects its vehicle to be between merely 5% to 10% as safe as human-driven vehicles. This mark is well below what the public expects from driverless cars to be in order to fearlessly accept them in the market.

A 2019 Chinese study also points out that, at this moment, there is not sufficient data to determine the benefits and costs of driverless cars to society, and it is not possible to make a formal cost-benefit analysis. It also says that the reported results of autonomous vehicle safety are conflicting.[234] The objective of that study was

[233] Amir Efrati, "Technical Glitches Plague Cruise, GM's $19 Billion Self-Driving Car Unit", (2019), online: *Inf* <https://www.theinformation.com/articles/technical-glitches-plague-cruise-gms-19-billion-self-driving-car-unit>.

[234] Peng Liu, Run Yang & Zhigang Xu, "How Safe Is Safe Enough for Self-Driving Vehicles?", *Risk Anal* (2019) at 315-316.

to create data that would help the debate about "how safe is safe enough for self-driving vehicles?" Their survey results showed that to be accepted by the public in the marketplace, the driverless vehicle must be 4 to 5 times as safe as human drivers, which means that it has to reduce the current traffic fatalities by at least 75-80%.[235] It is necessary, though, to say that the group selected for that study was a small sample formed by people from only one city in China. The researchers make clear that it is not possible to generalize their findings to the general population, and that further studies must be made.[236]

Another study endorses that concern. With samples collected in Israel, the United States and Canada, it shows significant differences between these regions concerning the acceptance to AVs. The research demonstrates that while 54% of Americans tended to favour regular cars, only 35% of Israelis chose for traditional cars.[237] The Americans that chose autonomous cars tended to choose private autonomous vehicles instead of shared autonomous vehicles (ride-hailing system with a yearly subscription cost), while Israelis that opted for autonomous vehicles had a more even distribution between those two options.

The study also concludes that the perception and preferences about AVs are influenced by other variables like commute time, income, gender, age and education. The ones that always chose the regular car were, on average, more likely to be female,

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[235] *Ibid* at 322.
[236] *Ibid*.
[237] Chana J Haboucha, Robert Ishaq & Yoram Shiftan, "User preferences regarding autonomous vehicles" (2017) 78 Transp Res Part C Emerg Technol 37 at 45.

older, less educated and with a lower income than the overall average.[238] Those with a longer commute time tended to favour autonomous vehicles. Gender does not play an important role in the choice decision for Americans. Israeli women were less likely to use shared autonomous vehicles than men, which the researchers hypothesized as a result of cultural differences between North America and the Middle East in relation to gender. Also, the higher the education, the higher the individual favoured the use of AVs. On that point, the researchers also speculate that maybe those who are more educated are more open to new ideas and technologies.

It is important to highlight a few aspects of the methodology utilized in this research. The surveys were distributed online through social media, making sure that all the respondents were drivers that used cars to commute to work or school. A total of 721 individuals completed the survey, whose answers led to a total of 4260 usable observations. From this total, 1920 usable observations were obtained from the U.S. and Canada, 2109 from Israel, and 231 from other global locations. Maybe, though, the most important aspect is that the surveys were answered almost five years ago, in September and November of 2014. In the last few years, not only we had some important advancements in the autonomy technology, but the media increased the coverage of these achievements and also gave a huge coverage of the first fatalities related to driverless cars. Another important fact is that ride-hailing service, such as Uber, was still in its early stage, not being as popular as it is nowadays. These facts

[238] *Ibid* at 43.

open the question about how different could be the results of this survey if it was made today.

A survey conducted by the AAA in January of 2019 informs that 71% of Americans are afraid to ride in a fully self-driving vehicle, but 55% believe that by 2029 most cars will be capable to drive themselves. The survey also suggests that drivers who use advanced driver assistance systems are much more comfortable with the idea of riding in driverless cars.[239] In a study made with insurance consumers published in October of 2018, executed by J.D. Power and the National Association of Mutual Insurance Companies (U.S.), 45% of the respondents marked they would require 100% level of safety (0% of error) before they ride in a fully automated vehicle, and 38% marked they would never ride it independently of the safety level.[240]

Those surveys show that the vast majority of Americans are afraid of using driverless cars. That shows one of the major challenges of driverless companies is to gain the confidence of the public that their product is safe and reliable, which demonstrates the prominence of the safety argument for the industry.

In March of 2019, the National Research Council of Canada (NRC) published a report on the literature about autonomous vehicles and connected vehicles

[239] American Automobile Association, "Three in Four Americans Remain Afraid of Fully Self-Driving Vehicles", (2019), online: *AAA NewsRoom* <https://newsroom.aaa.com/2019/03/americans-fear-self-driving-cars-survey/>.
[240] Lance Eliot, "Are 175 Million Americans Right About Driverless Cars? Remarkably, Yes", (2019), online: *Forbes* <https://www.forbes.com/sites/lanceeliot/2019/05/03/are-175-million-americans-right-about-driverless-cars-remarkably-yes/#350d7d774d62>.

awareness. The report says there are not many studies on public awareness about new technologies involving Advanced Driver Assistance Systems and most governmental websites around the world primarily focus on "technology development, infrastructure, policy and regulations related to advanced vehicle technologies. Some sources mention technology acceptance, but public education and awareness were rarely mentioned."[241] The report also affirms the majority of available sources across multiple sources focus on an education to "promote acceptance and marketing of the technology."[242] The study warns that an acceptance without "proper education, communication, awareness and understanding may lead to consumer fear based on misperception or lead to over-reliance on the technologies with potential impacts to safety."[243]

3.2 - Driverless cities and the creation of pedestrians' paradises

Journalist Aarian Marshall starts her article for Wired Magazine about her experience in the backseat of a Cruise Automation's driverless car stating: "Nothing will make you hate humans — capricious, volatile, unplanned, erratic humans — like sitting in the back of self-driving car."[244] After complaining about walkers, bicyclists and human drivers that were always alarming the driverless car with their erratic actions,

[241] Jennifer Welburn, *AV/CV Consumer Awareness Literature Review* (Ottawa, 2019) at 12.
[242] *Ibid* at 8.
[243] *Ibid* at 8-9.
[244] Aarian Marshall, "My Herky-Jerky Ride in General Motors ' Ultra- Cautious Self Driving Car", (2017), online: *Wired* <https://www.wired.com/story/ride-general-motors-self-driving-car/>.

she continues asking "why couldn't they be like this autonomous vehicle: extra cautious, considerate, aware?"[245] Right after these complaints, she accepts that

> this chaos [however] — this unpremeditated waltz of oops, no, you go and nope, buster, me first — is reality. It's how cities work. Which means that if a car is going to drive itself, no humans drivers involved, it must get very good at doing something very hard: interpreting and anticipating the behavior of humans.[246]

To see the world, driverless cars use a mix of different sensors and technology - light detection and ranging (lidar), radar, ultrasound devices and computer vision - requiring a complex data fusion[247]. To understand the world, the robot-car must postprocess the data captured by the sensors making estimations and matching patterns.[248] If a scene - or if a sensor does not function properly - does not match with the expected patterns, the driverless car may not be able to precisely understand what is happening and, therefore, may not act correctly and in time.

A self-driving car must deal with a huge number of variables existent in the real world. Beneath the most unpredictable variables, are the ones related to humans' actions.

> A key challenge in human-robot interaction is developing high fidelity models for the human agent. Without these models, the robot agent cannot properly predict human behaviors and respond appropriately. This problem is difficult, however, given the unpredictability of the human agent. Thus, there is a tradeoff between trying to be robust to all possible sets of human behavior, or focusing solely on the most likely actions. Another challenge is that each human is different. Each person has varying physical and cognitive capabilities and different preferences and expectations from the robot agent. In addition, they may change preferences over time, based on their affective (emotional) state. This problem is especially relevant in the

[245] *Ibid*.
[246] *Ibid*.
[247] Missy Cummings, "The Brave New World of Driverless Cars", *TR News* (2017) 34.
[248] *Ibid* at 35.

> intelligent vehicle domain, where autonomous vehicles must collaborate with human passengers and other human drivers.[249]

Indeed, within the interaction between road users, there is "a complex blend of physical design, psychology, social norms, and other factors."[250] One of the greatest challenges for autonomous driving is how to deal with the uncertainty factor of human behaviour. As researchers put it in a work published in 2018:

> the major outstanding challenge for real-world autonomous vehicles is to operate in environments containing people. Unlike static (and ballistic) environments, people are complex interactive agents having their own goals, utilities, and decision making systems, and interactions with them must take these into account in order to predict their actions and plan accordingly."[251]

One study shows some of our patterns while trying to cross a street. The "pedestrian crossing behaviour can be divided into 3 phases: approaching (stable speed), appraising (deceleration due to evaluation of speed and distance of oncoming vehicles) and crossing (acceleration)."[252] Some other studies, trying to understand interactions between drivers and pedestrians, found eye contact plays an important role[253]; that in 90% of the time pedestrians reveal their intention of crossing by looking at the approaching vehicles, and that pedestrians can use gaze to influence drivers behaviour to make them stop more often at crossings[254]. It also was demonstrated

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[249] Vijay Govindarajan, *Human Modeling for Autonomous Vehicles: Reachability Analysis, Online Learning, and Driver Monitoring for Behavior Prediction.* University of California at Berkeley, 2017.
[250] Adam Millard-Ball, "Pedestrians, Autonomous Vehicles, and Cities" (2018) 38:1 J Plan Educ Res 6 at 8.
[251] F Camara et al, "Predicting pedestrian road-crossing assertiveness for autonomous vehicle control" (2018) 2018-Novem IEEE Int Conf Intell Transp Syst Proceedings, ITSC 2098.
[252] *Ibid*.
[253] Dirk Rothenbucher et al, "Ghost driver: A field study investigating the interaction between pedestrians and driverless vehicles" (2016) 25th IEEE Int Symp Robot Hum Interact Commun RO-MAN 2016 795.
[254] Camara et al, *supra* note 251.

that vehicles usually "win" an interaction with a pedestrian, which means that the pedestrian - the loser - had to yield for the car. This is an expected result when the forces in the equation (interaction) have different strengths[255], and one has much more to lose (pedestrians can face death or be maimed) than the other (drivers can face the trouble of the judicial system and money loss).[256]

Yes, our actions are recognizable and predictable by patterns. In theory, we can gather all the possible different behaviours in all possible situations and assemble the collected data into a machine, creating a driverless car that can predict human behaviour with perfection. The reality, though, is that the variety of possibilities and the number of variables involved in each one of these patterns make the work to recognize them a herculean — if not impossible — process. Yet, despite the difficulties, researchers are putting their efforts into it.

Trying to solve that issue, a group of researchers explains that "considerable research has been conducted on navigation among pedestrians"[257] and different approaches are in test and construction. Some ignore pedestrians' intentions and interactions, treating them as static obstacles; others consider their intentions but not explicitly model their interactions, trying to predict trajectories from pedestrians' patterns learned from previous data. The problem, though, with those data-driven approaches is the difficulty to make predictions in new scenarios. Some algorithms

[255] *Ibid*.
[256] Millard-Ball, *supra* note 250.
[257] Yuanfu Luo et al, "PORCA: Modeling and planning for autonomous driving among many pedestrians" (2018) 3:4 IEEE Robot Autom Lett 3418.

have modeled both intentions and interactions, but still without the necessary emphasis on uncertainty.[258]

London startup *Humanising Autonomy* is creating an artificial intelligence "powered technology that is able to predict the full range of pedestrian and vulnerable road user behaviour in real time" and "develop natural interactions between people and autonomous vehicles."[259] The co-founder Raunaq Bose explains they noticed the automotive industry's view of automated vehicles was not taking into account the vulnerable road users outside the vehicle in the way the startup founders thought the industry should.[260] Because the vehicles will need to interact and understand the detailed communication between road users to navigate complex urban environments, the focus of the startup is a "human-centred implementation of autonomous technology"[261]. With deep learning and deep reinforcement, the startup uses culture and context specific predictions to "capture the full complexity of human behaviours in urban environments around the world."[262] The intention is that the technology can be used anywhere on the globe, independently of cultural differences in the behaviour, learning and improving from new detected activities.

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[258] *Ibid* at 3419.
[259] Raunaq Bose, "Why we started Humanising Autonomy", (2019), online: *Humanising Auton* <https://medium.com/@HumanisingAutonomy/why-we-started-humanising-autonomy-dbbf381ff51f>.
[260] *Ibid*.
[261] *Ibid*.
[262] "Humanising Autonomy", (2019), online: *Humanising Auton* <https://www.humanisingautonomy.com/>.

The difficulty of dealing with human complexity pushes companies, at least for now, to a cautious approach in the way driverless cars behave. When facing any minimal possibility of collision, the car stops. That behaviour makes the travel clumsy and slow, because the machine uses the breaks, often abruptly, much more than a human driver would. At this stage, where we are still figuring out how to deal with the human unexpected behaviours, that caution is necessary to avoid any risk of harm and to reduce any unwanted outcome from a system failure.

Apart from the "jerky" characteristic, it is not a problem *per se* that robots that can harm us are super cautious, more responsible and risk averse than the average human. In fact, that is exactly how every human driver should always be, and that is the most relevant characteristic that can make the robot-cars superior to us on the road. Assuming that manufacturers continue to produce autonomous cars with those qualities, that leads us to question how pedestrians may behave if driverless cars become the great majority of the automobiles and the pedestrians get confident about the risk aversion and safety of the technology.

Why do pedestrians not simply step on the streets whenever they want? Besides social pressure and law enforcement, in part, it is because they know there is a chance the driver is distracted, intoxicated, or even psychologically unhealthy.[263] Also, the pedestrian needs to consider the velocity of the automobile and calculate if it will have any chance to safely reduce the speed and stop before a collision. To cross

[263] Millard-Ball, *supra* note 250.

a street always involves a probability calculation of the odds of (not) being hit. How paradigm shifting it would be if pedestrians had the certainty that they could cross the streets anywhere and anytime they want without any chance of being slaughtered by an automobile? Nowadays, motor vehicles are the winners in most interactions with pedestrians, but with the cautious and responsible robot-car, some say pedestrians may be the new winners.

Paradoxically, this cautious and risk avoidance behaviour in support to the safety argument – sold by the industry and government agencies as the most prominent and attractive quality of a driverless world – can become the main reason to retard a manufacturers' (highly profitable) utopia.

Taking the premise of a paradigm change, Millard-Ball envisions the possibility of a "pedestrian supremacy."[264] Cyclists and pedestrians, becoming aware of driverless cars' cautiousness, would "exploit" that characteristic and be confident to behave more erratic than today. With diminished risks of collisions, pedestrians would not have great concerns to cross the streets. They would not need, therefore, to be as cautious as nowadays. This new societal behaviour - without the concern about being hit by car - would break pedestrian's patterns we are used to, creating more uncertainty. Consequentially, that would reinforce driverless car behaviour, making them act even more cautious when surrounded by humans. That would slow down motorized trips, especially in the heart of the urban neighbourhoods, leading to a

[264] *Ibid* at 10.

society where walking or cycling are quicker alternatives and, therefore, more advantageous. Self-driving cars would be used almost solely to travel around the edges of those urban neighbourhoods, dropping the passengers on its limits. That dynamic would encourage a virtuous cycle of increasingly pedestrian and cycling activity, leading to more urban density, that in turn pushes to even more non-motorized mobility.

In a future like that, cars would stay far from being the best option for most trips in the city. It would be like a paradise for walking and cycling. If driverless cars' industry continues to use the safety argument as the main selling point of the technology and ultra cautiousness as the main support for that argument, the reality can become similar to that pedestrian's heaven. The doubt is if a pedestrian's utopia can become a nightmare for the driverless industry's profits.

3.3 - Look both ways before crossing the street

For some, a future of pedestrian supremacy must be seen as a problematic "jaywalking paradise,"[265] where autonomous vehicles "will never get anywhere,"[266] once people realize "these cars are programmed to stop when they cross the streets."[267]

[265] Jackson Chen, "Autonomous Autos: Experts say driverless cars could turn Manhattan into gridlock hell and ' jaywalking paradise '", online: *The Villager* <https://www.thevillager.com/2016/10/autonomous-autos-experts-say-driverless-cars-could-turn-manhattan-into-gridlock-hell-and-jaywalking-paradise/>.
[266] *Ibid*.
[267] *Ibid*.

This was one of the topics discussed during a panel in New York City in 2016, where several panelists agreed that Manhattan will be a "unique stress test for the new vehicles because of the obstacles its clogged street grid provides, with cars in transit joined by a glut of pedestrians, increasing numbers of bicyclists, and, of course, the ubiquitous double-parked cars."[268]

In his article *We Need New Rules for Self-Driving Cars*, Stilgoes recalls the sociologist Brian Wynne's thoughts, remembering he

> argued that the reality of technology was far messier than normally assumed by experts. Technology, for Wynne, was "a form of large-scale, real time experiment," the implications of which could never be fully understood in advance. Technological societies could kid themselves that things were under control, but there would always be moments in which they would need to work things out as they were going along.[269]

Indeed, some recent trials of self-driving minibuses and cars in real environments raise doubts, like the one above, over what is the best way to deploy the technology in places with lots of pedestrians and cyclists like some areas of metropolises such as New York and Toronto.

Right now, in Hong Kong, a driverless minibus that can carry ten passengers is making real-world test trips during specific days in an arts hub district, originally dedicated only for pedestrians and non-motorized vehicles.[270] The shuttle is still under authorities' scrutiny. "If [such buses] have to drive through a heavily pedestrianised

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[268] *Ibid*.

[269] Jack Stilgoe, "We Need New Rules for Self-Driving Cars" (2018) 34:3 Issues Sci Technol.

[270] Shirley Zhao, "Tech worries throw future of Hong Kong's first driverless electric bus route into doubt", online: *South China Morning Post* <https://www.scmp.com/news/hong-kong/transport/article/3003944/driverless-electric-bus-fails-create-buzz-hong-kong>.

area, they basically have to stand still all the time,"[271] complains Zimmerman, the founder of the group *Designing Hong Kong*, who refers to the minishuttle as a "beeping monster", because of the alarm the vehicle sounds whenever it encounters an obstacle and stops. Zimmerman also complains about the possibility that, to solve this problem, the bus may require a separated road, which means the district will not be a pedestrian-only zone as it was initially supposed to be.[272]

Despite that type of complaint and authorities' doubts, a survey found the majority of the 6,000 visitors that took part in the minibus trial run support the system. It points out that one of the passengers interviewed by the newspaper *South China Morning Post* says the district would have to solve the practical issue of "how to prevent people from going near [the minibus] all the time," making it stop constantly and that the "autonomous shuttle system should serve the whole district in the future."[273]

In June of 2019, in Stockholm, while participating in the Global Public Transport Summit, the transit journalist and author Carlton Reid posted on the social media Twitter: "stepping in front of a driverless pod at @uitpsummit in Stockholm. Autonomous vehicles are going to be so much fun for pedestrians and cyclists."[274] Under those lines, he posted a 47 seconds video of himself "pranking" a minibus that was in use in the area of the summit. Every time the shuttle moved, he stepped in front

[271] *Ibid*.
[272] *Ibid*.
[273] *Ibid*.
[274] Carlton Reid, (2019), online: *Twitter* <https://twitter.com/carltonreid/status/1138430941486112768>.

of it, making the minibus abruptly stop and sound an alarm that increased as the time goes by. He ends joking and laughing: "you [the minibus] are not going anywhere."

That kind of attitude is also happening toward cars. Because it is a novelty, and people are learning about the ultra-cautious behaviour, Bloomberg reports pranks are not a rare problem:

> Some people just can't suppress the urge to test the technology's artificial reflexes. Waymo, which is owned by Alphabet Inc., routinely encounters pedestrians who deliberately try to 'prank' its cars, continually stepping in front of them, moving away and then stepping back in front of them, to impede their progress.[275]

In some localities, real attackers, not pranksters, are the problem for driverless companies. In a sort of return of the attackers from the early days of the conventional car last century or the Luddites from the 19th century, residents of an American city are throwing rocks, slashing tires, threatening with PVC pipes and even guns the Waymo's cars and their emergency drivers. During 2017 and 2018, the Police Department of Chandler, Arizona, documented at least 21 attacks, assaults or threats.[276]

The explanation some of the attackers give range from safety concerns to fear of losing their jobs by reason of automation. A couple received police warnings

[275] Jeremy Kahn, "To Get Ready for Robot Driving, Some Want to Reprogram Pedestrians", (2018), online: *Bloomberg* <https://www.bloomberg.com/news/articles/2018-08-16/to-get-ready-for-robot-driving-some-want-to-reprogram-pedestrians>.

[276] Ryan Randazzo, "A slashed tire, a pointed gun, bullies on the road: Why do Waymo self-driving vans get so much hate?", (2018), online: *Arizona Repub* <https://www.azcentral.com/story/money/business/tech/2018/12/11/waymo-self-driving-vehicles-face-harassment-road-rage-phoenix-area/2198220002/>.

multiple times for deliberately making the self-driving car "brake hard" or forcing it to pull over. They try to justify their actions accusing Waymo's car of almost hitting their 10-year-old son while playing in a blind alley. They told The New York Times that "they said they need real-world examples, but I don't want to be their real-world mistake. [...] They didn't ask us if we wanted to be part of their beta test."[277] Police reports that in many cases, Waymo prefers to simply avoid neighbourhoods where they faced those behaviours or residents' complains.[278]

Criminal actions, especially involving threats, violence or the possibility of harm, must be taken seriously and are not justifiable. Yet, what that couple said about not having been asked about being part of a test and the fear of becoming part of a bad outcome of an experiment raises an issue of informed consent for the public. Professor Cummings, in an opinion article where she writes about the need for interdisciplinary research in this field, says that moral question has not been sufficiently debated and is one of the many unknowns that appears with the development of self-driving cars and the government authorizations to real-world tests[279]. Having in sight that neither the United States nor Canada have federal legislation about minimum safety standards for autonomous vehicles but both have regulation mandating that all humans involved in an experiment should explicitly give their consent, she asks and argues:

[277] Simon Romero, "Wielding Rocks and Knives, Arizonans Attack Self-Driving Cars", (2018), online: *New York Times* <https://www.nytimes.com/2018/12/31/us/waymo-self-driving-cars-arizon>.
[278] Randazzo, *supra* note 276.
[279] Cummings, *supra* note 247.

> Should drivers be given the option to share the road with one or more driverless vehicles undergoing testing, especially without safety monitors? These cars have no established minimum safety standards, and the state evaluators who would determine road worthiness and public safety are not likely to have the appropriate background to make the judgment. At a minimum, discussion is warranted about clearly marking the driverless cars that are undergoing testing, so that drivers who are sharing the road have some understanding of the test environment for which they did not volunteer.[280]

Although many of those criminal behaviours may be based on irrationality, misinformation, or wrong analysis of the facts[281], they are to some degree expected with the deployment of this new technology. Trying to avoid those kind of violent reactions and also admitting the difficulties around the unpredictability of human behaviour, the driverless car startup Drive.Ai — recently acquired by Apple[282] after almost going out of business — prefers a different approach from most companies. Instead of trying to make the car seem "normal", they use flashy colours and big letters on all the sides announcing that it is a self-driving car. The most noticeable difference, however, is the use of external signages that communicate to pedestrians the intention and actions of the car, and if it is on driverless or manual mode. For example, a pedestrian can read "waiting for you to cross."

Even though there are studies showing that putting visual alerts on the vehicles does not produce the expected results[283], Andrew Ng — a machine learning

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[280] *Ibid*.

[281] For example, it is possible that, on the opposite of their perception, the couple's child was not hit precisely because of the driverless technology ability to avoid the collision.

[282] Eugene Demaitre, "Apple acquires Drive.ai as self-driving car drama continues", (2019), online: *Robot Rep* <https://www.therobotreport.com/apple-acquires-drive-ai-as-self-driving-car-drama-continues/>.

[283] Clamann, M., M. Aubert and M. L. Cummings (2017). Evaluation of Vehicle-to-Pedestrian Communication Displays for Autonomous Vehicles. The Transportation Research Board (TRB) 96th Annual Meeting Washington DC.

researcher who invested in Drive.Ai — believes that "self-driving cars should be made visually distinctive, so that people can quickly recognize them" because "even with great AI technology, it is safer if everyone recognizes our cars."[284] Writing about what he believes to be the key elements to provide a public self-driving car service he says:

> The industry must take a human-centered approach to safety — taking into account both people inside and outside the car — and emphasize communications and community education.
>
> Whether a self-driving car is safe depends not only on the behavior of the car itself, but also on the behavior of the people around it. It is unwise to rely exclusively on AI technology to ensure safety. Instead, the self-driving industry also has to think about the people who will be outside the vehicle, which is why we will be undertaking community-wide education and training programs where we operate.[285]

In a report about the challenges that will probably delay the deployment of a full scale use of driverless cars, the website The Verge says Ng "argues the problem is less about building a perfect driving system than training bystanders to anticipate self-driving behavior. In other words, we can make roads safe for the cars instead of the other way around."[286] When asked by the website about possible difficulties of the technology on how to behave in front of unpredictable cases — for example, a pedestrian on a pogo stick — he answers that most AI teams would have no problem to handle a pogo stick user pedestrian on a crosswalk, but that "bouncing on a pogo stick in the middle of a highway would be a really dangerous. […] Rather than building AI to solve the pogo stick problem, we should partner with the government to ask

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[284] Andrew Ng, "Self-driving cars are here", (2018), online: *Medium* <https://medium.com/@andrewng/self-driving-cars-are-here-aea1752b1ad0>.
[285] *Ibid*.
[286] Russell Brandom, "Self-driving cars are headed toward an AI roadblock", (2018), online: *The Verge* <https://www.theverge.com/2018/7/3/17530232/self-driving-ai-winter-full-autonomy-waymo-tesla-uber>.

people to be lawful and considerate. [...] Safety isn't just about the quality of the AI technology."[287]

Condemning this vision, roboticist and emeritus professor at Massachusetts Institute of Technology (MIT) Rodney Brooks argued this is a shortcut for the deployment of self-driving cars without fulfilling the safety promises made by the industry:

> He is giving up on the promise of self-driving cars seamlessly slotting into the existing infrastructure. Now he is saying that every person, every "bystander", is going to be responsible for changing their behavior to accommodate imperfect self-driving systems. And they are all going to have to be trained! I guess that means all of us. [...] The great promise of self-driving cars has been that they will eliminate traffic deaths. Now Professor [Ng] is saying that they will eliminate traffic deaths as long as all humans are trained to change their behavior? What just happened?[288]

Just as the risk-averse and ultra-cautious approach is not a problem in itself, education and training programs are also not problematic depending on how they are addressed. Having in mind the automobile history lessons from last century — although the intention of Drive.Ai may be an education in a way to simply diminish unrealistic fears the population may have — the idea of "training" the pedestrians because the technology is not perfected to the point of recognizing pedestrian gestures and intentions and not being able to properly handle unpredictable events raises justifiable concerns among those who desire the technology to be used to completely change injuries and deaths statistics and to transform society's car-centred

[287] *Ibid*.

[288] Rodney Brooks, "Post: Bothersome Bystanders and Self Driving Cars", (2018), online: <https://rodneybrooks.com/bothersome-bystanders-and-self-driving-cars/>.

perspective. It also raises the question of how much patience companies and public authorities have to wait for a safe deployment of the technology without the need of more law enforcement toward pedestrians and cyclists, or transforming city's infrastructure around autonomous vehicles' needs at the expense of other means of transportation.

Because of the challenges and difficulties around the "pedestrians-cyclists-behaviour-safety theme," one relatively frequent discussion in academia is how can autonomous vehicles communicate with people outside the car (communication vehicle-to-pedestrian or simply V2P). Most works do not rely on external physical signs like the ones used by Drive.Ai, but on the use of mobile devices like smartphones.

Hussein et al.[289] developed an application for smartphones that sends the pedestrian location to autonomous vehicles and vice-versa, and using a "collision prediction algorithm,"[290] "both pedestrians and vehicles can anticipate each others maneuvers and identify if there is a possibility of collision."[291] The researchers conclude that "results showed a good performance and high detection rate, as well as high user satisfaction derived from the interaction with the system."[292]

[289] Ahmed Hussein et al, *P2V and V2P communication for pedestrian warning on the basis of autonomous vehicles* (Rio de Janeiro, 2016).
[290] *Ibid* at 2036.
[291] *Ibid* at 2034.
[292] *Ibid* at 2039.

Cummings, Clamann and Huang[293], however, conducted an experiment that came to a different result from the one above. Their study "intended to look at the behaviors of pedestrians crossing a road while texting on a smartphone that would also alert them to the presence of an oncoming car, with varying degrees of reliability."[294] The results showed that pedestrians who were given smartphone aural and visual alerts of varying reliability while engaging in distracted walking had similar results of other observational research studies looking at typical pedestrians. In other words, the electronic warning approach may not be effective.

Although, it was not the original intention of the experiment, Cummings, Clamann and Huang found that cultural differences played an important role in the results, with significant variation between Americans and Asians' behaviour. That finding suggests that

> More research is needed to examine these theories in more detail but understanding these divergent viewpoints is needed in order to inform both vehicle and infrastructure design in the future. As cars with more automation increasingly move into various cultures, it is not clear that software designed in Silicon Valley that models rule-abiding pedestrians in the US will perform in the same way if deployed to a country in Asia, France, or any other number of countries. In addition, the creation of safer, more protected pedestrian spaces in countries where people routinely ignore crossing signals and warnings is another area of needed research.[295]

With a different approach, Gelbal et al. developed a pedestrian-to-vehicle (P2V) communication[296]. In case the autonomous vehicle's sensors fail to detect

[293] Mary Cummings, Michael Clamann & Lixiao Huang, *Development and Evaluation of Vehicle to Pedestrian (V2P) Safety Interventions* (2019).
[294] *Ibid* at 8.
[295] *Ibid* at 9.
[296] Sukru Yaren Gelbal et al, "Elastic band based pedestrian collision avoidance using V2X communication" (2017) IEEE Intell Veh Symp Proc 270.

someone crossing the street, the pedestrian's smartphones could be used as an additional safety step and communicate to the car the pedestrian's position and then the automobile could change its path avoiding the collision. Their simulation had good results, but they had to assume the pedestrian mobile had a specific type of communication (DSRC communication).

One common — and alarming — point of argument between Hussein et al. and the Cummings, Clamann and Huang studies is the results related to user's overconfidence on the alert system. Hussein et al. found it "particularly remarkable that some subjects stated that they would ignore the traffic risks and rely completely on the warnings of a mobile application."[297] In the same direction, Cummings, Clamann and Huang note that overall in their study, "people trusted the alert app more than they did their own judgement, even when the app generated late alerts. This study demonstrates just how critical the timing is for these devices and if such alerts are even a second late, the results could be fatal."[298]

Although systems like the ones above may be theoretically a good approach, the users' overconfidence on these alerts in addition to the overconfidence of drivers in today's Advanced Driver Assistance Systems — ADAS — like Tesla's "autopilot mode," can cause the opposite desired outcome. The best conclusion is that more

[297] Hussein et al, *supra* note 289.
[298] Cummings, Clamann & Huang, *supra* note 286 at 9.

studies and experiments before using a mobile alert system through P2V and V2P are still necessary.

Moreover, the fact that this is being seen by some as an implementable improvement to autonomy safety may be an indication the driverless technology is not yet ready to be deployed as soon as some manufacturers desire. On this point, one problem raised by Cummings, Clamann and Huang is that self-driving companies that are already authorized to test the vehicles in real-environments are collecting that type of information "at levels researchers never could," but independent researchers have no access to the data. The authors argue that companies "allowing non-partisan researchers to access this data and develop safety-based models to be shared across all manufacturers" would be a good way to prevent future fatalities and fast-forward research aiming to develop solutions that could benefit both society and the industry. It is very unlikely, though, that — in a competition involving multi-billion dollar investments and high profits for the winners — companies will easily share their knowledge and data.

3.3.1 – The pedestrian problem

The industry is constantly promising that a large scale use – without changing current infrastructure – of 4 or 5 level autonomous cars is near. How to make that possible with the challenges reported in this chapter? Can the automobile continue to be as attractive as it is today in a world where lawful and highly risk-averse robot-cars

will be slow when surrounded by big crowds of pedestrians or cyclists and will be constantly stopping whenever a pedestrian tries to step into its way?

Because of those kind of doubts, Millard-Ball not only envisioned a possible "pedestrian supremacy," but also a scenario of "regulatory response:"

> In this scenario, policy makers react to the impunity shown by pedestrians with a combination of regulatory changes, physical design, and enforcement. Laws are changed to reduce pedestrian priority, for example, by eliminating unmarked crosswalks at intersections. Physical barriers in the form of fences between the sidewalk and roadway are erected to corral pedestrian traffic along busy streets, marking a return to the mid-20th century street designs that emphasize segregation of road users. Enforcement action against jaywalkers and similar violators is stepped up, and legislation specifies that an autonomous vehicle manufacturer is not liable for any collision where a pedestrian was unlawfully present in the roadway.[299]

If policy makers embrace the idea of using methods from the past — and that are still in use — to turn around the challenges of driverless cars as a way to accelerate the deployment, that "regulatory response" scenario may be a real possibility. Just like the idea of "make roads safe for the cars instead of the other way around"[300] expressed by the Drive.Ai investor, other people from inside the industry are talking about the necessity of measures similar to the ones from the early days of the conventional car in order to make that deployment possible.

The concerns raised in the panel cited in the beginning of section 3.3 are in the core of that possible future imagined by Millard-Ball. Although three years have passed since that panel happened — the same year Millard-Ball's paper was published

[299] Millard-Ball, *supra* note 243 at 10.
[300] Brandom, *supra* note 286.

— those same worries still remain beneath some industry insiders, researchers and policy makers as a recent article of The New York Times indicates.

With the title *How Jaywalking Could Jam Up the Era of Self-Driving Cars*,[301] the reportage states that places like Manhattan "poses a pedestrian problem," because "if pedestrians know they'll never be run over, jaywalking could explode, grinding traffic to a halt."[302] A former head of the National Highway Traffic Safety Administration who nowadays works as chief safety innovation officer in a self-driving startup said to the newspaper that "with autonomous vehicles, the technical stuff will get worked out. It's the societal part that's the most challenging."[303] The report says the "solution" proposed by an automotive industry official to this "pedestrian problem" is "gates at each corner, which would periodically open to allow pedestrians to cross."[304]

In an even more explicit thought in that direction, during a podcast episode about autonomous vehicles, while talking about a possible partnership between private and public sector in Japan, a former General Motor's director of global social media said the industry could:

> deliberately [pick] a small town and with the mayor and city council [...] committed to [rebuild] the entire town around the idea of autonomous vehicles. So You have got now city planners and people who are running an entire village determining that we are gonna try moving to the future and see this works. That's really cool. It's not just about the technology, it is about what happens around the technology.

[301] Eric A Taub, "Make Way for Self-Driving Cars: How Jaywalking Could Jam Up the Era of Self-Driving Cars", *New York Times* (2019) Section B 7.
[302] *Ibid*.
[303] *Ibid*.
[304] *Ibid*.

> […]
>
> It [the deployment of driverless cars] is gonna happen. Now we just have to start conditioning people to recognize that there is a learning process along the way.[305]

A few days before that Times' publication, during an event titled "Autonomous Cars: Science, Technology, and Policy,"[306] the Director of the Intelligent Transportation Systems Joint Program Office (United States Department of Transportation — DOT) remembered the six principles the document *Preparing for the future of transportation, Automated Vehicles 3.0* establishes for a clear Federal approach to shaping policy for automated vehicles. The sixth principle states clearly that the United States Government will not try to use the autonomous vehicle to shift the past century view that relates highway to freedom, and automobile to individuality. The document says:

> 6. We will protect and enhance the freedoms enjoyed by Americans.
>
> U.S. DOT embraces the freedom of the open road, which includes the freedom for Americans to drive their own vehicles. We envision an environment in which automated vehicles operate alongside conventional, manually-driven vehicles and other road users. We will protect the ability of consumers to make the mobility choices that best suit their needs. We will support automation technologies that enhance individual freedom by expanding access to safe and independent mobility to people with disabilities and older Americans.[307]

As seen in the first chapter, that "freedom of the open road" and the "freedom for Americans to drive their own vehicles" came at the expense of public transit investments, safety of pedestrians and cyclists. The urban infrastructure and

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[305] Brain+Trust Partners, *The Difference - Autonomous Vehicles: The Crucial Missing Piece of the Discussion* (United States: Unthinkable Media, 2018).
[306] "Autonomous cars: Science, technology, and policy", (2019), online: *Brookings Inst* <https://www.brookings.edu/events/autonomous-cars-science-technology-and-policy/>.
[307] U.S. Department of Transportation, *supra* note 187.

investment choices of the last century made it much easier and safer to move around cities inside a car. That was the opposite of protecting "the ability of consumers to make the mobility choices that best suit their needs," because this system *creates the need* for an automobile. If the population in general does not feel safe to cycle, and cannot rely on a good public transit system, the automobile — for those who can afford it — becomes the easier and logical choice.

3.3.2 – Heads up! Watch out for petextrians!

Given the challenges involving pedestrians' and cyclists' behaviour, and the safety argument and the infrastructure we have today, it is unclear when the technology will be ready to provide faster, less "jerky," and more "human like" travels inside crowded cities. The discussion in this sections suggests it is also unclear what investors and authorities would do if the technology takes longer to surpass those challenges than previously predicted and if they would accept the idea of using old methods to accelerate the deployment of the new car.

In 2017, Ford Company released a new version of its Ford Fusion model.[308] One major improvement of that version was a *Pre-collision Assist with Pedestrian Detection*. In one of the websites dedicated to promote this feature, Ford argues that

[308] Jordan Fraade, "Who's Afraid of the 'Petextrian'?", (2018), online: *The Baffler* <https://thebaffler.com/latest/whos-afraid-petextrian-fraade>.

collisions involving pedestrians are on the rise in recent years.[309] The cause of this problem, the company says, is the rise of a new type of jaywalker: the "petextrian," the person that walks and texts or talks to a mobile simultaneously.[310] A Ford safety engineer says they "were startled to see how oblivious people could be of a 4,000-pound car coming toward them, [...] It was a real eye-opener to how distracted people are today."[311] The company announces that the system is "one step ahead of pedestrians," and it "helps predict distracted 'petextrians' movement."

To demonstrate how the collision avoidance system works, Ford released a video titled "Watch out for petextrians!"[312] with comic intentions, where actors played afraid, worried, careful drivers surrounded by stereotyped walkers on their mobiles: a careless mother, a distracted teenager, a hipster juggler and an angry businessman. Summarizing, one of the "jaywalkers" recklessly crosses the street and is saved by the collision avoidance system. The video ends saying that the system helps keeping "everyone safe from petextrians."

Although Ford's website mentions in one sentence of the text that it is not only pedestrians but also "the rise of distracted driving due to smartphones" that "created a massive new safety problem," the focus of the website is clearly on the pedestrians' behaviour. The short ad film is even more obvious about who is to blame,

309 "One Step Ahead of Pedestrians", online: *Ford Motors* <https://corporate.ford.com/articles/winning-portfolio/petextrian.html>.
310 *Ibid*.
311 *Ibid*.
312 *Ibid*.

even though, in Toronto, 67% of pedestrians hit by a car had the right of the way.[313] That type of advertisement can lead to the wrong perception that pedestrians are the ones to accuse for the majority of their own injuries.

The most probable way the deployment will occur is in a slow-paced movement. It is highly improbable the market "jumps" from today's cars straight to highly automated vehicles. Besides the technological difficulties and the high prices, especially for the traditional manufacturers — that have great hardware expertise, but are still grasping over the software construction — from a profit point of view, it is better to improve conventional cars year after year with more sophisticated driver assistance systems. Even though we must not conclude future publicity will follow the same path, the way the *Pre-collision Assist with Pedestrian Detection* was advertised may indicate how part of the industry can approach the "pedestrian problem."

To be lawful is one of the most proclaimed characteristics of the robot-car toward a future with virtually zero fatalities. Technologies, however, "do not just follow rules. They also write new ones."[314] In that Times report, along with those statements, the journalist writes the arrival of Level 4 autonomous vehicles in the market "makes the formulation of new rules for cities and citizens imperative,"[315] and that

> those rules are being contemplated by such organizations as the Society for Automotive Engineers, university transportation departments and Partners for Automated Vehicle Education, a recently formed industry and academic

[313] Toronto Public Health, *Pedestrian and Cyclist Safety in Toronto* (Toronto, 2015).
[314] Stilgoe, *supra* note 269.
[315] Taub, *supra* note 301.

> coalition that is conducting autonomous vehicle demo days, workshops and other activities.[316]

With no clear evidence[317] that pedestrians' distraction is the cause of a rise in pedestrians' deaths in recent years, and in what resembles the first law against jaywalking in Los Angeles last century, cities, states and provinces in the United States and Canada have proposed or passed bills against "petextrians," or "phone zombies" as they are called by Canadian media.[318] The first city to pass a bill of this kind was the capital of Hawaii, Honolulu, in July of 2017. Soon after, other localities had similar bill proposals.[319] In Canada, explicitly inspired by Honolulu's example,[320] Ontario introduced *Bill 11, Phones Down, Heads Up Act, 2018*[321] that establishes fines ranging from fifty Canadian Dollars to a hundred and twenty five Canadian Dollars to pedestrians that "cross a roadway while holding and using a wireless communication device, electronic entertainment device or other prescribed device."[322]

Some worries about distracted pedestrians comes from two studies: a 2013 American study[323] that was featured in some major American newspapers[324] estimating that more than 1500 pedestrians were treated in emergency rooms for using a mobile

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316 *Ibid*.
317 Fraade, *supra* note 308.
318 Amara McLaughlin, "Phones down, heads up when walking: Ontario private member's bill wants fines for phone zombies", (2017), online: *CBC News* <https://www.cbc.ca/news/canada/toronto/phones-down-heads-up-when-walking-ontario-private-member-s-bill-wants-fines-for-phone-zombies-1.4375444>.
319 Fraade, *supra* note 308.
320 McLaughlin, *supra* note 318.
321 Bill 11, An Act to amend the Highway Traffic Act to prohibit pedestrians from holding and using certain mobile devices while crossing a roadway, 3rd Sess, 41st Leg, Ontario, 2018.
322 *Ibid*.
323 Jack Nasar & Derek Troyer, "Pedestrian injuries due to mobile phone use in public places" (2013) 57:August 2013 Accid Anal Prev 91.
324 Matt Richtel, "Forget Gum. Walking and Using Phone Is Risky.", *New York Times* (2010) A1.

while walking and from a report of the US Governors Highway Safety Association stating that the number of pedestrian deaths from 2010 to 2015 in the United States raised 25 percent and that "a contributing factor" for that number "may be the rapidly growing use of smart phones to access wireless data while walking and driving."[325]

It is important to note that the numbers from the 2013 study, even though they attract attention,[326] represented only 3% of the overall pedestrians injuries and they were not related only to traffic events but to any kind of accident — on road or not — suffered by walkers. Also, around 70% of the injuries were related to talking in the mobile, not texting. About the GHSA report's numbers, if we compare it to the United Kingdom's pedestrian deaths during the same period - from 2010 to 2015 — the argument that the pedestrians distracted by smartphone are possibly the chief cause maybe cannot be sustained.[327] Even though, during this time, the UK also saw a boom in the use of smartphones, pedestrian deaths remained stable.

Research shows that our attention drops when we walk and use a mobile. Traffic statistics, however, show that, in cities like Toronto, the vast majority of pedestrians injured by automobiles were in their right of way, and it can be even a higher number if we take into account that there is no certainty if the pedestrian was

[325] Governors Highway Safety Association, *Pedestrian Traffic Fatalities by State 2016 Preliminary Data* (Washington, DC, 2017).
[326] "The Hysteria over 'Distracted' Walking", (2017), online: *Syst Fail* <https://systemicfailure.wordpress.com/2017/07/24/the-hysteria-over-distracted-walking/>.
[327] Department for Transport, *Reported road casualties in Great Britain: 2017 annual report* (London, 2018).

at fault in 19%[328] of collisions involving pedestrians' injuries in that city. The crucial point for the discussion in this work is not if the use of a mobile decreases pedestrians' attention or if it makes it more dangerous to cross a street. The main point is the empowerment of a discourse born in mid-1920's that changed the focus of danger from the automobile and driver's responsibility, and helped create car-centred cities.

About that change of perception, Sakuraba cites a Brazilian philosopher's statement that the cell phone is a value in Western society, since people risk dying in order to check their devices while driving. Sakuraba points out:

> People risk their lives, [the philosopher] says, for the cell phone. It is interesting in this thought how car driving is taken for granted, while using the cell phone is not. If a person is driving a car and, distracted, hits a wall, the damage will be extremely different from if the same person were walking and hit the same wall. The factor of danger for [the philosopher], however, is the cell phone, because the car is too integrated in our modern daily commute to even be noted.
>
> In fact, nowadays, when somebody is hit by a car, many elements may be considered as the cause. Was the driver drunk? Were the road conditions appropriate? Was the pedestrian jaywalking? These are questions that might arise, and they show that the blame for a person's death may be put on either the motorist, the municipality or the pedestrian themselves. Naturally, many other actors might be blamed depending on the circumstances.[329]

Questions like those are common and obvious for our society today. As seen in the first chapter, during the early days of the conventional car, they would sound illogical. It was very clear for citizens from that time that the car was to blame without questioning the acts of the pedestrian. To walk was a necessity, to drive was a luxury.

[328] Toronto Public Health, *supra* note 313.
[329] Sakuraba, *supra* note 66 at 17.

Even though they are proposed with good intentions, bills like *Phones Down, Heads Up Act* deviate the public debate from a more complex system of causes and effects to a more simple, easy and digestible debate that centres on the culpability of the most vulnerable part of the equation. It contributes to the "common sense" that cars' right to use the streets are greater than other means of transportation.

That said, it is necessary to note that, obviously, it is not the intention of this work to encourage people to cross streets looking to a screen without attention to the traffic. That surely can be fatal but not simply because of the pedestrian act. Most of the time, it is dangerous due to the design of the streets and a culture that in general incentives speed and closes its eyes to pedestrians' right of way. That fatal risk, as seen in the previous sections of this work, is exactly what makes pedestrians look both ways and many times — even when they have the right of way — yield to the car.

The bill *Phones Down, Heads Up*, just like the "petextrian" advertisement, was not proposed with robot cars in mind. Both, however, despite coming as responses to new technologies and new behaviours, evoke century-old concepts. In addition to the examples in this chapter, it is fair to raise doubts about how all this will fit with the brand new car and new behaviours — including the car's behaviour — that may come with it.

3.4 – Necessary debates for a better future

The conventional automobile was not born with safety as its core characteristic. In fact, social safety and legal concerns were raised by the "outsiders," — pedestrians, parents, downtown businessmen, and authorities — not by the industry and aficionados. Historically, for financial reasons, manufacturers were resistant to design changes and implementations that could increase safety, and when such changes were applied they were mostly to the protection of the passengers, not pedestrians or cyclists. Now, with autonomous systems and safety argument, manufacturers are in the front line in the defence of general safety, not only of the passengers, but everyone. From the beginning until now, cars have been seen as inherently dangerous. That is why in many countries a person must be at least 16 years old and pass various levels of exams to be authorized to drive. Driverless cars, by contrast, are coming under the premise that they will be so safe that persons with severe vision impairment and unsupervised children will be able to use it. If that ever become the reality, how can it shift the cultural vision of the automobile?

The situation today is quite blurry because a kind of blending between two antagonistic strategies to sell one product is ascending. From the mid-1920s, cars have been sold as symbols of freedom and individuality. In advertisements, cars are constantly connected to power, high speeds and roads free from obstacles. Even their appearance is designed to give the visual perception of velocity and strength. Those are exactly the attributes that make cars dangerous and deadly. Those qualities and

representations unified with cities designed for automobiles made cars one of the most desired and needed products for the last hundred years. Suddenly, the strategy for the new car - the robot-car - is in many aspects the opposite of that old one. Now, the focus is not on high speed nor power, but cautiousness and safety; not on the excitement of having the freedom to control the wheel, but on the freedom *from* the wheel, freeing hands and eyes to use the phone or watch a movie.

Even if the whole industry shifts from individual car ownership to ride-hailing service, in the end, they will probably still have to sell the idea that cars are a better way to move in the city than public transit, walking or cycling. With the possibility of connection between cars, one promise of the driverless future is the end of traffic jams. Since cars would be able to communicate with each other, they would mathematically create an intelligent net of driverless cars that would move in coordination, with no delays or long stops. One important question is: where the unpredictable pedestrians and cyclists fit into that math? Theoretically, it is possible. Pragmatically, this possibility is probably not going to be a reality any time soon. For how long will investors patiently wait to see their investments become profit?

Even when the evolution of the technology gets to the point that it is indeed unquestionably safer than human drivers, it is virtually inevitable that beneath millions of machines some may malfunction once in a while, especially in the early days of adoption. The results are usually highly different between a crash involving a car moving at 50km per hour and a crash involving a car moving at half of that speed. In

collisions involving pedestrians, the design of the car is also relevant: pedestrians hit by SUVs are twice more likely to die than in collisions with cars of other sizes.[330]

Failures and crashes are still going to happen "as a matter of physics, or technology errors (such as improper servicing or software bugs), or technology limitations, or other causes,"[331] even if at a much lower level. If the objective of the society is to have the lowest levels of fatalities, those many aspects that influence deaths and injuries on roads must be part of the debate. Instead of questioning how to simply adapt the technology to the society we have today — with the mobility values constructed along the last century — maybe the central aspect toward that objective should be questioning how we can use it as an unique opportunity to replace what attracts us in the automobile — speed, power, and egotistic individuality — for values more adequate to the construction of a safer and fairer society.

Professionals involved in driverless car projects are pursuing a better society where deaths and injuries on roads are a problem of the past. It is difficult, however, to escape from the reality those projects are made within an industry that has in many countries (including Canada), a decisive weight in the economy, employment rates, and GDP's growth. Even though their leaders and employees are in the pursuit of perfect cities and a world that respects pedestrians, bicyclists, people with disabilities, children and elders, as companies — and competitors in a market with huge players

[330] Carlton Reid, "Restrict Twice-As-Deadly SUVs In U.K. Cities, Urge Transport Data Scientists", (2019), online: *Forbes* <https://www.forbes.com/sites/carltonreid/2019/08/15/restrict-twice-as-deadly-suvs-in-u-k-cities-urge-transport-data-scientists/#e72269b61e10>.
[331] Lin, *supra* note 201.

— profit is for many the first interest, and unquestionably imperative for companies' survival. Companies must respond to their investors, and the best response is to give them great, constantly growing profit margins, and the sense the company has a stable future ahead.

During the last century, as seen in the first chapter, the automotive manufacturers, seeking the rapid growth of the industry, created campaigns to shift the roles of pedestrians and cars, leading us to a car-centred society. Connecting that to the emergence of driverless cars, Stilgoe writes that the

> early experience with automobiles is a cautionary tale of how, if society does not pay attention, technologies can emerge so that their flaws become apparent only in hindsight. The car did not just alter how we moved. It also reshaped our lives and our cities. Twentieth-century urban development took place at the behest of the internal combustion engine. Cities are still trying to disentangle themselves from this dependence.[332]

Learning from the past, it is fair questioning how much companies and investors are willing to embrace an Utopia if it means to create a society where the non-motorized and the public transit are in the centre of the urban mobility and planning.

In the last decades - facing the various problems created by the centrality of the car in the urban development - citizens, authorities, and important leaders of the automotive industry, are pushing for changes in the urban environment.

[332] Stilgoe, *supra* note 269.

As William Clay Ford Jr. stated in 2011[333]:

> The problem [...] is one of mathematics. [...] Our transportation system simply won't be able to deal with [this]. We're going to create the kind of global gridlock that the world has never seen before. [...] It's clear that the mobility model that we have today simply will not work tomorrow. Frankly, four billion clean cars on the road are still four billion cars, and a traffic jam with no emissions is still a traffic jam [...] So what's going to solve this? The answer isn't going to be more of the same. [The] answer to more cars is [...] not to have more roads. When America began moving west, we didn't add more wagon trains, we built railroads [...] Today we need that same leap in thinking [...] The solution is not going to be more cars, [or] more roads [...] We must have an infrastructure that's designed to support [a] flexible future.

Reports and studies show driverless cars can revolutionize the world. The change, however, to be fairly called "revolution" must transform not only the deaths and injuries statistics, but also the whole status quo constructed around the automobile in the past century. Otherwise, we will not be using the full potential of this technology to help build fair and efficient cities.

To achieve that objective, our society must propose ideas and projects that are not mere shortcuts that promote more of the same. If we give up the promises raised with the safety argument to aiming a rapid deployment, we may deepen some problems we have today. As Rodney Brooks wrote:

> If changing everyone's behavior is on the table then let's change everyone's behavior today, right now, and eliminate the annual 35,000 fatalities on US roads, and the 1 million annual fatalities world-wide. Let's do it today, and save all those lives.
>
> [Some] suggests having the government ask people to be lawful. Excellent idea! The government should make it illegal for people to drive drunk, and then ask everyone to obey that law. That will eliminate half the deaths in the US immediately. Let's just do that today![334]

[333] Reid, *supra* note 2 at 265.
[334] Brooks, *supra* note 288.

In this same sense, historian of technology Dan Albert, in an interview for CNBC said:

> One of the things I often hear from people is when an autonomous vehicle is better than the fiftieth percentile drivers on the road, we have the absolute responsibility to let them on the road. [...] It presents a problem, which is people dying on the road or crashing and so forth, and saying, well, therefore, you need this solution. But of course, there are a lot of solutions. A lot of the promises about autonomous vehicles are around congestion and particularly safety. [...] There's a much less exciting solution to road deaths, particularly in urban areas, and it's called Vision Zero. And the premise is pretty straightforward. It says, let's start with safety and then let's add mobility. The current idea around driving, around cars, is let's get as much mobility as we can and then let's start to make things safer. Whether or not autonomous vehicles are safer than human drivers is in a lot of ways beside the point. They're more lucrative than selling cars to people. They're more lucrative than selling rides by human beings.[335]

There is one important debate that runs through some discussions in this work and that may help trace the paths of the technology and how it may change or deepen some social relations in our society.

Professor Thomasen raises a discussion about the relation between robots and public space, and the intersection between law, space and society. She argues in favour of studies about how the deployment of robots may interfere in the regulation and the nature of public spaces, proposing questions like "how does law shape a space or the experience of a space? What is a public space?"

> Regulators, [...] lawmakers, real decision-makers who come up with the rules for how robots can be used, who can use robots, and what laws protect robots, will be imposing a particular vision of public space through those rules, through the permission of robotic systems in different places. [...] How

[335] CNBC, "Inside The City Where Waymo Tests Self-Driving Vehicles", (2019), online: *CNBC* <https://www.youtube.com/watch?v=dpODZvJxXZo>.

> should these regulators think about the task of regulating robots in public, and importantly, I think, should any special considerations apply to the way in which these robots given that they are operating in spaces that is meant to be public, that is meant to be communal.[336]

It is possible to relate some of her thoughts with Balkin's when he proposes we should focus

> on what features of social life the technology makes newly salient. What problems does a new technology place in the foreground that were previously underemphasized or deemed less important? What aspects of human activity or of the human condition does a technological change foreground, emphasize, or problematize? [...] what are the consequences for human freedom? [...] We might say, then, that the most important lesson of cyberlaw for robotics is the need to attend to the relationships between affordance and imagination, between tools and relations of power, between technological substrate and social use."[337]

The driverless car and the pursuit of a driverless world may place a more clear view of problems that have been neglected, and it is paramount to include debates over public space and its nature, the relations of power and accessibility, with the objective of reaching the full societal benefits that this technology may be able to provide. As many studies and reports point out, there are still many unknowns about a driverless future. The examples in this last chapter are not conclusive about the future being a mere repetition of the past. They are relevant, however, as indicators that our society must be alert about the paths the uncertainties of the present stage of the technology can lead us. If lawmakers, policy makers, researchers and manufacturers

[336] Kristen Thomasen, "Robots in Public Spaces: Privacy and Design", (2019), online: *McGill AI and Law* <https://www.youtube.com/watch?v=MER_-MFj2ng>.
[337] Balkin, *supra* note 141.

use a new technology to simply reproduce old visions we may not be able to use the technology toward a future that fulfil the promises of safety and equity.

CONCLUSION

The relations and experiences we have with and on the streets of our cities have not always been the way they are today. Conflict is a natural part of humanity and has always existed in many aspects of the public life. The rise of the automobile in the last century, however, elevated road violence to levels never seen before. In its early days, the car was seen by many as an undesired guest and the responsible for a carnage.

Through campaigns of public relations and associating it with an era of economic and scientific progress, the image of the automobile shifted. It became a symbol of power, speed, freedom and individuality. Through educational campaigns and law enforcement, the roles of pedestrians and cyclists also changed. The word "jaywalker" was established to create the image of the pedestrian that does not respect the space owned by cars. Following society's trends, courts also made a shift and started to use jaywalking to justify the harm suffered by a pedestrian. In the same way, courts have assumed that cyclists should have no right to compensation when considered to have done a "foolish thing" and therefore was "the sole author of his misfortune."

The driverless car is appearing as the solution to many problems associated to the automobile. Silicon Valley's companies and traditional automobile

manufacturers are in a race to create driverless cities. The safety argument is the most used selling point of the technology.

The predictions for the wide use of these robots are constantly changing and pushed to the future because some problems are more difficult to solve than at first glance. The unpredictability of human behaviour is one of the challenges that may delay the deployment of these robots in cities, especially in big urbanized centres. Although the technology has potential to revolutionize our world in many significant aspects, the fact that these robots are also automobiles – *or are seen as automobiles* – may limit our vision of the potential uses for it and also potential problems that may appear only after a few years after the deployment. In its early years, automobiles were commonly called horseless carriages. Today, no one would consider an automobile a mere type of carriage or wagon.

I say "or are seen as automobiles," because I want to leave open the possibility that in the future, we may see it as another kind of machine, though part of the same family. We can use the rise of the smartphone as an analogy. Smartphones were not seen as a completely new thing, they were seen as a huge improvement of telephones. With them, however, many new unpredicted uses and concerns arouse, from addiction to distraction, changes in society's overall productivity, and even the interference in children's brains development. Today, smartphones are more related to computers than to telephones. In a similar way, with the heavy use of robot-cars in

the society, we may have many new challenges that we cannot see or understand at the present.

Because we cannot predict the future, and probably have a limited vision of the outcomes of the technology, and also the companies and governments are under the pressure of becoming the first ones to deploy the driverless car, we may feel tempted to use old methods to create an environment and legal framework safe for the technology through segregation and law enforcement that could make humans more predictable.

Although during this work the word "utopia" has appeared, the crux of what I am proposing with these thoughts is not to create predictions about a perfect or a terrible future. We will not become an utopia or dystopia. What is proposed, however, is a mental effort to look for probable flaws not simply of the technology in the stage it is today, but flaws of the discourse that is used to promote its use. Pushing a bit harder, we may even question ourselves if some aspects of what we today consider as flaws of the technology are considered like this because we frame it under premises of a society whose values are base in the centrality and needs of the automobile of the last century. Citing Balkin:

> We might identify many different features of a technology as its key or essential characteristics, but the real issue is always why we care about them. How we define the central features of a technology depends on what our definition is for, and the purpose it serves in our particular area of inquiry.[338]

[338] *Ibid*.

To conclude, if the objective is to eliminate as much as possible the fatalities on the roads and to pursue equity and accessibility, we must not simply search for better forms to evaluate if driverless cars are safer than human drivers and better performers in unpredictable events. Those searches are important and necessary. It is also important and of great value that companies and governments put safety as the main argument for the technology. This is a paradigm shift in relation to the selling points of the conventional automobile. It is, however, necessary to amplify the debate to include other social aspects that can aggregate visions over the technology, and also question some established assumptions.

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