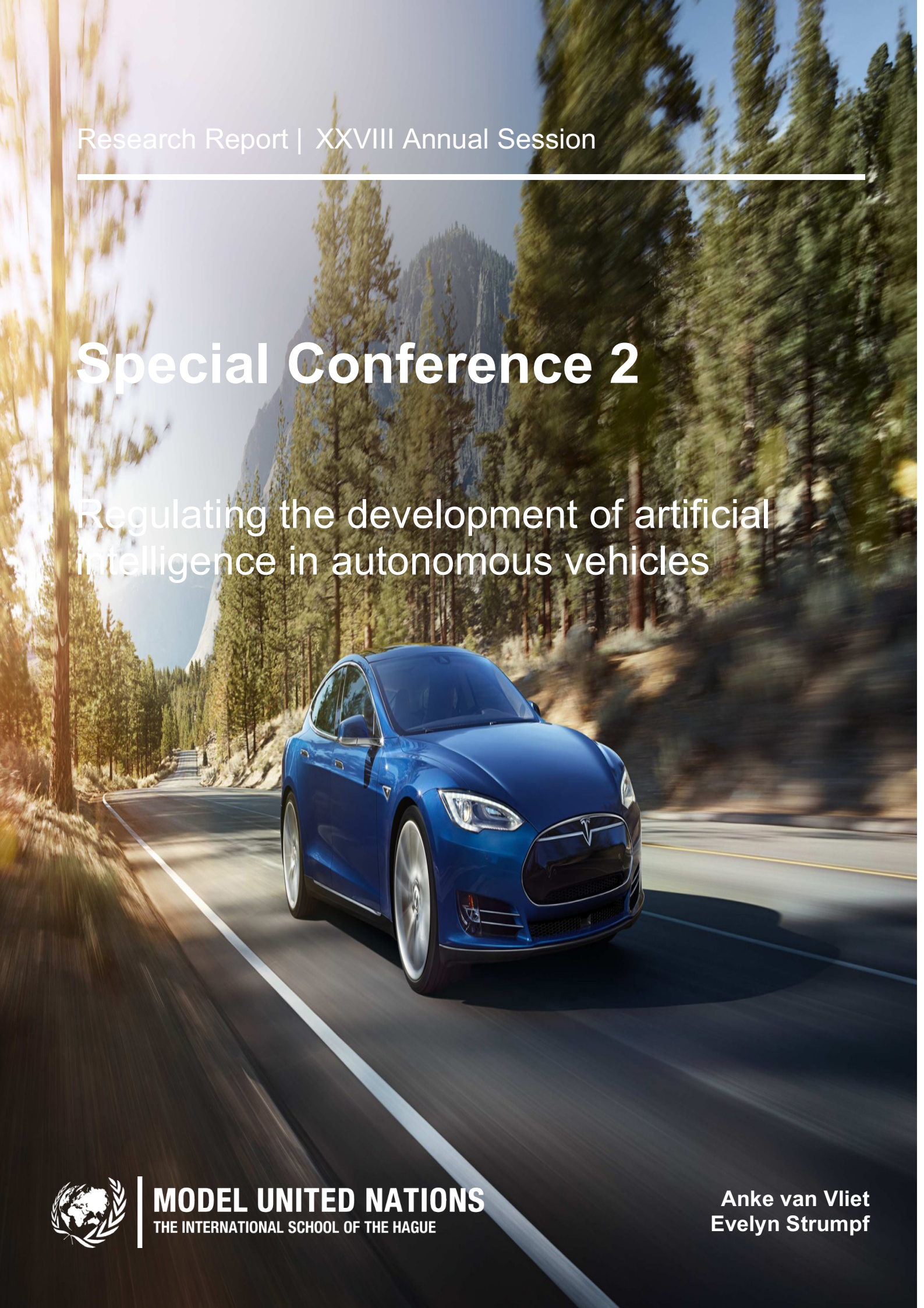
Special Conference 2

Regulating the development of artificial intelligence in autonomous vehicles



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Introduction

Some say it is the future, others say it is one of the greatest threats to the human species. This report will focus specifically on the risks, but also the benefits of Artificial Intelligence (AI) in autonomous vehicles. Research is progressing steadily, and the influence of AI on our society will likely be enlarged. Because of this, it is important to do as much research on the subject as possible and find out in which ways it could be beneficial, while at the same time avoiding potential pitfalls.

To give you an example of one of the benefits of autonomous vehicles:

According to a report published by the World Health Organisation, Road traffic crashes are the leading cause of death among people between 15 and 19 years old, while among the 10-14 years and 20-24 years age groups, they are the second leading cause of death. Of course, some of these deaths could not have been prevented. But most of them are caused by human error. Autonomous vehicles, when designed and developed correctly and under strict measures, can significantly decrease the number of deaths caused by car accidents.

Definition of Key Terms

Artificial Intelligence (AI)

If a machine is able to mimic the human cognitive functions, one says it possesses a certain form of intelligence, so-called Artificial Intelligence (AI). This includes learning, problem solving and understanding human speech. An example of AI is Siri from Apple. There is a difference between Narrow AI, which is focused on completing narrow tasks, and General AI, which is able to complete tasks in the same way as humans do, or even better.

Autonomous vehicle

A vehicle that can guide itself without human conduction. When a vehicle reacts autonomously – without active intervention from a driver – through algorithms that force the vehicle to react in a specific way, one speaks of autonomous driving.

Smart roads

A road with the ability to be responsive to changes in the environment and connect with vehicles, traffic lights and even cities. Since they are able to connect with the cars, the roads will play a vital role in the development and usage of autonomous vehicles. These roads will come with sensors and data capture capabilities and will be very important for the development of not only autonomous vehicles, but also smart cities.

Smart cities

A city that uses information, collected through sensors and data, and communication technologies to increase operational efficiency, share information with the public and improve the quality of government services and citizens welfare. These cities are able to communicate with the roads and the cars, and if there is, for example, a road blockage, make sure that the cars navigate around it.

General Overview

History

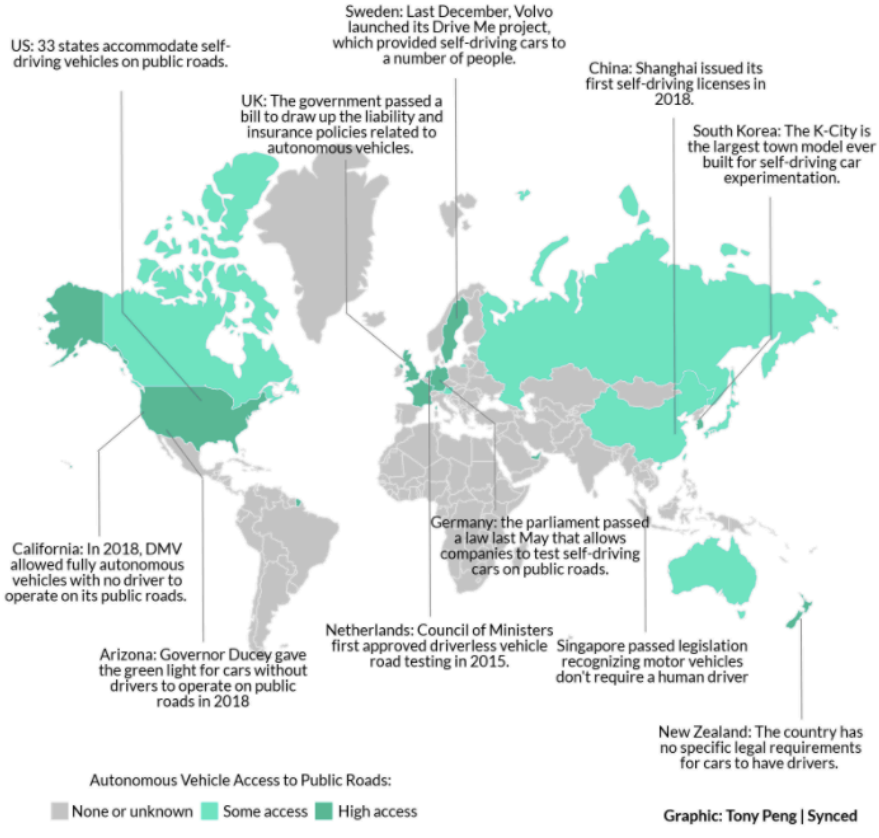
Self-driving vehicles were first introduced at General Motors' Futurama exhibit at the 1939 World's Fair in New York. Futurama was a ride, where viewers could see a quite accurate prediction of the future of the American road system. Prior to this exhibition, the

people had few expectations about the future of autonomous transport. However, it took a while before the first 'smart' car was created. Still, this car looked more like a buggy than an actual car. The so-called Stanford Cart successfully crossed a chair-filled room without human intervention, which was an important achievement in robotic mobility. In 1977, what could be called the first autonomous car was shown in Japan. This vehicle was able to process images of the road ahead.

More and more companies wanted to join in on this new rage. In 2004, the first long-distance competition was organised for autonomous vehicles. Unfortunately, none of the 15 competing cars made it to the finish line. In 2005, during the second competition, five cars were able to make it until the end. This competition has been going on since then, with more participating vehicles, but also more challenging courses such as a race through an urban environment.

Latest developments

While breakthroughs in self-driving technologies have come from different technology companies, the important role of lawmakers and local authorities in the research and development process cannot be overlooked.



According to the Vienna Convention on Road Traffic, a human driver must always remain in control and be held responsible for their vehicle. European and North-American countries have created regulations for autonomous vehicles on public roads. In the USA, California and Arizona became the first two states that allow autonomous vehicles on public roads without a driver.

Partly-autonomous cars are already on the road. Brands such as Tesla have created a car that is able to keep itself in its lane and at safe distance from other cars, allowing the driver to take their hands of the wheel. However, the driver must keep paying attention,

because these systems can't see traffic lights, or know that they have to stop when an ambulance passes. Two people have already died using this system, raising a lot of questions around not only this system from Tesla, but also autonomous cars in general.

Future Possibilities

Just like today looks nothing like 20 years ago, the future will look nothing like today. This is something that is easily overlooked when discussing measures and legislations. It is important that cities and countries shape the introduction of autonomous vehicles. We have the possibility to make our cities less congested, our air less polluted and our people safe. But this will not happen if we keep all of our old measures the same. That is why we must act now, by actively taking part in debate and creating measures to regulate the development of autonomous vehicles. This could be achieved by, firstly, being willing make a change, secondly, by actually changing legislations, and thirdly, by having an open mind towards the future. One important question that should be asked is whether the promise of these possibilities is worth the risks we would be taking.

Risks

One of the risks of autonomous vehicles is the unemployment it will cause among drivers. Taxi's and buses will no longer be necessary in a self-driving world. It is important that these people can diversify their income before we take away their current jobs.

It is important that we ensure that autonomous vehicles help our cities, not drive them to financial ruin. This is very much possible, because many cities depend on the money brought in by car use: traffic tickets, parking revenue, taxes. Self-driving cars do not need these things, causing huge deficits. Cities are looking for many ways to fill this void, but are not always supported by the government. Struggling sections of cities will be put at a particular disadvantage by the rise of autonomous vehicles. The main problem in these areas is the accessibility of transport. So, before we deploy driverless cars in our cities, we must realise that public transit is a crucial element in the well-being of our people.

Autonomous vehicles will either increase or decrease safety: Our current infrastructure is not yet optimized for the use of autonomous vehicles. This may cause accidents and it is therefore important to realise that a lot is going to have to change in cities as they are now. The autonomous vehicles will require 'smart roads' for operation.

Furthermore, there will be new cyber security risks. Imagine if someone were able to hack into your car and take control over the steering wheel or disable your engine entirely. In the future, this might be a real possibility. In fact, it already is right now. In 2015, two hackers

developed a tool to hijack the controls of a car and were able to take control of the vehicle through its entertainment system. Luckily, this was just for an experiment and the driver was aware that this was going to happen. However, while performing the hijack, the hackers could see a lot of similar cars in other parts of the country and, had they had any bad intentions, they could have easily taken control of these cars and hurt a lot of people.

One of the important and ethical questions comes with the development of autonomous cars, is the question of 'Who is responsible?'. If an autonomous vehicle crashes, there are two parties that could be blamed. Either the driver, or the company who produced the car made a mistake. Could the driver have prevented the accident? Was there anything wrong with the car even before the driver bought it, leading up to the crash? It is a little hard to find that out when the car is completely broken. This will not only make for difficult court cases, but also create an issue for the insurance companies.

Another problem of ethics: what if the car has to choose between killing its occupants or killing other people? Answers should be found to these questions before we fully adopt autonomous vehicles.

Major Parties Involved

The United States

Each US State is responsible for its own autonomous driving legislation. Last year, 33 states had either passed legislation, issued executive orders, or announced initiatives to accommodate self-driving vehicles on public roads.
California is undoubtedly the top-ranked state in openness and preparedness for autonomous vehicles. Its autonomous vehicle testing regulations were introduced in September 2014 and required a driver be in the vehicle, ready to assume control. Recently, California took a step forward by allowing fully autonomous vehicles without driver to operate on its public roads. There are currently fifty companies testing their technology in California.

Furthermore, leading companies in the development of autonomous vehicles, such as Google, with their self-driving car project, called Waymo, and Tesla come from the United States of America.

The European Union

The European Union has some strict regulations on conducting experiments with driverless vehicles on public roads. Despite several EU nations such as Germany and The

Netherlands moving to introduce rules to allow self-driving cars on the roads, there is currently no EU-wide framework on rules for autonomous vehicles.

The Netherlands

As shown by a report of KPMG, called "*Autonomous Vehicles Readiness Index",* The Netherlands is actually the most-ready for the self-driving cars, before the USA (6th place) and China (16th place). This was due to the well-maintained road network and the over 30.000 electric vehicle charging points. Furthermore, they have access to high-quality wireless networks for transmitting data to and from these cars and are also adapting a lot of traffic lights to enable them to communicate with autonomous vehicles.

China

Although China was not actively taking part in the development of autonomous cars in the past, they are now. Multiple cities have shown interest in the possibilities of these self-driving vehicles. Shanghai and Beijing have already had test drives through the city and the local governments of more cities are already making plans for the future.

Singapore

Singapore is one of the leading Asian countries in adapting to autonomous vehicles. In the KPMG report, they already have the highest score on policy and regulations regarding autonomous vehicles. The government of Singapore has passed legislation recognizing that motor vehicles don't require a human driver.

Timeline of Key Events

Timeline of events in reverse chronological order leading up to present day.

Date	Description of Event
23rd of March 2018	Deadly car crash in an autonomous vehicle by Tesla
20th of January 2016	The first autonomous car fatality
2009	Google starts project Waymo
March 2005	Five autonomous vehicles made it to the finish line in the second Grand Challenge

March 2004	Fifteen autonomous vehicles participate in the Grand Challenge
1979	The Stanford Cart as the first autonomous vehicle
November 1968	Vienna Convention on Road Traffic signed by 74 states
April 1939	Futurama exhibition at the New York World's Fair, the first introduction of autonomous vehicles.

Previous Attempts to Resolve the Issue

IBM has come up with a new cognitive system that could help determine if and when a person should take control over the car. It's based on a variety of indicators, including factors like human fatigue and emotional state, as well as the overall mechanical function of the vehicle.

Onboard sensors would monitor physiological aspects of the human—like their heart rate, the direction of their gaze, and if their attention is focused—and the cognitive system might realize that the car is better able to safely navigate a given situation. The system would simultaneously keep close tabs on the technical aspects of the car, looking out for obstacles or errors that might be better navigated by a human. IBM envisions it as a third intelligence, keeping watch over both potential drivers.

A new start-up, called iSee has also come up with a way to make autonomous vehicles better at dealing with unexpected situations. Instead of relying on simple rules or machine-learning algorithms to train cars to drive, the startup is taking inspiration from cognitive science to give machines a kind of common sense and the ability to quickly deal with new situations. It is developing algorithms that try to match the way humans understand and learn about the physical world, including interacting with other people. The approach could lead to self-driving vehicles that are much better equipped to deal with unfamiliar scenes and complex interactions on the road.

The transport minister of Germany has laid out three key rules regarding autonomous driving:

1. "It is clear that property damage takes always precedence of personal injury."
2. "There must be no classification of people, for example, on the size, age and the like," and,
3. "If something happens, the manufacturer is liable"

Although the las one may make it seem like the driver is never responsible, the minister stated that driver-awareness is still a must. More countries should try to come up with measures such as stated above. However, some international legislations should also be set.

Possible Solutions

In the future, it will be important that legal systems evolve, in order to encourage optimal investment in technologies that will increase social welfare, public safety, and sustainable energy consumption, as well as positively impact labour markets, land use, public health, and more. A key aspect in this development is deciding exactly where we want to go, and what is necessary in order to get there.

Along with the changes in our cars, changes should also be made in our cities. For if they were to remain the same, we would have no benefits from the autonomous vehicles. Introducing: Smart cities. In these smart cities, smart traffic management is used to monitor and analyse traffic flows to optimize streetlights in order to prevent roadways from becoming too congested based on time of day or rush-hour schedules. Furthermore, these cities are able to collect data, which will make sure that they work as efficient as possible. They can share information both with the citizens and the government, and by doing so, make sure that everyone will receive the help they might need.

Instead of owning vehicles, we could be driven around by robot taxi's. These would be in constant use, making parking lots unnecessary. This space could be used to build houses for the growing population. Not only will we need less parking space, but also less roads. By 2050, it is expected that the total amount of cars on the road is about half of its current number. If we direct this properly, then the traffic could be much more efficient, while requiring fewer roads. Local governments should be supported in finding ways to adjust their cities to these upcoming changes. They could, for instance, provide special parking privileges for pooled cars and introduce shared mobility lanes. Federal police regulating fuel economy could award extra credit to automakers that sell vehicles for pooling services. And, as stated before, cities could be redesigned with less parking space.

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