



Autonomous Vehicles – the Butterfly Effect

Notes to follow presentation:

Slide 2-4 New BUZZ word, getting away from Autonomous

Slide 6 Easter Parade **1900** – NYC ---- One car!

Slide 7 Easter Parade **1913** – NYC One horse!
We are in this transition period currently, but it will NOT take 13 years to change the business model!

Slide 8 ONE year later since I started presenting the Butterfly Effect Zoox Concept car

Slide 9 in 2015 – 10 companies had applied for permits to test AV

Slide 10 2017 – 30 companies have applied for permits to test AV

Slide 11 Look at all the relationships!

Didi Chuxing, formerly Didi Kuaidi, is a major Chinese ride-sharing company founded by Cheng Wei, providing transportation services for more than 450 million users across over 400 cities in China. Its headquarters is located in Beijing.

Gett, previously known as GetTaxi, is a global on-demand mobility company that connects customers with transportation, goods and services.

NuTonomy is an MIT spin-off technology startup company that makes software to build self-driving cars and autonomous mobile robots. The company was founded in 2013. In August 2016, it launched its robo-taxi service in Singapore.

Sidecar was a [US-based transportation network company](#) that provided ride-sharing services and business-to-business delivery services. It was founded in 2011 in [San Francisco](#) and closed on December 31, 2015.^[1] Sidecar was the first transportation network company in the [real-time ridesharing](#) industry,^[2] which was later popularized by companies like [Uber](#) and [Didi Chuxing](#)

Cruise, the self-driving startup acquired by GM last year, is already operating a complete autonomous ride-hailing service in San Francisco for its employees.

Slide 12 Driverless Transportation 20 INDEX - D20
A stock market index of the top 20 up and coming AV companies

Slide 13 The make-up of the D20

Slide 14 You don't have to understand the stock market to see this visual image of the rising value of the D20 companies

Slide 15 We are now in the Software business – traditional jobs will disappear, but we have to look towards our future

More than 33 million autonomous vehicles will be sold globally in 2040, Total U.S. volumes of autonomous vehicles are expected to reach 7.4 million units per year in 2040.

“Volumes will surpass 51,000 units in 2021 when personally owned autonomous cars reach individual buyers for the first time, and IHS Markit forecasts estimate nearly 1 million units will be sold in 2025 across shared fleets and individually owned cars.”

as the industry shifts from thinking exclusively about unit sales to usage per distance or time.

Slide 16 Let's review

Slide 17 review the 5 levels of AV

Slide 18 DAD BRAND! <https://youtu.be/2jopCaHOfxY>

Slide 19 **COLLISION AVOIDANCE** **LEVEL 1** Autonomous

No autonomous feature is more important to safety than collision avoidance systems.

This works with the vehicle's braking system and applies the brakes when a vehicle gets too close to something in front of it.

Other systems merely chime or vibrate the driver's seat when a crash threat is detected

Slide 20 ADAPTIVE CRUISE CONTROL LEVEL 1/2 Autonomous

This radar-based technology is one of the most obvious and necessary features when asking a car to drive itself.

How adaptive cruise control essentially works is the driver sets a speed and determines distance to maintain ahead and then when engaged, the vehicle will slow down, even stop, with the flow of traffic, and then pick back up as traffic flows faster.

Adaptive Cruise uses radar and cameras to locate the vehicle in front of the consumer vehicle and matches the speed by keeping the same distance between the two vehicles.

This technology allows the control of the throttle and brakes by the computer to keep this distance consistent

Slide 21 ADAPTIVE CRUISE CONTROL LEVEL 1/2 Autonomous

V2V-equipped vehicles share information that can be used to alert drivers to upcoming potential hazards, laying the groundwork for a connected, safer future.

Dedicated Short-Range Communications (DSRC) and GPS and can handle 1,000 messages per second from vehicles up to nearly 1,000 feet away.

Only vehicles equipped with compatible V2V systems communicate with one another

This technology allows the control of the throttle and brakes by the computer to keep this distance consistent

Slide 22 LANE DEPARTURE WARNING LEVEL 2 Autonomous

Lane detection is used to keep a distracted or tired driver from crossing into another lane of traffic

This sensor-based technology is perhaps the most common.

It's called different things according to each automaker, but even affordable vehicles like the Honda CR-V, Ford Fusion, Chrysler 200 and Toyota Prius use this system, which alerts drivers when they go over a line into another lane.

Some of these systems, will even self-correct, gently steering the vehicle back into its own lane.

Slide 23 LANE DEPARTURE WARNING LEVEL 2 Autonomous
NOW- DSRC – Vehicle to Vehicle (V2V)

Slide 24 Night View assist – This is perhaps the most advanced, and least common autonomous technology currently available. It uses infrared cameras to help a driver see beyond the reach of the vehicle’s headlights. This can help a driver, in darkness and poor weather conditions, avoid hitting pedestrians, animals or objects that may be on the road. You only find this technology on the luxury vehicles (due to the cost) as Audi, BMW, Lexus and Mercedes-Benz all have vehicles with night view assist

Slide 25 Mercedes Benz Multibeam LED Headlights
Here is MB utilizing all the sensor and image modeling for the betterment of an existing technology – headlamp operation!

Slide 26 MB video <https://youtu.be/qggcnXtCPPk>

Slide 27 V2V-equipped vehicles share information that can be used to alert drivers to upcoming potential hazards, laying the groundwork for a connected, safer future.

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Slide 28 Illustration of V2V

Slide 29 V2X – a collection of all types of communication

Vehicle to Network	V2N
Vehicle to Person	V2P
Vehicle to Infrastructure	V2I
Vehicle to Vehicle	V2V

Slide 30 – What is wrong with this picture?

Autonomous Cars: In 2018 the first self-driving cars will appear for the public. Around 2020, the complete industry will start to be disrupted.

The computer receives information from several inputs such as radar, cameras, sensors, lasers, and GPS coordinates.

Cameras allow the computer to see in 360 degrees, radar allows for sight in low visibility situations (Pullen).

Cameras also struggle in low light situations where radar is a necessary device for safe maneuvering (Reina, Johnson, and Underwood).

Lasers provide a three dimensional omni-directional view with sensors providing raw data to the computer (Pullen).

The image provided by the lasers and the data collected from the sensors allow for a second fail safe image to compare to the camera image to make sure all things are being seen.

The high resolution of the lasers also makes it the desired device to help with accident avoidance (Reina, Johnson, and Underwood).

The GPS gives the computer an exact location of where it is on the earth to compare to already existing maps for the use of steering, throttle and brake controls (Pullen).

All of these devices allow the computer to make programmed decisions to drive a vehicle safely without human

Slide 31-34 Mercedes F 015

The F 015 made its debut at the Consumer Electronics Show in Las Vegas more than two years ago.

It's packed with advanced (or what was considered advanced in 2015) autonomous technology, and can, in theory, run for almost 900 kilometers on a mixture of pure electric power and a hydrogen fuel cell.

Slide 35 Tesla Autopilot <https://youtu.be/jWreyC2l-dw>

Slide 36 the Butterfly Effect

KODAK - In 1998, Kodak had 170,000 employees and sold 85% of all photo paper worldwide.

Within just a **few years**, their business model disappeared and they went bankrupt.

What happened to Kodak will happen in a lot of industries in the next 10 years - and most people don't see it coming.

Did you think in 1998 that 3 years later you would never take pictures on paper film again?

Slide 37 AIRBNB

Airbnb is now the world's largest accommodation provider, owns no real estate.

<https://www.airbnb.com>
<http://qz.com/329735/airbnb-will-soon-be-booking-more-rooms-than-the-worlds-largest-hotel-chains>

Slide 38 UBER

Uber is just a software tool, they don't own any cars, and are now the biggest taxi company in the world.

<https://www.uber.com>

Slide 39-40 FACE RECOGNITION

Facebook, the world's most popular media owner, **creates no content**. **Facebook** now has a pattern recognition software that can recognize faces better than humans.

Watching head movement, blinks, pupil dilation,

By 2020 there will be apps that can tell by your facial expressions if you are lying - More **Point Cloud** Technology!

Slide 41 3D PRINTING

All major shoe companies started 3D printing shoes

At the end of this year, new smart phones will have 3D scanning possibilities.

You can then 3D scan your feet and print your perfect shoe at home

Slide 42 BY 2027, 10% of everything being produced will be 3D printed

Slide 43 WELCOME TO THE NEXT INDUSTRIAL REVOLUTION!

Slide 44 BABY ON IPAD

By 2020, 70% of all humans will own a smart phone.

That means, **almost** everyone has the same access to world class education

Slide 45 IBM WATSON

IBM Watson, you can get legal advice (so far for more or less basic stuff) within seconds, with 90% accuracy compared with 70% accuracy when done by humans

Watson already helps nurses diagnosing cancer, 4 time more accurate than human nurses

How could Watson and the automobile work together? Diagnosis?

Slide 46 WORKFORCE

I read once that 70-80% of jobs will disappear in the next 20 years.

There will be **a lot of new jobs**, but it is not clear if there will be enough new jobs in such a small time.

Slide 47 The shift of power from Big Oil to.....?

So, other businesses that could be affected:

- Medical insurance
- Medical costs
- Medical earnings – doctors, nurses, hospitals, ambulance drivers & EMT
- Funeral expenses
- Automobile insurance
- Legal expenses due to accident faults
- Collision repair and suppliers
- Automotive education – both mechanical and collision
- EPA and OSHA
- Construction
- Public transportation – air, land, train, etc
- Big Oil !

Will we eventually lose these driving skills? Like speed dial or GPS?

Generations to be born who **never** have driven!

Slide 48 AUTONOMOUS TRACTORS!

There will be a \$100 agricultural robot in the future.

Farmers in 3rd world countries can then become managers of their field instead of working all days on their fields.

Slide 49 Kongsberg- Autonomous Vessel

Slide 50 Smartflower <https://youtu.be/nHl9iRxD-uk>

Slide 51-52 SOLAR

Last year, more solar energy was installed worldwide than fossil.

The price for solar will drop so much that all **coal companies** will be out of business by 2025

Elon Musk's Solar panels and battery pack

Slide 53 WATER

With cheap electricity comes **cheap and abundant water**.

Desalination now only needs 2kWh per cubic meter.

We don't have scarce water in most places, we only have scarce drinking water.

Imagine what will be possible if anyone can have as much clean water as they want, for *nearly no cost*

Slide 54 So, Let's bring all this together and TALK AUTONOMOUS !

Autonomous Cars: In 2018 the first self-driving cars will appear for the public.

Around **2020**, the complete industry will start to be disrupted.

An American on average spends forty-two hours a year stuck in traffic,
You don't want to own a car anymore.

Slide 55 CALL UP YOUR TRANSPORTATION

An automobile is the second largest purchase in your life, next to housing.

Today, the vehicles entering shops for maintenance or repairs sit parked 95 percent of the time.

Tomorrow, fleets of driverless cars will spend nearly all their time on the road—with an increase in wear and tear and a proportionate need for maintenance and repair.

Slide 56 NOT COOL ENOUGH?
Who cares??

Slide 57 16 YEAR OLD GETTING A LICENCE

Our kids will never get a driver's license and will never own a car.
It will change the cities, because we will need 90-95% fewer cars for that

Slide 58 24.5% of 16 year olds have a drivers license

The top three reasons were:
"too busy or not enough time to get a driver's license" (37 percent),
"owning and maintaining a vehicle is too expensive"(32 percent),
"able to get transportation from others" (31 percent)

<http://www.usatoday.com/story/news/nation/2013/10/13/teen-drivers-license/2891701>

Slide 59 NETFLIX, Amazon, etc
We don't leave home as much....

Alibaba, the most valuable retailer, has no inventory! It is a market place, a search engine and a bank – ALL IN ONE!

Slide 60 PARKING

Seeing that a typical vehicle today sits parked 95% of the time and 4 times the parking spaces per car are required, significant savings from land costs could be achieved

You will not need to park it, you only pay for the driven distance and **can be productive** while driving

We can transform former parking space **into parks**

Slide 61-62 Elon is Boring <https://youtu.be/xNQeqlzPDGE>

Slide 63 INSURANCE

Insurance Companies will have massive trouble because without accidents, the insurance will become 100x cheaper.

Consulting firm KPMG predicts the auto insurance industry to shrink by up to 40% in the next twenty-five years

Their car insurance business model will disappear

Slide 64 *BESIDES INSURANCE* – WHAT ABOUT ACCIDENTS ?

Accidents involving automobiles is one of the leading causes of death for Americans,

34,000 deaths a year are far too many to not try to make cars safer.

The national highway Traffic Safety Administration concludes driver fault is the result of 94% of all road accidents

1.2 million people die each year in car accidents **worldwide**.

We now have one accident every 100,000 km (62K miles)

with autonomous driving that will drop to one accident in 10 million km (6.2Million miles)

That will save a million lives each year.

Slide 65 **PERSPECTIVE** - 35,000 deaths in the US each year due to automobile related accidents is the equivalent of a fully loaded Boeing 747 (660 passengers) crashing every week for 52 weeks a year!

Slide 66 CYBER-HACKING

The biggest negative for autonomous vehicle technology is the blame for when this technology fails.

like anything else there will be failures.

So who is to blame for the results of said failures?

Cyber Hacking?

With this technology come some very real concerns.

Among them are the owner's right to privacy, and the vulnerability of these systems to cyber attack.

Slide 67-68 Future Shop

Slide 69 GOOGLE Vehicle (Pre-WAYMO)

Most car companies **may** become bankrupt

Traditional car companies try the evolutionary approach and **just build a better car,**

while tech companies (Tesla, Apple, Google) will do the revolutionary approach and build a computer on wheels.

Google purchased 60 acres then expanded to around 100 acres to train safety drivers and test autonomous vehicles.

These courses are set to mimic normal driving conditions, included are street lights, urban and semi-urban neighborhoods, slip roads, and t-stops.

In total Google has already driven over 1.3 million miles on public streets, routinely driving 10 to 15 thousand a week (Levy).

All the mileage Google has been adding up is all recorded.

Over the last year in California only ten accidents have occurred with an autonomous vehicle involved.

Zero have been the fault of the autonomous vehicles, all were the fault of driver error (**March 19, 2018 recent pedestrian accident causing a death**)

Slide 70-72 **Waymo** is a self-driving technology company with the mission to make it safe and easy for everyone to get around—without the need for anyone in the driver's seat.

Our journey started at Google in 2009, and we became Waymo in 2016.

We drive more than 25,000 autonomous miles each week, largely on complex city streets.

That's on top of 2.7 billion simulated miles we drove just in 2017

Slide 73 **MAVEN** ride sharing

Slide 74-75 TESLA Vehicle

In the fall of 2015, the Tesla Model S was able to drive from Los Angeles to New York City with 96% autonomy in two days making the first cross country trip.

This led to Tesla founder Elon Musk to predict fully autonomous cars to be operating in the United States within the next three years.

engineers from Volkswagen and Audi are completely terrified of Tesla.

May 7, 2016 – 40 Year old Floridian Joshua Brown dies in auto pilot accident

Slide 76 APPLE Vehicle -- The iCar project is codenamed '**Titan**', according to The Wall Street Journal

Apple has spent more money on the research and development of electric, autonomous vehicles in the last few years than it did on the development of the iPhone, iPad, and Apple Watch — combined.

<https://cleantechnica.com/2016/06/01/apple-invested>

Even more astonishingly, Apple is outspending the major car manufacturers at a rate of 20:1.

The near \$5 billion it has spent in the last three years compares to the average spend of \$192 million at the top 14 auto makers.

It even outranks Tesla by a factor of more than 10:1.

Slide 77 -Future mass transit

Slide 78 - Otto <https://youtu.be/Qb0Kzb3haK8>

** Owned by UBER

Slide 80 What about snow? Cant see the road markers or buried obstacles?

<https://www.aarp.org/content/dam/aarp/home-and-family/personal-technology/2013-10/Longevity-Economy-Generating-New-Growth-AARP.pdf>

The Generation over 50 contribute \$3.0 trillion to consumer spending 5 years ago, NOW responsible for 46% of the GDP, but only 33% of population 23% of new business in US started in 2012 were by entrepreneurs between 55-64 years old

Slide 52 Act Autonomously (Independently) about your education!

What are autonomous vehicles and what technologies are necessary to create them?

Sensor fusion - the car's eyes

How lane departure systems are calibrated

Vehicle stability control strategy

Throttle controls

Steering control

Long range radar

Short range lidar

Digital mapping and geo location techniques

Vehicle to vehicle communications

Vehicle to infrastructure and intelligent transportations systems

For example, on a 2009 GMC Arcadia, the systems involved with stability control are the antilock brake system (ABS), the bi-state engine mount (BSM), the dynamic rear proportioning (DRP), traction control system (TCS), variable effort steering (VES) and the vehicle stability enhancement system (VSES). Just to summarize how complex some of these systems can be, the components of this system are electronic brake control module (EBCM), the brake pressure modulator valve (BPMV), the ABS pump motor, the bi-state engine mount solenoid, the brake booster vacuum sensor, the variable effort steering solenoid, a lateral accelerometer, a master cylinder pressure sensor, a steering wheel position sensor, a yaw rate sensor, four-wheel speed sensors and last but not least a traction control switch. So what's amazing is this vehicle has six systems and 11 components that make up the stability control system, and the vehicle is seven years old already! Oh, did I forget to mention the body control module (BCM) along with the instrument cluster (IC) that control the warning indicators for the dash? I would suggest on any stability control problem you face that you read up on how the system works and who the players involved are. It's only going to get more complicated as technology progresses. –

See more at: <http://www.searchautoparts.com/automechanika-chicago/commitment-training/making-sense-stability-control-systems?cid=95882#sthash.TdeGBaPQ.dpuf>

Help make society a better place for everyone. Get informed, share the information, and help progress autonomous vehicle technology into common practice.



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