FUTURE OF CITY TRANSPORT
TODAY:

Avg 18% of household income
Parking challenging
Congestion & Time wasting
Excludes young/old/disabled
Poor air quality
Reduces city livability
Clean

+Walking
+Biking
+Clean Fuel & Electric
+Less Congestion
Action:

All shared and intensively used vehicles added in 2020 must be zero emission; by 2025 all shared and intensively used vehicles must be clean.
space required to transport 60 people

car

bus

bicycle
Technology has Transformed Sharing

GPS, Wireless Tech & Internet made **CARSHARING** possible

As easy to rent a car as use your own
30 seconds to reserve/pay for a car
Self service pickup/dropoff
Reserved “homebase” parking space

1 shared car = 12 personal cars
Need less parking
People drive less (financially rational)
Technology has Transformed Sharing

With Smart phones, **TRANSIT APPS** make it easy to know
- Which train, bus
- What time
- Where to get on & where to get off

City Benefits:
- More riders
- Cheaper & better access
- Less congestion
Technology has Transformed Sharing

With Smart phones & better AI, taxis can enable real RIDESHARING:
- Origin-destination-timing matches

City Benefits:
- Reduced congestion
- Better access
Action:

Start thinking about transportation, not as “the car” but as multi-modal (walk, bike, transit, share, drive yourself).

Start moving resident parking up to market rates.

Rationalize safety & regulatory distinctions between personal vs “shared taxi” driving.

Break open the monopolies of transit, taxis, ride-hailing, require shared open data.

(start building a continuum of shared transport)
**SHARING** is still imperfect:

- Might have to walk a few blocks
- Transit trips indirect & sometimes much longer
- Wait times can be long
- Not all can use it (young, old, disabled)
- Can be expensive
space required to transport 60 people
We're dedicated to putting autonomous vehicles on the road for millions of people, not just those who can afford luxury cars...this next decade is really going to be defined by the automation of the automobile.

FORD CEO, Mark Fields
There’s an urgency to our mission about being part of the future. This is not a side project. This is existential for us.

UBER CEO Travis Kalanick on deploying Autonomous UBERs in Pittsburgh (August 2016)
Every month in 2016 has been the hottest on record

2015: BLISTERING FINISH
Average Global Temperature Anomalies (°F)

Source: NOAA
Anomalies based on 20th century average
THICKNESS OF THE ICE SHEETS AT VARIOUS LOCATIONS 21,000 YEARS AGO COMPARED WITH MODERN SKYLINES

- TORONTO
- CHICAGO
- BOSTON
- MONTREAL

Credit: Randall Monroe
LEVEL 1 Car in 1970
Vehicle has no automation. Driver has full control.

LEVEL 2 Cars today
Vehicle provides information/warnings. Drive has informed control.

LEVEL 3 Tesla
Vehicle integrates detection/response. Driver ready to take control.

LEVEL 4
May/may not have steering wheel
Geofenced or restricted

LEVEL 5
Everywhere, all the time, no steering wheel
https://www.youtube.com/watch?v=VjcMZJm0L9A
http://bit.ly/2g85ng8
Sales Promised by 2019-2021 & New Companies Emerging

Old guard:
- GM
- Ford
- Toyota
- Nissan
- Volvo
- BMW
- Audi
- Volkswagen

New companies:
- Google
- Tesla
- Uber
- Apple
- Many startups

<table>
<thead>
<tr>
<th>Prediction</th>
<th>Year in the Market (Year Announced)</th>
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<tbody>
<tr>
<td>Google's founder Sergey Brin</td>
<td>2018 (2012)</td>
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<tr>
<td>Volkswagen head of Digitalization Strategy, Johan Jungwirth (not necessarily Volkswagen brand)</td>
<td>2019 (2016)</td>
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<tr>
<td>General Motors head of foresight, Richard Holman</td>
<td>2020 (2016)</td>
</tr>
<tr>
<td>Ford's head of production development, Raj Nair</td>
<td>2020 (2016)</td>
</tr>
<tr>
<td>Toyota</td>
<td>2020 (2015)</td>
</tr>
<tr>
<td>Andy Palmer, the Executive Vice President of California-based Nissan Motors Ltd</td>
<td>2020 (2013)</td>
</tr>
<tr>
<td>Ford CEO, Mark Fields</td>
<td>2021 (2016)</td>
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<tr>
<td>BMW CEO, Harald Krueger</td>
<td>2021 (2016)</td>
</tr>
<tr>
<td>Baidu's Chief Scientist</td>
<td>2021 (2016)</td>
</tr>
<tr>
<td>Tesla's Founder, Elon Musk</td>
<td>2021 (2015)</td>
</tr>
<tr>
<td>Justin Rattner, CTO of Intel</td>
<td>2022 (2012)</td>
</tr>
<tr>
<td>Jaguar and Land Rover's Director of Research and Technology</td>
<td>2024 (2014)</td>
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<tr>
<td>U.S. Department of Transportation</td>
<td>2025 (2015)</td>
</tr>
<tr>
<td>Dieter Zetsche, Chairman of Daimler</td>
<td>2025 (2014)</td>
</tr>
<tr>
<td>Automotive Supplier Continental</td>
<td>2025 (2012)</td>
</tr>
<tr>
<td>Robert Hartwig, President of the Insurance Information Institute</td>
<td>2028 (2013)</td>
</tr>
<tr>
<td>Institute of Electrical and Electronics Engineers (IEEE)</td>
<td>2040 (2012)</td>
</tr>
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</table>
Most important takeaway:

When you take the driver out of the car:

THE ECONOMIC THRESHOLD for moving a vehicle is low.

EXPLOSION OF VIALBE USES
Where this explosion of trips happens matters.
AV benefits are differentiated by geography.

AVs
- Personal & Electric
- Exurban

FAVES
- Fleets of AVs that are Electric & Shared
- Urban.

Safety benefits felt here.

Fewer cars (shared) & better air quality (electric) key benefits here.
We are getting a chance to DO OVER cities!
Cheonggyecheon River in Seoul
Cheonggyecheon River in Seoul
Today’s Retail in Urban Areas
Tomorrow

RATS?
We don’t like RATS in cities, but they are fine in the country!

Remember
DENSITY MATTERS
For AV policy & benefits
HOW WE INTRODUCE
MATTERS
WRONG: We won’t get there by replacing buses with AV buses

Good for bus company
Bad for passengers

This will NOT encourage the switch from personal cars to FAVES.

RIGHT:
#1: Start with small vehicles to deliver quality experience.
#2: Increased demand will require larger vehicles on some O-D trips.
A LIKELY SCENARIO: 5-year transition from CARS to FAVES

**Year 1:** 100 small vehicle pilot in mid-size city (students/tourists)

**Years 2-5:** Expands to 1000 vehicle fleet. *Cheaper & more convenient than status quo.* First 2nd vehicles sold. Then primary. On some routes, vehicles will become shuttle & bus size.

**Years 3-5:** Other cities need to adopt to be competitive/modern, innovative.

AVs for Urban & trucking
→
Suburban & Rural?
Figure 5: Active U.S. Driver-Partners Over Time, by City

Note: Figure reports the number of U.S. UberBLACK and uberX driver-partners making at least one trip in the specified month, indexed to the number of months since Uber began in the city or June 2012, whichever came later.
FAVES will be the fastest path to electric mobility
HOW WE TAX
MATTERS
Taxes for Motor vehicle manufacturing & use = $206 Billion/year*
($110b state & $96b in federal)

Current Sources: Gas Taxes, Toll revenues, Permits & Fees, Tickets & Fines, Parking, Registrations

With electric Avs
None

Fall by 60-90% (the higher end if we go to FAVES (reduced vehicles through tolls))

& 2nd order effects
Loss of taxes on associated labor & businesses now defunct

Center for Automotive Research, Ann Arbor MI
Taxing AVS

Getting the incentives right

Certificates of Entitlement

Vehicles on purchase category
- Fuel type
- Weight
- Square footage

Road user fees (based on category)
- Distance
- Congestion
- ZERO OCCUPANCY PREMIUM

Retail
- Pickup/Dropoff
- VAT
HOW WE HANDLE LABOR MATTERS
Increased access to jobs & jobs with higher wages
JOB LOSS (US)
We need no drivers & with FAVES only a fraction of manufacturing

Today, we have:
3.5 million freight and delivery truck drivers
665k bus drivers
90k licensed taxi drivers in NYC alone

5.6 million in direct automotive manufacturing
1.65 million automotive dealerships

Vehicle cleaning, maintenance & repair crews
Gas station attendants & insurance agents
Waiters & cooks that feed the 3.5 million truckers

Center for Automotive Research, Ann Arbor MI
Registry: Laid off, first hired

Pilot Universal Basic Income
Do Transit and AVs Coexist?

YES!

Metro, light rail, BRT in dedicated ROW will be faster than vehicles. But buses will disappear.

FAVES as feeder to rail; and to reduce transfers.
To accomplish this big vision
10% OF CURRENT VEHICLES
We need to the involvement of many sectors

LAND USE & URBAN PLANNING
Planning & Criteria for New Space

TRANSPORT INFRASTRUCTURE REVS
No gas tax, parking, tickets, 1/10th tolls
New: fuel type, weight, distance, congestion, occupancy

TRANSPORT
w/out ownership, integrated multimodal

LABOR
Rapid crash in sector jobs
Enable diversification today; plan for future

DATA
Open APIs, Privacy, Security
Transparency, Portability

ENERGY
New grid load must be renewables

COMMUNITY
Demand for FAVES vision

VICTIMS
Organize those who have suffered

Shared, Electric
Local city research

**ACCESS DIVIDEND**
How many jobs newly accessible? At higher wages?

**LAND VALUE DIVIDEND**
Inventory on-street & off-street parking. What new uses, criteria & priority? What new value?

**LABOR DIVIDEND**
How many jobs lost? How might they be redeployed for more community gain?

**TAX DIVIDEND**
How much transport & labor tax revenue lost? Get to redo with better incentives & amounts.
A FUTURE PRIORITIZING PEOPLE NOT CARS
Action:

All Avs in densely populated areas must be in shared fleets.

• Maximize learning & safety from each vehicle
• Full-time professionals monitoring maintenance, software upgrades for safety
• Equity & access to benefits (can buy a seat in a shared vehicle; not just for wealthy Tesla buyers)
• Codify OEM commitment to shared fleet introduction.
(1) Starting in 2020, all new vehicles intended for shared and intensive use must be clean fuel or EVs. By 2025, all shared use vehicles must be clean fuel or EVs.

(2) New transportation BTUs added to energy grid must be renewable.

(3) Shared-vehicle and shared-ride services must use standard open APIs.

(4) All AVs in densely populated areas must be in shared fleets.

(5) Local land use, zoning, building regulations, and user fees will support and incentivize these requirements.
Paris signed!
Time to Seize the Moment

What are we waiting for?

robin@osmosys.org
Local (metro) research

To quantify benefits:
• How many jobs newly accessible? Increased wages?
• Inventory on-street & off-street parking. What better uses? What value?

To quantify costs:
• How many jobs lost?
• How much transportation & labor tax revenue lost?