Osher Lifelong Learning Institute, Summer 2022

Contemporary Economic Policy

University of Hawaii, Manoa
July-Aug, 2022

Jon Haveman, Ph.D.
National Economic Education Delegation

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Available NEED Topics Include:

- Healthcare Economics
- US Economy
- Climate Change
- Economic Inequality
- Economic Mobility
- Trade and Globalization
- Minimum Wages
- Immigration Economics
- Housing Policy
- Federal Budgets
- Federal Debt
- Black-White Wealth Gap
- Autonomous Vehicles
- US Social Policy

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Course Outline

- **Contemporary Economic Policy**
  - Week 1 (7/8): Economic Update (Geoffrey Woglom, Amherst College)
  - Week 2 (7/15): The Black-White Wealth Gap (Jon Haveman, NEED)
  - Week 3 (7/22): Cryptocurrencies (Geoffrey Woglom, Amherst College)
  - **Week 4 (7/29): Autonomous Vehicles (Jon Haveman, NEED)**
  - Week 5 (8/5): Federal Debt (Joseph Carolan, Oakland University)
  - Week 6 (8/12): Gender Pay Gap (Jon Haveman, NEED)

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Submitting Questions

- **Please submit questions of clarification in the chat.**
  - I will try to handle them as they come up.
- **We will do a verbal Q&A once the material has been presented.**
- **OLLI allowing, we can stay beyond the end of class to have further discussion.**
- **Slides will be available from the NEED website tomorrow (https://needelegation.org/delivered_presentations.php)**

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OLLI – University of Hawaii, Manoa

Driving Change – Autonomous Vehicles' Big Impact

National Economic Education Delegation

Jon Haveman, Ph.D.

July 29, 2022

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Credits and Disclaimer

- **This slide deck was authored by:**
  - Jon Haveman, NEED
- **This slide deck was reviewed by:**
  - Ronald Fisher, Michigan State University
  - William F. Fox, University of Tennessee, Knoxville
- **Disclaimer**
  - NEED presentations are designed to be nonpartisan.
  - It is, however, inevitable that the presenter will be asked for and will provide their own views.
  - Such views are those of the presenter and not necessarily those of the National Economic Education Delegation (NEED).

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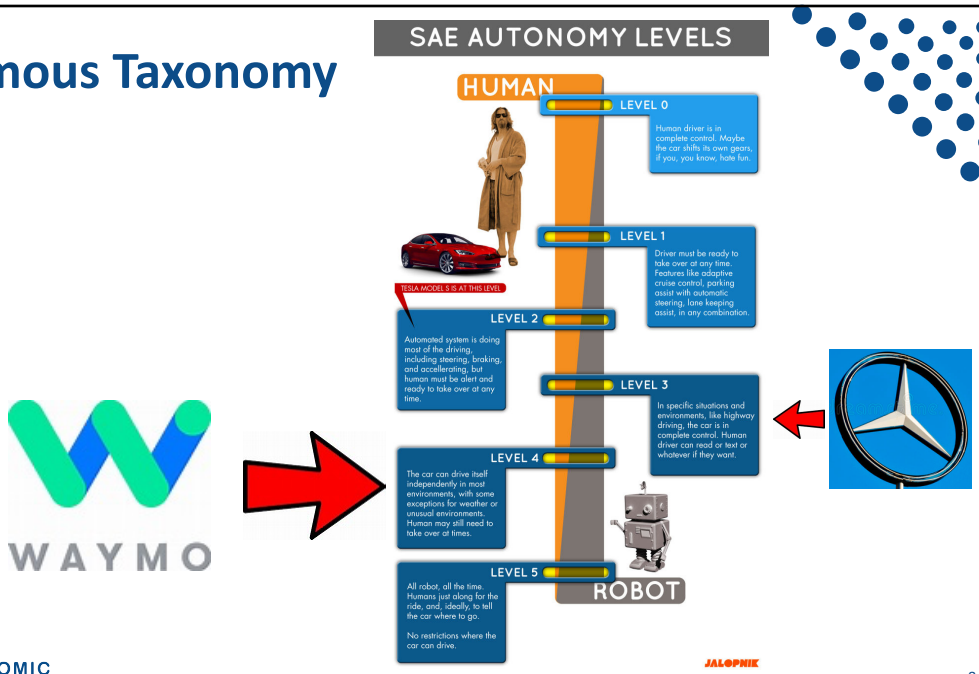
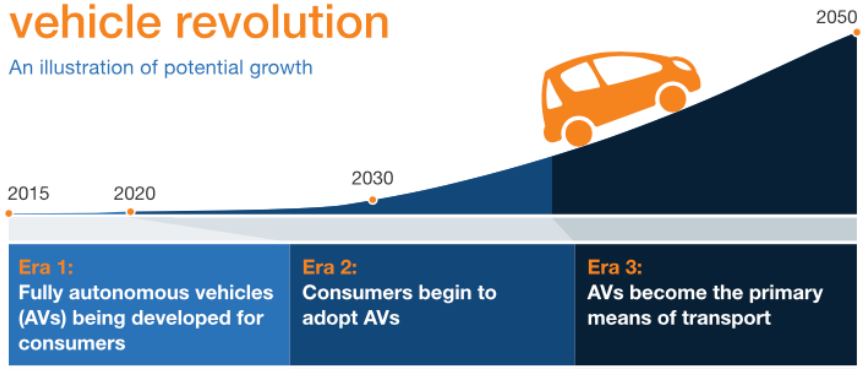
Outline

- Where does the AV path lead?
- Transition
- Policy/Planning Issues
- Major Economic/Development Changes
- Environmental Implications

Autonomous Taxonomy



Growth Path



McKinsey & Company

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McKinsey isn't Always Spot On

- **"In 1980, McKinsey & Company was commissioned by AT&T to forecast cell phone penetration in the U.S. by 2000.**
  - The consultant's prediction, 900,000 subscribers,
  - was less than 1% of the actual figure, 109 Million."
    - Professor Angel Lozano, 2014

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Three Important Questions:

1. When will Transportation as a Service (TaaS) be available?
2. How quick will the transition be?
3. What will the future look like?

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WHEN?
What do the headlines say?

NVIDIA to introduce level-4 enabling system by 2018

Audi to introduce a self-driving car by 2020

Volkswagen expects first self driving cars on the market by 2019

First autonomous Toyota to be available in 2020

Elon Musk now expects first fully autonomous Tesla by 2019, approved by 2021

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40+ Corporations Working On Autonomous Vehicles

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WHEN? What is possible?

- By 2025 (?)
- Potentially 95% of VMT by 2035.
- Last 5% is going to be very difficult to achieve.
- Is this possible?
  - Horses to cars: 10 years – early 1900s
  - But adoption of EVs is so slow!
  - Adoption of AVs will be rapid.

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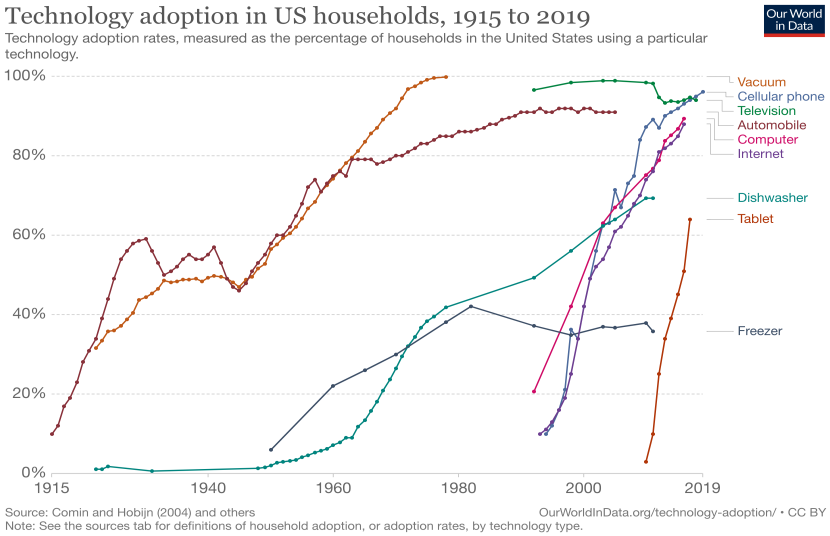
Rate of Technology Adoption – Faster!



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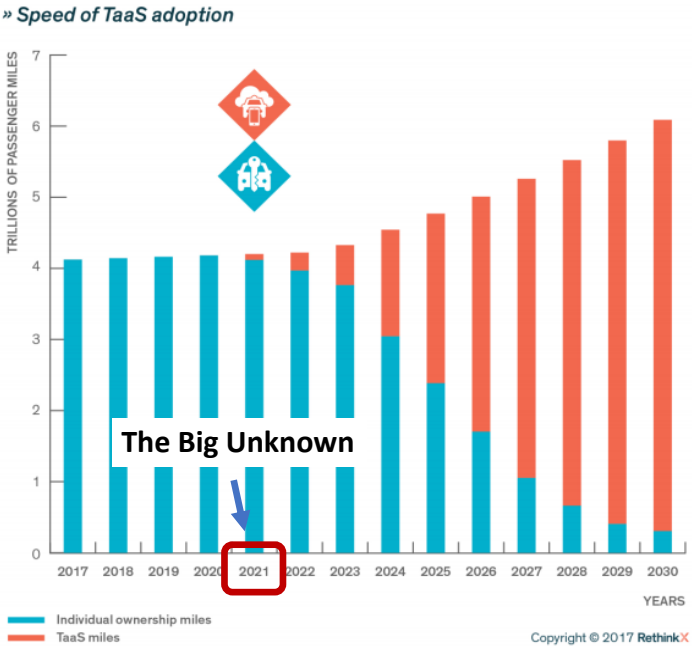
Forecast

Timing may be off.

But the point is:

RAPID ADOPTION!



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Waymo's self-driving cars are now available on Lyft's app in Phoenix

Hyundai plans to launch a free robot taxi service in California

Singapore's self-driving cars can now be hailed with a smartphone

NuTonomy joins forces with 'the Uber of Southeast Asia'

Cruise to offer free robo-taxi rides in S.F. for the public — without backup drivers

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Waymo is in New York!

WAYMO

New York City

Image courtesy of Waymo

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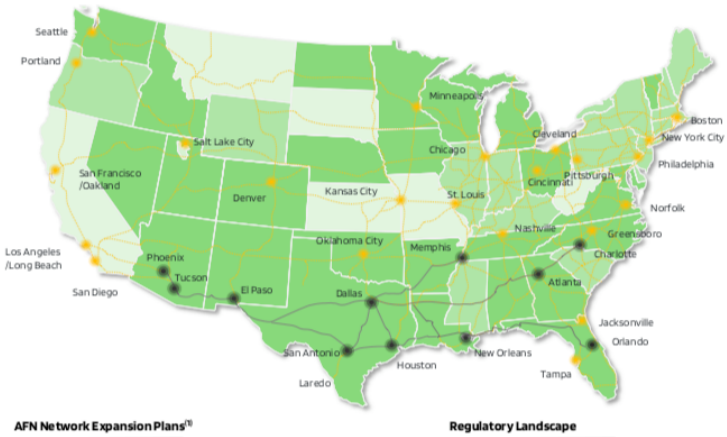
Trucking – Highly Fertile Ground

- **Long haul trucking is likely the first place we will see it adopted.**
  - Reduces costs associated with drivers.
  - End run around limits on hours of driving.
- **Where does it stand?**
  - Lots of trials underway.
  - TuSimple – actively building a long haul network.
  - Waymo – focused more on last mile/local delivery.

TuSimple Current and Future Routes (Level 4)



44 states
allow autonomous semi-truck testing

26 states
allow autonomous semi-truck commercial deployment

50 states
cohesive AV operations framework laid out in US DOT 4.0 AV Regulations

What will the future look like?

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This:

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But, will it be:

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Hell

- **Primarily individual private car ownership**
  - Much as today.
- **Internal combustion engines**
- **Why Hell?**
  - Dramatically increased VMT and pollution.
  - Potentially increased congestion
  - Parking.

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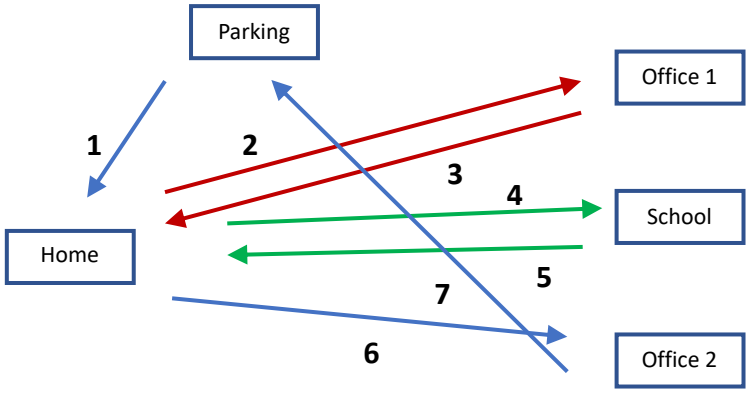
Two Adults and a Child: Morning Miles



And this is just the morning…..

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Heaven

- **Vehicle ownership will be very limited**
  - Private ownership for those with specialized vehicle needs.
  - Fleet ownership will serve everybody else.
- **Engines: electric**
- **Insurance: product liability**
- **Not clear when we will get there, but this is the likely model.**
  - 2030 for widespread adoption in many regions.

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Why is this Heaven?

- **Not only autonomous, but:**
  - Shared
  - Connected
  - Green
- **Far fewer cars in existence.**
  - Better resource utilization.
- **VMT could go up or down, but more productive than in Hell.**
- **Congestion effects – unclear, but likely reduced.**
  - Right-sized vehicles, platooning, sharing, V2V communication
- **Minimal need for parking.**

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Transition

- **Short term: Tesla model of highway autonomy**
  - Level 2, adaptive cruise control.
- **Medium term:**
  - short period of personal vehicle ownership with level 3 capability.
  - introduction of independent private fleets – Uber, Lyft, Google, nuTonomy, etc., with level 4/5 capability.
- **Long term:**
  - Personal vehicle ownership is largely a thing of the past.

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Economics Drives Transition: Private

- **Adoption dividend for private individuals**
  - Eliminate car ownership
    - Ave annual cost of owning a car: $9,666 (2021)
    - Cost per mile will fall: $0.64 to $0.19
  - Repurpose your garage
    - $50,000 from transition to bedroom

Average Costs Per Mile

Miles per Year	10k	15k	20k
Average Cost	82¢	64¢	55¢

- **Time recovery**
  - 50% of the San Francisco Bay area workforce has a commute in excess of 30 minutes.

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Economics Drives Transition: Public

- **Economic and social costs associated with human drivers are enormous:**
  - ACCIDENTS:
    - Drive 25% of congestion.
    - Result in 40,000 deaths.
    - And 2 million injuries.
    - 90+% caused by human error.
  - Increased productivity from not driving.
  - Costs of human drivers estimated at up to $1.3 **TR**illion each year

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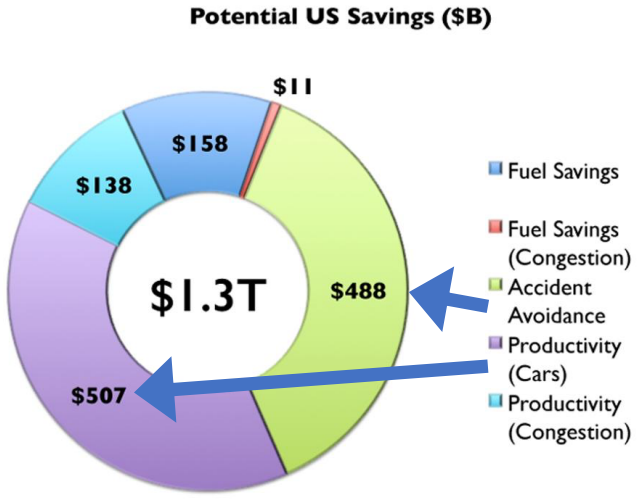
Potential Savings



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Morgan Stanley

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Public Policy/Planning Issues

- **Government buy-in:**
  - Essential – gov't must encourage progress
  - Difficult – because of displacement issue
- **Important transitional issues:**
  - What infrastructure should be developed?
  - What to do about public transportation?
  - What to do with all of the parking spaces?

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Responding to the coming changes:

- **Transportation organizations must develop a forecast for adoption in their specific geography**
  - San Francisco – faster than Chicago
  - Chicago – faster than Fresno
  - Fresno - faster than Kansas
- **How does this affect the ROR calculation on projects?**
  - Highway expansion? Public Transportation?

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Encourage Change

- **Mobility and equity considerations.**
  - Elderly/disabled/impoverished
- **Safety:** only way to reduce traffic fatalities is by coordinated effort.
- **Productivity:** reduced congestion.
- **Environment:** speed transition to electric vehicles.

These are all societal benefits that come about too slowly if the private market is left to itself.

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Mobility and Equity

- **Mobility**
  - Handicapped
  - Elderly
  - Lower income
- **Equity**
  - Public Transportation often does not work well for low-income workers/residential workers
    - Does not go from residential to residential, but from residential to commercial

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Safety and Productivity

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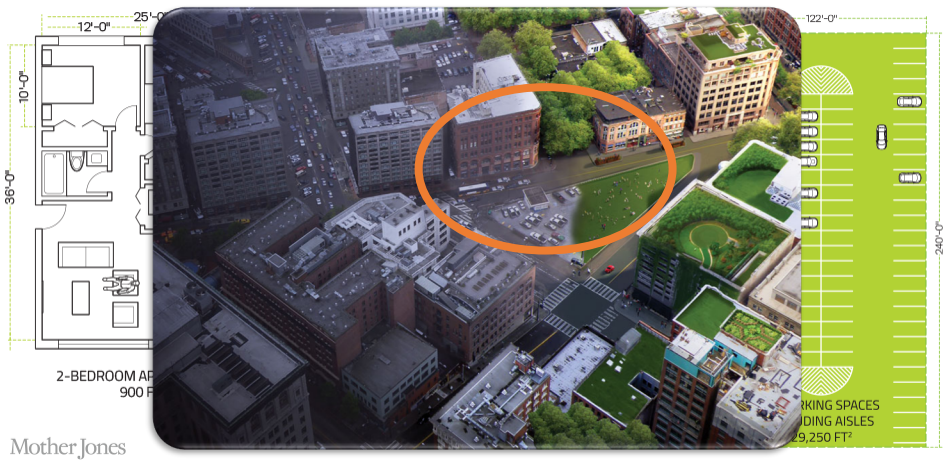
Environment



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Environmental Implications Depends: Heaven or Hell

- **Improved resource utilization**
- **More efficient travel**
  - Right sized vehicles
  - Optimized routes
  - Reduced congestion
  - No searching for parking
- **Increased VMT**
- **Cleaner technologies**
  - Electric
  - Lighter vehicles
- **Energy use of onboard electronics**
  - Weight and functional
- **Increased urban sprawl**

Bottom line: push governments at all levels to embrace and to implement policies deterring private vehicle ownership and zero passenger miles

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Incentives Through Policy and Planning

- **Allow vehicles equipped with ACC into HOV lanes**
  - Eventual conversion of HOV lanes to ACC/AV lanes
- **Allow ACC equipped vehicles to travel faster in HOV lanes**
- **Subsidize ACC upgrades**
  - Arguably more concrete benefits than electric vehicles
- **Sticks: higher costs of vehicle ownership**
  - Registration fees, VMT taxes, etc.

Note: ACC = Adaptive Cruise Control

Interim Summary

- **Transition is coming very quickly!**
  - Most reports are extremely conservative.
  - Apply generally, but faster in many regions.
- **Very important to start incorporating AVs into planning now.**
  - To realize the benefits of AVS.
  - Sacrifice expansion for maintenance.

What Changes Will This Bring?

- Disposable income
- Government finances
- Transportation
- Infrastructure
- Public transportation
- Employment
- Housing
- Parking

Potentially dramatic improvements in infrastructure planning and maintenance - Data sharing and integration

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Disposable Income

- Costs $9,666 to own a car.
- Will cost $3,000 to use TaaS.
- Net increase in disposable income of > $6,000.
- Spread across all households: more than $1 trillion in new spending in the economy.
- Major boost to economic activity.
  - CREATING JOBS!

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Government Finances

- **Government finances thrown for a loop:**
  - Revenues up and down:
    - Parking revenue, tickets, traffic violation revenues
    - More commercial, retail and residential space
  - Less spending on road development
  - More (maybe less) spent on road maintenance
    - Fewer road miles
    - but perhaps more VMT

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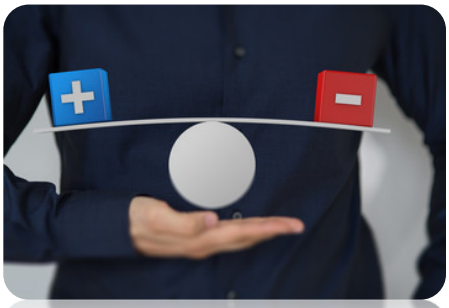
Transportation

- **Demand for transportation will likely increase significantly: price falls, demand rises**
  - Commutes may increase in distance, but not necessarily in duration
  - Zero passenger trips will arise
    - Deliveries
- **At the same time, demand for roadway lane-miles will likely decrease**
  - AVs make significantly more efficient use of space
  - Front to back and side to side



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Infrastructure

- **Focus of transportation infrastructure:**
  - Currently on expansion
  - Will turn toward:
    - Maintenance
      - TaaS providers push for fewer potholes?
    - Adding technology
      - Stop lights will be digital as well as visual
  - Some will disappear: Signs!

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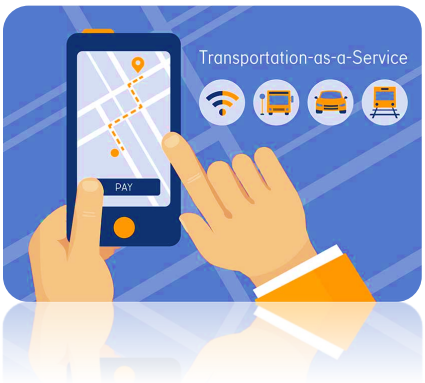
Public Transportation



- **Ambiguous implications for public transportation**
- **Demand may:**
  - Shrink because of low cost of TaaS
  - Grow because last mile problem is solved
- **Extensions may be added through contract with TaaS company**

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Cautionary Tale From Long Ago

- **Automobiles impact on rail:**

"The increasing dominance of cars was also felt by railway companies, which by June 1894 had to start making **pricing concessions** for transporting goods, even including free transport."

- Samuel I. Schwartz, No One at the Wheel, 2018

Employment

- **Massive job displacement/relocation (Millions!):**
  - Drivers of all varieties: truck, taxi, delivery…
  - Car production jobs, car parts production jobs
  - Gas station, vehicle repair, and body shop
  - Police and fire
  - Health care workers
  - And so on…

Employment (con't)

- **What jobs will be created?**
  - IT jobs
  - Retail/Production jobs
  - ??
- **Always easier to identify things that will go away than to identify what will pop up in its place.**
- **Regardless of where they are created, training programs will be crucial to the transition.**

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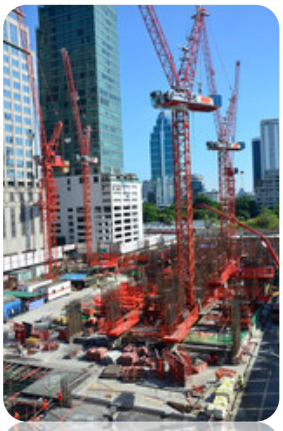
Housing



- **Housing is suddenly easier to build**
  - Issue of traffic congestion is significantly reduced.
  - Space for new housing is available where parking lots used to be.
- **Existing houses can now accommodate more people: garage to bedroom conversions.**

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Parking

- **Greatly reduced demand for parking lots.**
- **Service providers will own parking lots in strategic places.**
  - Where the cost of land is low.
- **Street parking will largely be a thing of the past.**
  - More green space in cities.
- **Shopping mall parking will be converted to:**
  - More shopping mall? Housing?
- **Apartment complexes will convert parking.**

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Freeing Up Urban Space from Parking

- **Los Angeles: 14% of incorporated land area**
  - 200 Square miles
- **San Francisco: 275,450 on-street parking spaces**
  - Enough to parallel-park a line of cars 900 miles.
    - California's entire coastline is 840-miles.
  - Enough parking to fill parking lots that would cover the **Presidio, Golden Gate Park, and Lake Merced**.
- **Nationwide: (estimate) 500 million spaces**
  - That's larger than Delaware and Rhode Island combined.
  - Could be as many as 2 billion (add in Connecticut and Vermont).

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Potential Problems and Concerns

- Expansion of the electric grid to provide sufficient capacity.
- Mining for rare earth minerals for batteries.
- Hacking of autonomous vehicles for nefarious purposes.
- Competition in service provision in some markets.
- And many more…

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Summary of Change

- Massive employment upheaval.
- Local government finances will look very different.
- Housing will be easier to build and more plentiful.
- Parking conversions will be commonplace.
- Demand for transportation infrastructure will likely decline.
  - Transportation infrastructure technology will be a booming business.
- Demand for public transportation may well decline.
- Coming likely sooner rather than later!

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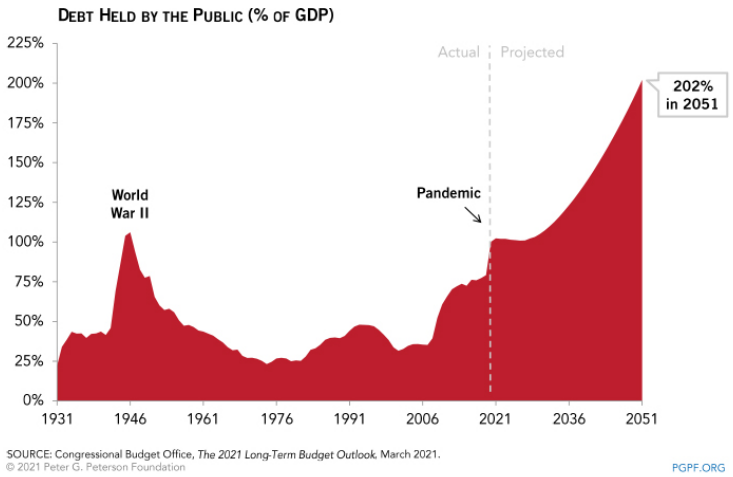
The Federal Debt: Joe Carolan, UConn

PETER G. PETERSON FOUNDATION

The national debt is on an unsustainable path



SOURCE: Congressional Budget Office, *The 2021 Long-Term Budget Outlook*, March 2021.

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Thank you!

Any Questions?

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