

# Autonomous Vehicles

INFORMATICS 161

3PM GROUP 9

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01

Introduction

- **Urbanization & Traffic Congestion** – Increasing need for efficient, shared mobility solutions.
- **Regulatory Evolution** – Governments balancing safety concerns with innovation.
- **Consumer Trust & Adoption** – Public perception and safety concerns influencing market growth.
- **AI & Electrification** – Autonomous taxis becoming smarter and more sustainable.
- **Business Model Shifts** – Rise of uber like services vs. private ownership of autonomous vehicles.

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## Strengths

- **Strength: Efficiency & Cost Savings** – Autonomous taxis reduce labor costs, optimize routes, and lower congestion, making transportation more affordable and accessible.

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## Opportunities

- **Opportunity: Sustainability & Electrification** – The shift towards electric autonomous taxis aligns with global sustainability goals, attracting investment and government incentives.

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## Weaknesses

- **Weakness: Regulatory Hurdles** – Strict safety regulations and varying policies across regions slow deployment and increase compliance costs.

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## Threats

- **Threat: Public Trust & Safety Concerns** – High-profile accidents and skepticism around AI-driven vehicles hinder mainstream adoption and market expansion.
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02

Implementation Expectation

# Anticipated Benefits

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## Traffic

- Reduced traffic congestion

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## Safety

- Reduced human error accidents
- Free of drivers - passengers conflicts

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## Resource Utilization

- Decoupling of drivers and vehicles
  - Fuel efficiency
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## PRIVACY

- Passenger monitoring through internal camera
- Service history data
  - Ex. routes taken, transaction data

## SERVICE INEQUALITY

- Possible service quality difference based on price or membership
  - Ex. route selection

## SAFETY

- Sensor precision error
- Security of system
  - Implementation errors
  - Prone to hacking

## ETHICS

- Accident liability
- Human life accountability on software programs

# Overall Attitude

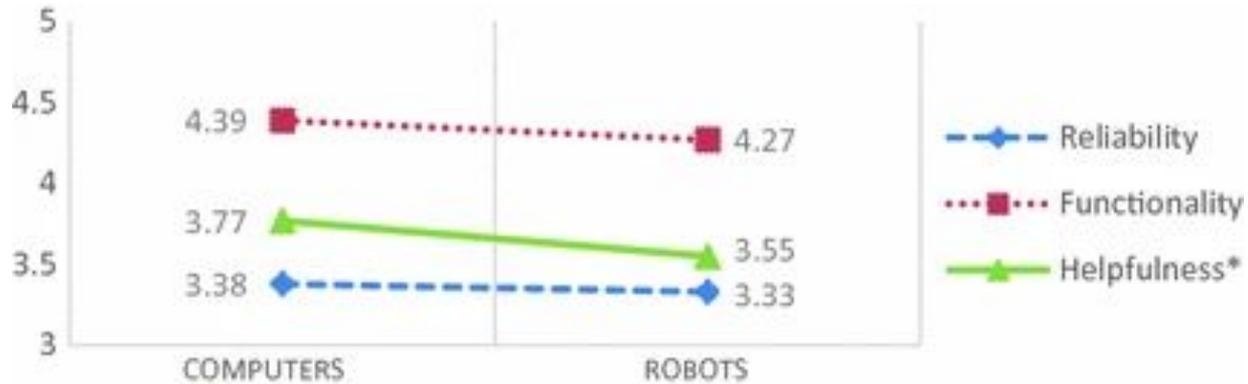


Figure 1. Positive Attitude Towards Self-Driving Taxi

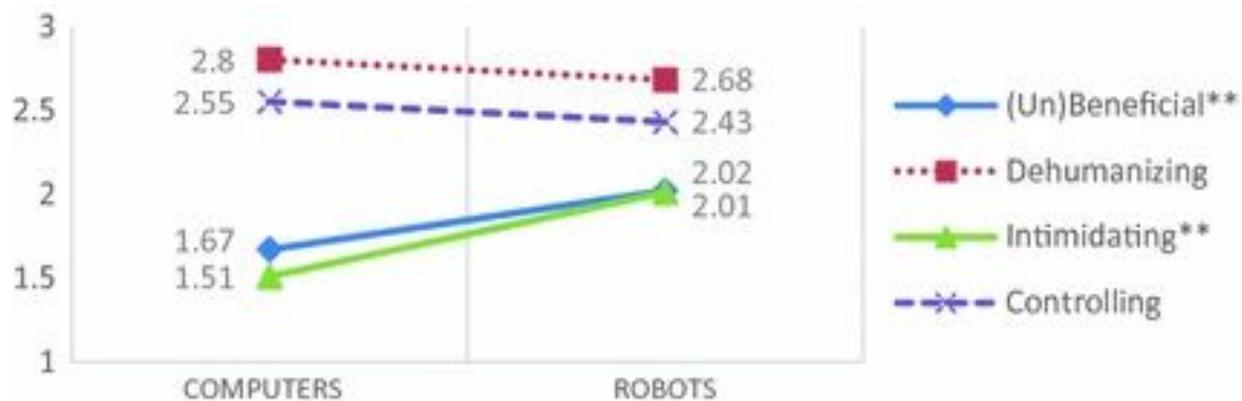
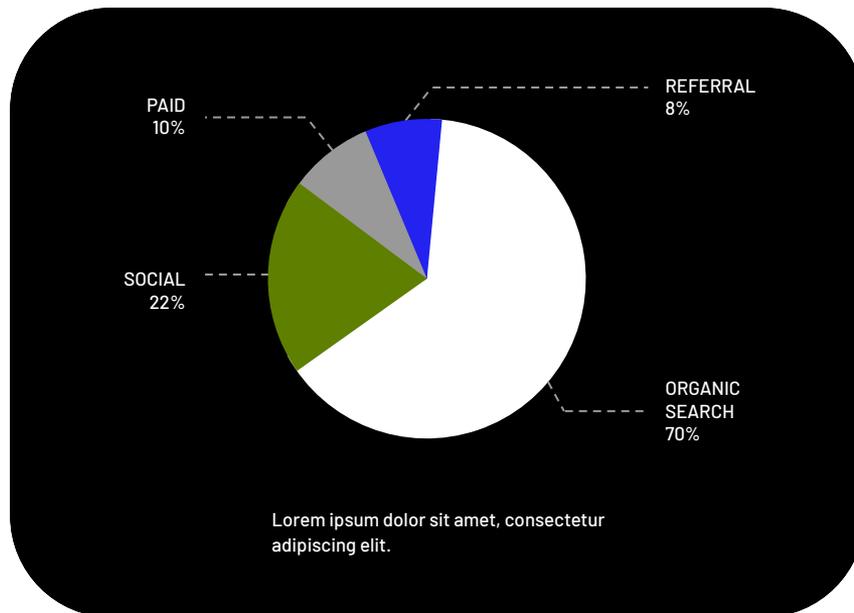


Figure 2. Negative Attitude Towards Self-Driving Taxi

# Market Size

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# DIFFERENTIATORS

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## PRICE

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## SAFETY

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## COMFORT

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## EASE OF USE

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03

**Public Expectation**

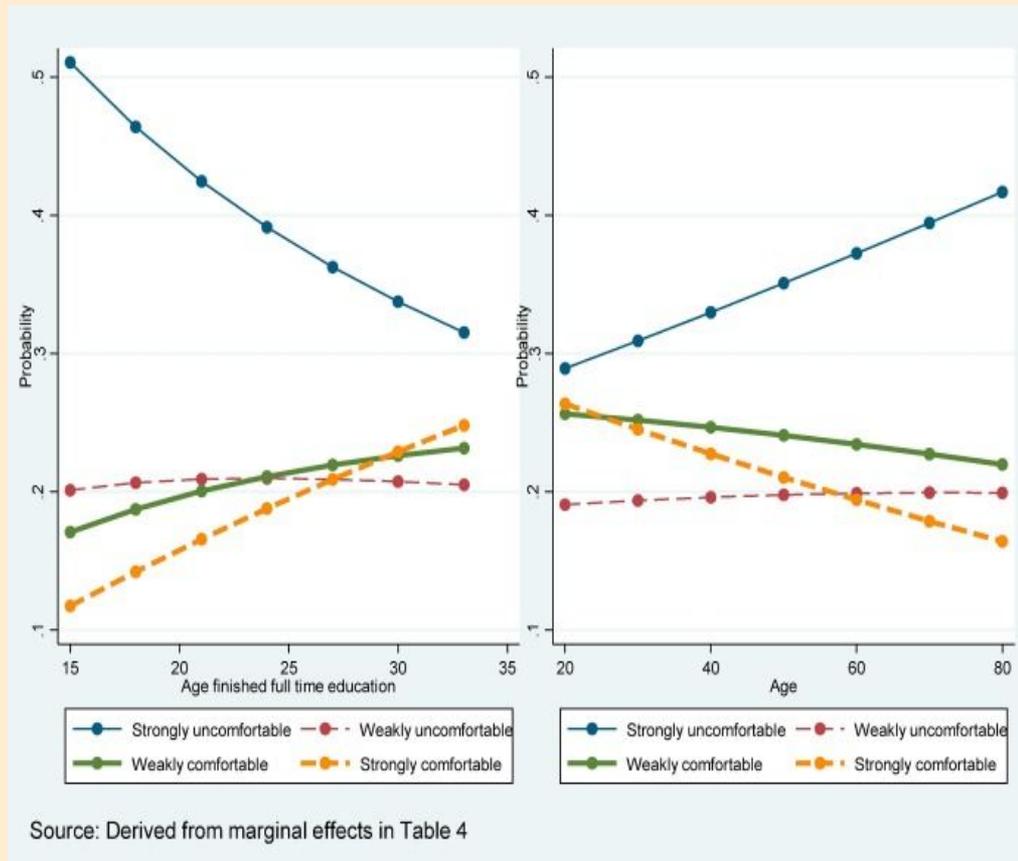
How SDT would affect  
employment

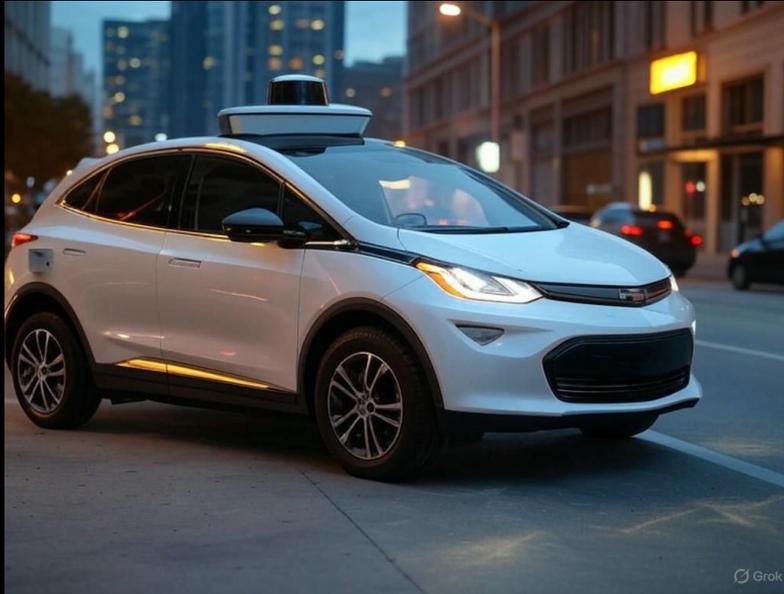
# General Public Concerns

- Many fear SDTs will replace taxi and ride-hailing jobs (Uber/Lyft).
- Low-wage workers who rely on driving as a primary income source may be affected the most.
- Public concern stems from broader fears about automation and job loss.
- Reference from the Eurobarometer survey (2018): attitudes toward automation are shaped by age, education, and economic status.

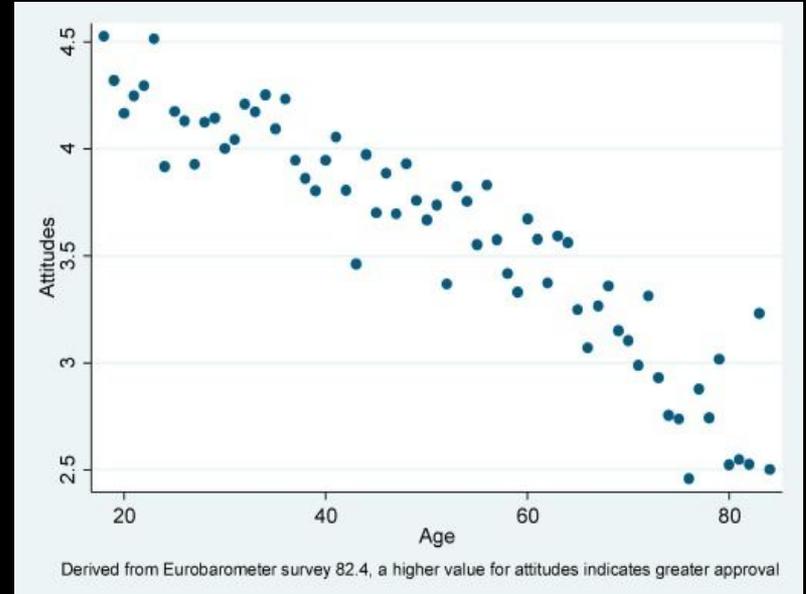
Education and age significantly shape acceptance of automation.

Public Attitudes Toward Self-Driving Taxis





Self Driving Car



The scatterplot from Eurobarometer showing approval ratings by age.

<https://doi.org/10.1016/j.tra.2018.08.018>



Drivers

Risk of job displacement



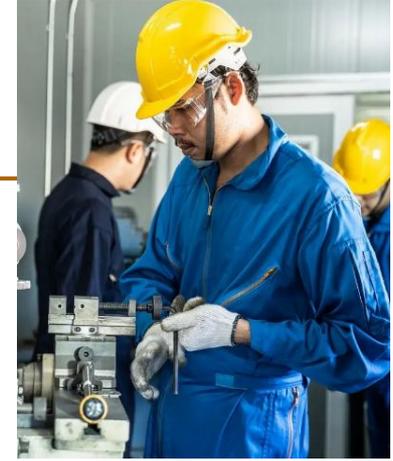
Delivery Workers

Shift to automated logistics



Elderly & Disabled

Improved transportation access.



Tech & Maintenance Staff

New job opportunities in AV upkeep.

## Who Will Be Affected?



**SDTs may replace some jobs, but they will also create new opportunities. Public perception varies, and policies will shape the impact.**

04

Actual Outcome

# Cities with Waymo Services



## **Phoenix**

Waymo One is open to all across 315 square miles of the Valley of the Sun.



## **San Francisco**

Anyone can download, request, and ride today in the City by the Bay and Daly City.



## **Los Angeles**

Welcoming all riders in the City of Stars! Ride from Santa Monica to Downtown today.



### Step 1

Download Wayo one app



### Step 2

Tell them where you want to go



### Step 3

Get In the Car



### Step 4

Click "Start Ride" and Enjoy safety and comfort!

## ACTION PROCEDURE

Download the app and create an account to get started. Choose your destination, and let us take care of the pick-up and drop-off. A self-driving car can accommodate up to four passengers. Use the app to unlock the door, and fasten your seatbelt once you're in. Tap "Start Trip" to view the road conditions and route as seen by the Waymo Driver on the passenger screen.

# Waymo Driver compared to human benchmarks

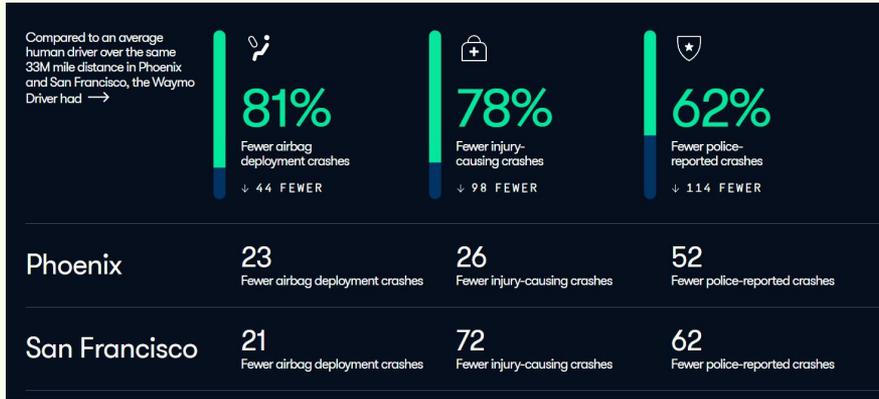
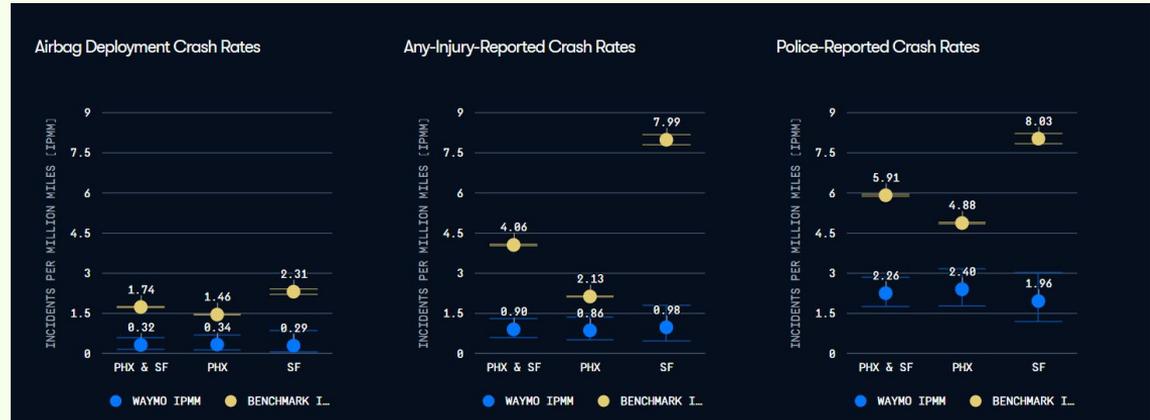


Figure 1. This table shows how many fewer RO crashes Waymo had (regardless of who was at fault) compared to human drivers with the average benchmark crash rate if they were to drive the same distance in the areas we operate.

Figure 2. The graphs below show how many fewer incidents (crashes) per million miles (IPMM) Waymo had compared to human drivers with the benchmark crash rate if they would have driven the same distance in the areas we operate. The error bars represent 95% confidence intervals for the IPMM estimate.



# User Experience and Public Feedback



ALEXIS JOHNSON

The future is here! No driver, just smooth, autonomous cruising. Wild experience but surprisingly normal. @Waymo

waymo • Follow

waymo • How would you describe your first ride experience (only using emojis)?

- ibITZ 🟡🟡🟡
- drinkd\_travel\_diaries 🟡
- lovenac 🟡
- micromonix 🟡
- sp\_producer 🟡

waymo • Follow

waymo • Trading gridlock for great reads.

hey\_dell\_top 🟡

roscoe\_0 🟡

blessed\_1111 🟡

youhaveemystapler 🟡



GREGORY PUCKETT

Recovered 80 minutes of reading time today by riding in a @Waymo instead of driving. The future of productivity is bright with AI 🌟

waymo • Follow

waymo • Trading gridlock for great reads.

hey\_dell\_top 🟡

roscoe\_0 🟡

blessed\_1111 🟡

youhaveemystapler 🟡

196 likes

November 22, 2024

waymo • Follow

waymo • "You're a wizard, Waymo."

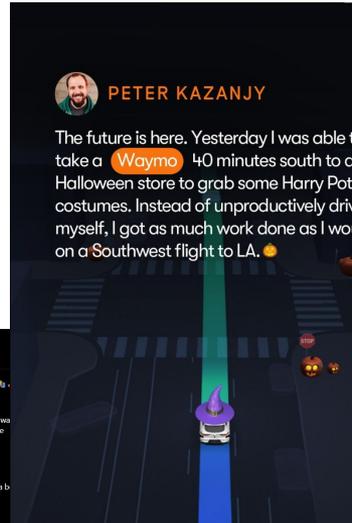
liftingjelly 🟡

mjkpruner 🟡

daleyfly 🟡

shapine 🟡

ban963k 🟡



PETER KAZANJY

The future is here. Yesterday I was able to take a Waymo 40 minutes south to a Halloween store to grab some Harry Potter costumes. Instead of unproductively driving myself, I got as much work done as I would on a Southwest flight to LA. 🍂

waymo • Follow

waymo • "You're a wizard, Waymo."

liftingjelly 🟡

mjkpruner 🟡

daleyfly 🟡

shapine 🟡

ban963k 🟡



waymo • Follow

Original audio

waymo • 93w

From running errands to going on date night, we love hearing stories like Ron's about the sense of independence and autonomy they get from riding with Waymo One. #WhyIRideWithWaymo 🚗 - Waymo One rider Ron

davefrombpt 82w

#banWaymo

er\_vip 85w

Putting a blind guy in a driverless car makes me question the person who thought it would be a good idea to put a blind person in a driverless car. It doesn't make me wanna ride the driverless car.

267 likes

May 16, 2023

Add a comment...

## Personal Experience



### Cons

- Too slow

### Pros

- Convenient
- 24/7
- Safe
- cost performance
- Quite and Clean



# 05

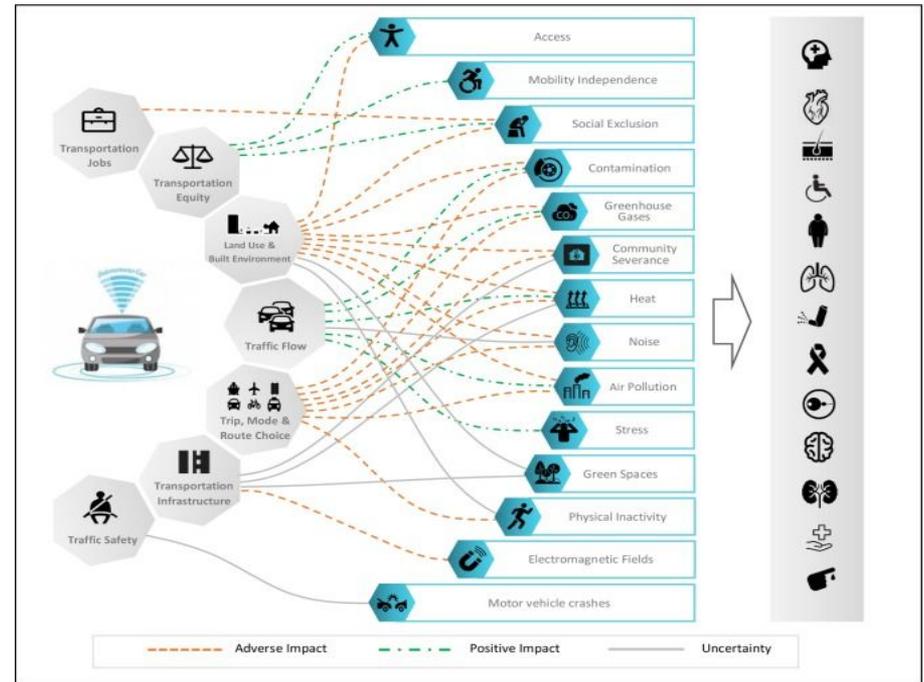
Comparison and Analysis of  
Expectation vs Actual  
Outcome

# Comparing Outcomes

- Waymos are generally accepted amongst the population
- Benefits may outweigh other services like Uber and Lyft.

Wallace, R. L. (2017). *Mobility: The socioeconomic implications of autonomous vehicles*. Science, Technology, and Public Policy, University of Michigan.  
<https://stpp.fordschool.umich.edu/research/policy-brief/mobility-socioeconomic-implications-autonomous-vehicles>

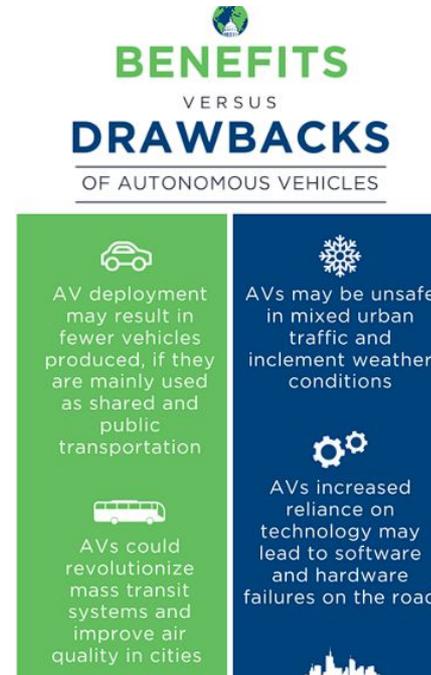
Sohrabi, S., Khreis, H., & Lord, D. (2020). Impacts of autonomous vehicles on public health: A conceptual model and policy recommendations. *Sustainable Cities and Society*, 63, 102457.  
<https://doi.org/10.1016/j.scs.2020.102457>



# Comparing Outcomes (cont.)

- Are people ready for a change like this?
- People may not completely let go of more traditional services like Uber and Lyft.

Wallace, R. L. (2017). *Mobility: The socioeconomic implications of autonomous vehicles*. Science, Technology, and Public Policy, University of Michigan.  
<https://stpp.fordschool.umich.edu/research/policy-brief/mobility-socioeconomic-implications-autonomous-vehicles>



Nunno, R. (2021). *Autonomous vehicles: State of the technology and potential role as a climate solution* (Issue Brief). Environmental and Energy Study Institute.  
<https://www.eesi.org/papers/view/issue-brief-autonomous-vehicles-state-of-the-technology-and-potential-role-as-a-climate-solution>



Graphic By: Sydney O'Shaughnessy

06

Environmental Effects of  
Autonomous Vehicles

# Potential Benefits of AVs

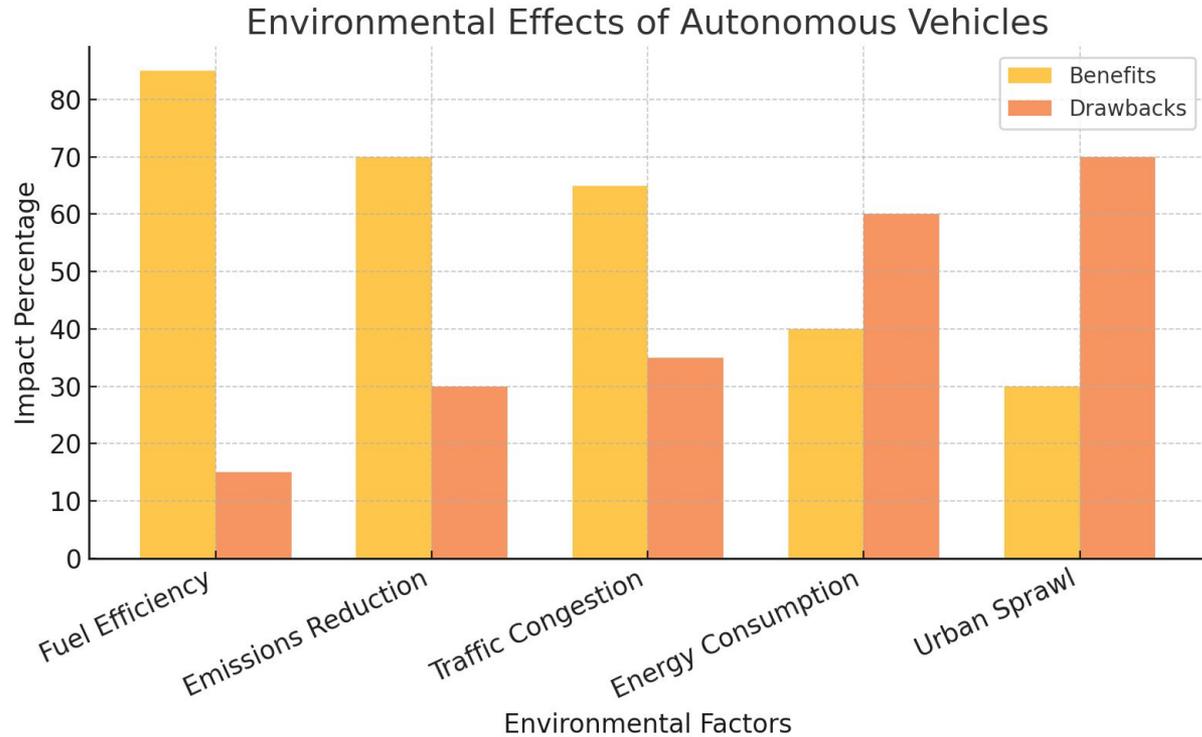
- **Fuel Efficiency:** Reduced fuel consumption due to optimized driving patterns.
- **Emissions Reduction:** Lower greenhouse gas emissions when combined with electrification.
- **Traffic Congestion Reduction:** Smart routing minimizes idle time and unnecessary fuel waste.
- **Urban Land Use Benefits:** Reduced need for parking space allows for greener urban environments.



# Potential Drawbacks of AVs



- **Increased Travel Demand:** Cheaper, convenient travel could lead to more vehicle miles traveled (Taiebat et al., 2019).
- **Higher Energy Consumption:** More AVs on the road may lead to greater total energy use.
- **Urban Sprawl Risks:** Easier commutes may encourage city expansion, increasing environmental footprint.



Data from Taiebat et al. (2019) highlights these trade-offs

Taiebat, M., Brown, A. L., Safford, H. R., Qu, S., & Xu, M. (2019). A Review on Energy, Environmental, and Sustainability Implications of Connected and Automated Vehicles. *Environmental Science & Technology*, 52(20), 11449–11465.

# Policy and Planning Considerations

- **Renewable Energy Integration:** Using green energy for AV infrastructure.
- **Urban Planning for Sustainability:** Smart city designs to mitigate urban sprawl.
- **Regulations on AV Usage:** Incentives for shared AVs over personal AV ownership.
- **Lifecycle Emission Management:** Sustainable policies for production and disposal (Taiebat et al., 2019).



THANK YOU

COMPANY NAME