

# Technology Trends

## Autonomous Transportation Systems

Center for Learning in Retirement

CLR Fall 2020

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Week 3

# The What

- ~~Artificial Intelligence & Machine Learning~~
- ~~Robots & Drones~~
- Autonomous Transportation Systems
- Surveillance
- (Cyber) Crime, Security & Warfare
- Medical Tech
- Media (incl. Social Media)
- (Virtual) Money & Blockchain
- Communication
- Earth & Sky
- Space

# Let's talk about

- Cars
- Trucks
- Ships
- Trains and
- Planes

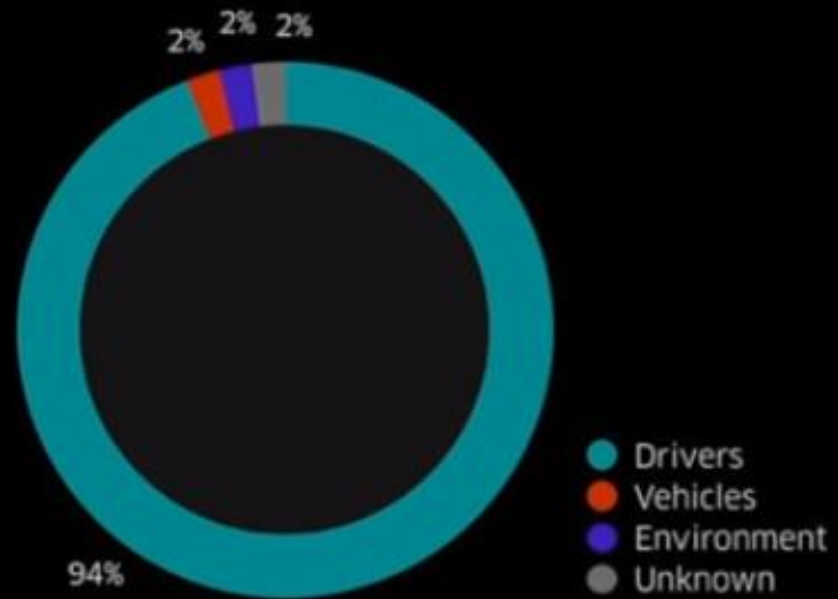
# How Self-Driving Cars Work ([source](#))



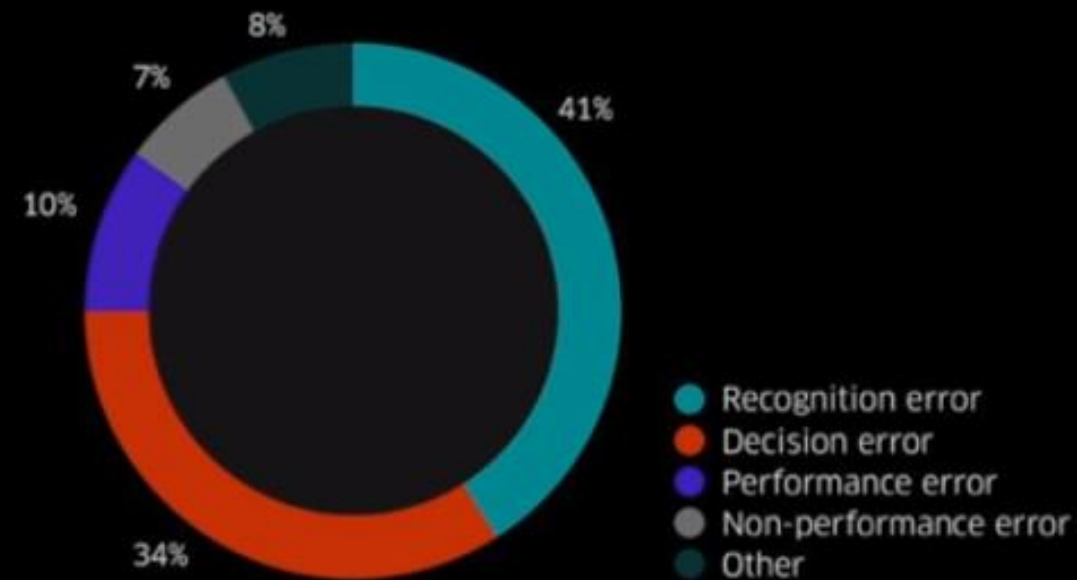
# How Your Self-Driving Car Learns 'Ethical Behavior' ([source](#))



Drivers are the leading cause of critical pre-crash events

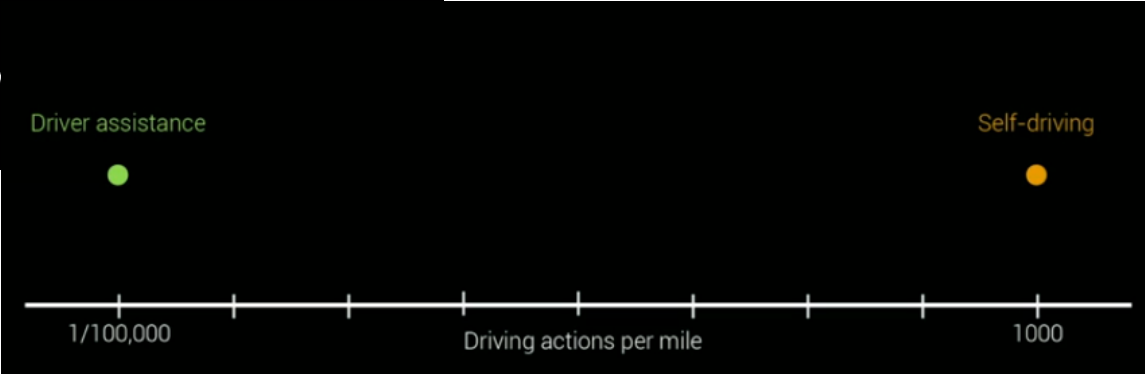
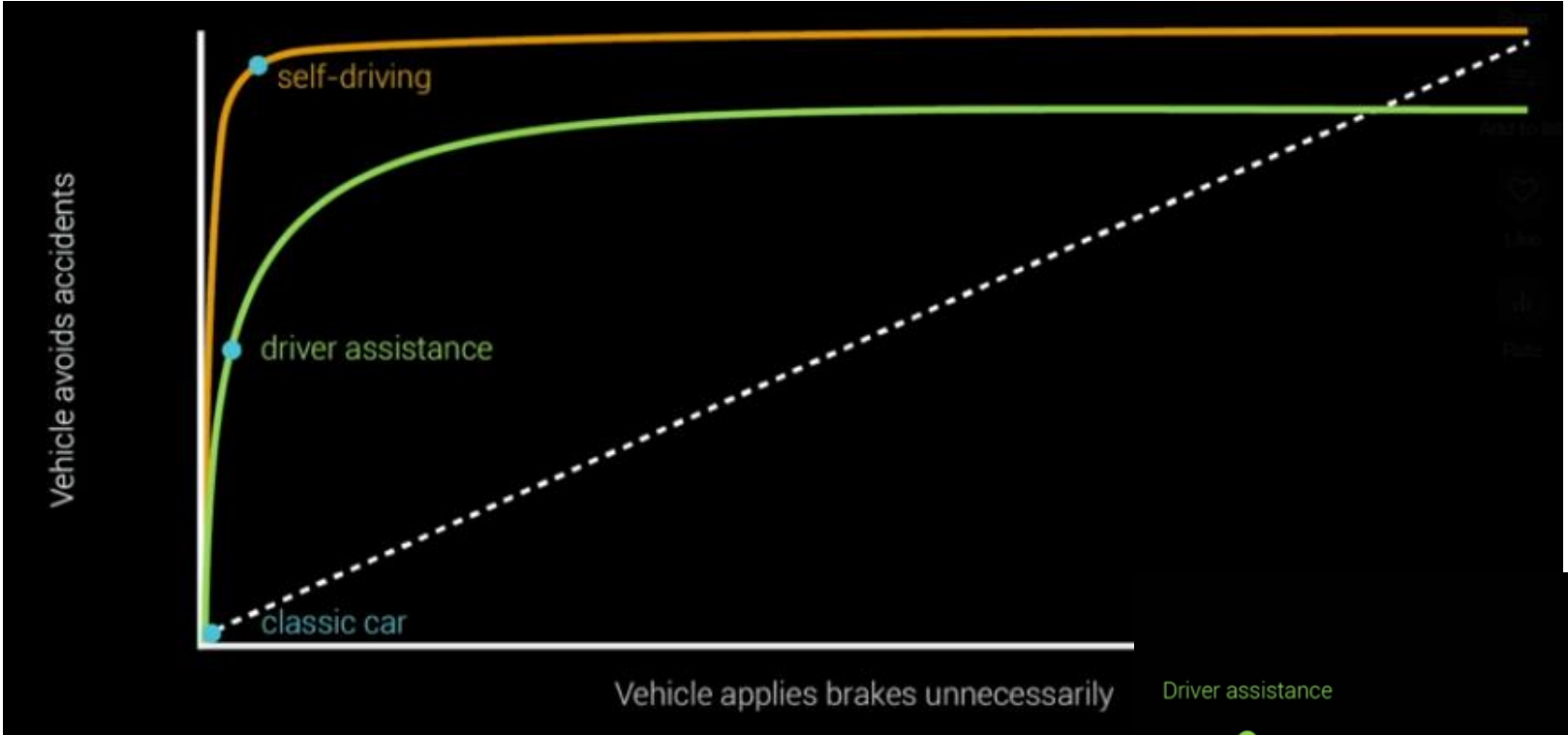


Recognition & decision error are the leading causes for these events



# Driver Assistance vs. Self-Driving

- Better technology offsets less reliable driver
  - Driver assistance doesn't avoid ALL accidents – maybe half
  - Self-driving (more sensors) – low frequency of crashes
- Technology – better at doing the right thing?
  - Driver Assistance – accident from human mistake once every 100,000 miles
  - Self Driving system – making decisions 1000 times per mile
- How the system handles uncertainty?
  - Driver Assistance – can't take action, driver still in 'control'
  - Self Driving system – slow down, take better look, react





# The Future of Trucking (5 min)



# The Future of Trucking

Technologies converging and hypercompetitive marketplace will change the trucking industry

- 3 mil drivers, 2.5 mil trucks, 532 carriers... not well automated
- Problem: inefficient systems, trucks running empty...
- [Tesla Semi electric trucks?](#) [Nikola One hydrogen fuel cell truck?](#)
- Autonomous trucks – [platooning](#) (Otto Motors and Uber)
- Next 10 years: fleets of driverless trucks, some autonomous, electric?
  - Skeptics: “someone on board skilled enough to take over”, “we’re different...”
  - \$168 billion/year saved by autonomy – labor, fuel, productivity and accident costs

Good read: [\*Tractor-trailers without a human at the wheel will soon barrel onto highways near you\*](#)

# Rolls-Royce shaping the future of shipping (2.5 min)



# Rolls-Royce shaping the future of shipping

## Characteristics:

- Flexible modular design
- Efficient, ballast-free hull design
- Modular, swappable accommodation containers, power packs, fuel tanks and battery packs
- ‘Virtual bridge’, automatic look-out with decision support, analytics
- “Autonomous operation ready”
- Vessel reconfiguration during ‘port-time’
- Interface standards ‘allow sharing within fleet’

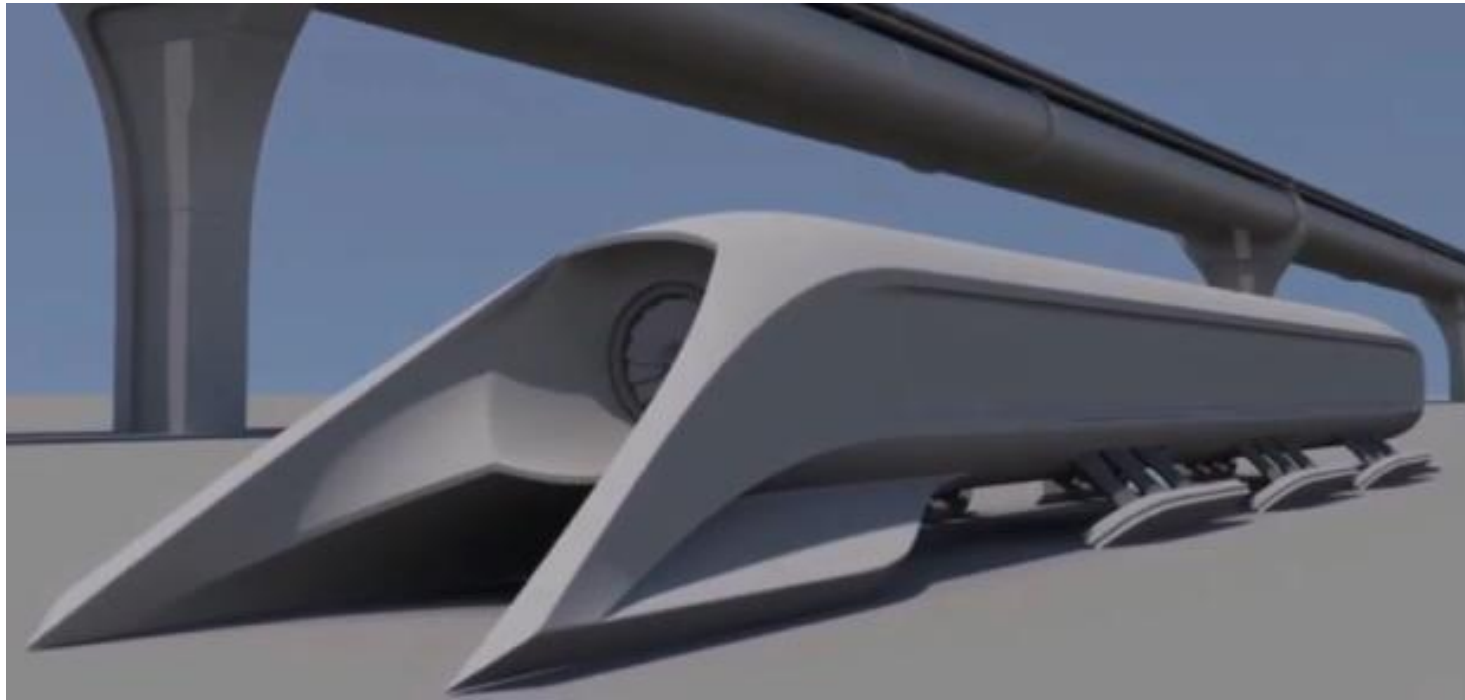
- *Future-proof design* -

# Autonomous Shipping



[Emerging Technology Opportunities for Maritime Autonomous Ships](#) - \$5000  
[Transport 2040: Automation, Technology, Employment - The Future of Work](#) - free

# Future Trains



# Trains

## Future Trains

- Musk's Hyperloop
- Amtrak – 5<sup>th</sup> generation (Avelia) high-speed trains ([Problem\\*](#))
- Magnetic Levitation Twin Pipe Transport System
- [Shanghai Maglev](#) – 268mph ([Fastest Trains](#))

\*2016 - [Are Amtrak's New High-Speed Trains Too Good for Amtrak?](#)

\*2020 - [In crisis, Amtrak is focused on testing and training for new trains to debut in 2021](#)

The first trains enter service in late spring or early summer next year with nine of the 28 train sets operating by fall 2021. All 28 trains “will be produced and delivered by 2022.”

# Aircraft



[Single Pilot or Autonomous Flight](#) (4 min)



# Aircraft

[Airbus Futures](#) (4 min)



# Aircraft

- Fact: [The U.S. will face a staggering shortage of pilots](#)
  - World will buy 41,000 new airliners between 2017 and 2036 and will need 637,000 new pilots to fly them
- [Pilotless planes could save airlines billions. But would anyone fly?](#)
  - The aviation industry could save \$35 billion/year by moving to pilotless planes, but only 17% of travelers are willing to fly without a pilot
- [As Airlines Aim For Autonomous Flight, Near-Term Revolution Will Be Going Single Pilot](#)
  - We may start seeing planes with a single pilot in the cockpit within the next three to five years ([video](#))
  - It is likely to involve a second on-the-ground pilot, following a NASA's 'ground back-up system'
- [Airbus](#) – What's the future airliner going to look like?
  - Sustainable, comfortable, less stressful, more services, fewer delays
  - Problem: 5 million hours excess flight time (9 million tonnes extra fuel, 28 million tonnes CO<sub>2</sub>)
  - Solution: Ground ops, smarter skies, less noise, free-glide approach, alt fuels, formation flying...
- Good read: [Self-Flying Planes May Arrive Sooner Than You Think. Here's Why](#)

# Elon Musk – what he's up to?

What does an exciting future look like?

- [Boring Company](#) – 3-D network of tunnels under LA ([video](#))
- [Hyperloop](#) – test track build adjacent to Space X
- Electrifying Automobiles (Tesla) – Model 3 autopilot ([video](#))
  - 'Shared Autonomy Fleet'
- [Long-range semi-truck](#) – issue: [battery weight versus cargo weight](#)
- [Solar Roof tiles](#)
- [Giga factory](#) – 100 giga watt hours of battery per year (100 factories)
- [Space X and Mars](#) – reusable rockets, many people to Mars in 20 years...
  - Is this a distraction? Actions effect probabilities. Sustainability has to happen!
  - Musk accelerating sustainable energy – good. Space colonization a dream - inspires.

# And there's more

[Boeing's Echo Voyager](#) – autonomous underwater system (2 min)



# And more

[Cora, Lilium, Vahana, and Switchblade](#) – personal passenger drones (5 min)



# Discussion

- Does this 'emerging' technology' have the potential to benefit everyone equally?
- What are its risks and rewards?
- Does it promote autonomy (self-determination) or dependence?

# Resources

- [Driverless cars of the future: How far away are we from autonomous cars?](#)
- [No Need For Speed When It Comes To Autonomous Vehicles](#)
- [Autonomous Vehicles: Are You Ready for the New Ride?](#)
- [The Ethics of Autonomous Cars](#)
- [Tractor-trailers without a human at the wheel will soon barrel onto highways near you. What will this mean for the nation's 1.7 million truck drivers?](#)
- [The Relentless Pace of Automation](#)
- [What is the Tesla Semi?](#)

How Self-Driving Cars Will Transform Our  
Cities and Our Lives | Jeff Schneider (9 min)

**TED**xCMU

x = independently organized TED event



# How Self-Driving Cars Will Transform Our Cities and Our Lives | Jeff Schneider

- Study to figure out the defective component in automobiles
  - Surprise: It's the driver – 'recognition error', 'decision error'
- What to do?
  - Solution: Cars that drive themselves
- Opportunity:
  - Reinvent our lives, our cities, and how our time and money are spent
  - What to do with all the resources freed up by self-driving cars?

Good read: [The Ethics of Autonomous Cars](#); *Sometimes good judgment can compel us to act illegally. Should a self-driving vehicle get to make that same decision?* And [video](#) (7 min)



# How the Driverless Car Sees the Road



Driver Assist vs. Self-Driving (5 min)

# How the Driverless Car Sees the Road

How Self-Driving Cars Do What They Do (6 min)

The TED logo is displayed in a large, bold, red, sans-serif font. The letters are thick and blocky, with a slight shadow effect behind them.

Ideas worth spreading

# Start here



# Ethics

## [What moral decisions should driverless cars make? - TED Talks](#)

- The '[Trolley Problem](#)'
- The '[Tragedy of the \(Algorithmic\) Commons](#)'
- Regulation – people may not opt in to 'safer' technology
- Moral machine – 5 million decisions
- Problem of how to get society to agree on and enforce the trade-offs they're comfortable with – social dilemma
- Problem: technological and societal cooperation

Good read: [The Ethics of Autonomous Cars](#); *Sometimes good judgment can compel us to act illegally. Should a self-driving vehicle get to make that same decision?* And [video](#) (7 min)