Autonomous Vehicles, Safety, and Blame

Slides by Kelsey Hawkins and Ronald Arkin

Unintended Consequences
Intended Consequences…?

Are Self-Driving Cars on the Horizon?

- Dozens of companies working on this
  - Google, Uber, Tesla, Toyota, Honda, Volvo, Nissan, Ford, GM, Daimler etc.
- 20 states introduced legislation in 2016
- Google reports 2 million miles self-driven since 2009
  - Seems big?
  - Average 20-34y/o driver: 15k miles/yr
  - 2mil = 26 cars driving average amount over 5 years
- There are 250mil autos on US roads
Technology
World's First Self-Driving Taxis Debut in Singapore

nuTonomy

Big Rigs

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WERGE UPDATE
Driverless bus line coming to Helsinki

With the RoboBusLine, autonomous transit will go from experiment to regular scheduled service

By Patrick Sisson | Jun 15, 2017, 1:32pm EDT

Boeing Autonomous Air Car
Technological Imperative

- The demand is clear
  - General public
  - Old/young/disabled
  - Truck drivers
- Totally transformative
- Technology is showing progress
- Fear of “losing out” will force competition
  - Blockbuster didn’t adapt quickly enough—bankrupt
- Control, planning, and perception techniques have been around for decades
- Sensors are more thorough than human eyes
  - No blind spot
- Machine learning is maturing perception
  - Recognition is improved from “big data”

Motional is now testing fully autonomous vehicles in Las Vegas

*The Hyundai-Aptiv joint venture joins the Level 4 club*

By Andrew J. Hawkins | @andyjayhawk | Feb 22, 2021, 8:00am EST
How Self Driving Cars See the World

Massive Human-Robot Interaction

- Self-driving cars have to interact with people almost every minute on the road
  - Other cars, pedestrians, cyclists, traffic officers
- Commercial self-driving cars will be largest HRI experiment ever conducted
- Stakes are high
- Problem is complicated
Will They Be Safer Than People?

- Won’t be distracted/get drowsy—consistent and robust operation under nominal conditions
- Can perceive obstacles in all directions
- Can potentially take into account more obstacles at the same time
- Lack common sense
  - What is it, anyways?
- Difficult to assess—machine learning techniques are often black box
- Understanding safety flaws requires real-world interactions with people

Citizen Uprisings

Wielding Rocks and Knives, Arizonans Attack Self-Driving Cars

By Joseph Winning

Dec 15, 2023

CHANDLER, Ariz. — The Arizona dispatched more than 100 police cars in October and November to a neighborhood where residents shot and killed a self-driving car operated by Waymo, the autonomous-car company spun off of Google.

He confronted the street with an unidentifiable楞 knife, stabbing one of the cars. The suspect, identified as a white man in his 30s, then confronted the neighborhood band leader.

The incident was one of nearly 300 such attacks on autonomous vehicles over the past two years in Chandler, a city near Phoenix where Waymo started testing its cars in 2017. In every large and small city in the US, the fear has been ever more overt.
On the other hand…

Apparently, People Say “Thank You” to Self-Driving Pizza Delivery Vehicles

The New York Times

BUSINESS DAY

Researchers Show How a Car’s Electronics Can Be Taken Over Remotely

By JOHN MARKOFF  MARCH 6, 2013

With a modest amount of expertise, computer hackers could gain remote access to someone’s car — just as they do to people’s personal computers — and take over the vehicle’s basic functions, including control of its engine, according to a report by computer scientists from the University of California, San Diego and the University of Washington.
Motor Mouth: Will your self-driving car kidnap you?
This cyber-theft scenario could be reality very soon, and it's scary indeed

San Francisco restricts the use of delivery robots on its sidewalks

San Francisco just put the brakes on delivery robots
Oops….

A Tesla driver was caught sleeping on Autopilot at high speed, police are charging him criminally

Fred Lambert - Sep. 17th 2020 1:16 pm ET ‏@FredericLambert
Death & Injury in Autonomous Vehicles

- People will die from autonomous vehicles
  - This is not disputed
- Tesla crash – May 2016
  - “The car’s sensor system, against a bright spring sky, failed to distinguish a large white 18-wheel truck and trailer crossing the highway”
  - “the self-driving car attempted to drive full speed under the trailer”
  - “The top of the vehicle was ‘torn off by the force of the collision’, according to a police report”

Tesla driver dies in first fatal crash while using autopilot mode

The autopilot sensors on the Model S failed to distinguish a white tractor-trailer crossing the highway against a bright sky

Joshua Brown, the first person to die in a self-driving car accident. Photograph: Facebook
Distracted? Drowsy? There are solutions…

Open Question: Who’s to Blame?
Alternative Scenario

- Suppose the car instead hit a pedestrian, killing the pedestrian but did not harm the person in the car.
- Does this change the question of who’s to blame?

Determining Liability

- Negligence
  - “A person has acted negligently if she has departed from the conduct expected of a reasonably prudent person acting under similar circumstances.”
  - “The Reasonable Person”
    - Takes into account knowledge, perception, and experience
    - Knows common knowledge

- Types of defects
  - Manufacturing defect
    - Bugs, faulty brakes
  - Failure to warn/inform
    - Risks not properly disclosed
    - Critical operation knowledge not made available
  - Design defect
    - “The foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design, and the omission of the alternative design renders the product not reasonably safe.”
Relative Risk

▪ What if frequency of accidents is increased but number of fatalities is decreased?
▪ Passenger side airbags suit
  ▪ Airbags didn’t deploy—defective
  ▪ Not legally required by gov.
  ▪ Jury awarded $18mil
  ▪ Adding this safety feature saved lives but opened company to liability
▪ Tesla crash – it’s easier for the car manufacturer to hurt you than others
▪ Comparing autonomous vehicles to piloted vehicles—fair?
▪ Comparing autonomous vehicles to other autonomous vehicles?

Can You Make Self-Driving Cars Safer?

1. Drunk driving was less of a problem before cars. If you got on your horse drunk and fell asleep, it could just walk home.
2. And if you tried to ride into a tree, the horse could be like “no.”
3. Forget human drivers—that’s the benchmark we should be judging self-driving cars against.
4. Soon: This baby has 200 horses under the hood and 3.5 in the computer.
Can You Make Self-Driving Cars Safer?

- Safety is directly related to speed and distance from other cars/people/obstacles
- Totally safe autonomous vehicle
  - Plug in destination—if already there, report “you have arrived”—if not there, report “unsafe destination”
- A little less safe
  - Drive only at speeds of 20mph and never on highways
- Even less safe
  - Can drive on highways but always keeps a 20 second following distance, never passes
- Why are these proposals unreasonable?
  - Should the laws be changed?
  - New infrastructure?
  - Should a robot be able to “cut you off”?

Danger of Not Producing Self-Driving Vehicles?
Public Perception

- Autonomous vehicles will fail, and when they do it will be in unintuitive ways
  - Tesla crash—how can someone not see a huge tractor trailer?
- Deadly crashes
  - Convenience of blaming the dead driver
- Will car companies shoulder the stigma of being blamed for the deaths of thousands?
- Has utilitarianism gone too far?
- "Right" to own autonomous vehicles?
  - 2nd amendment

Social Justice Issues

- Self-driving cars will probably start by being only for the wealthy
- Are the costs of accidents tolerable, even if less likely to happen?
- Suppose a significant proportion of fatalities in piloted cars are of people who are negligent in some form
- If replacing all cars with autonomous vehicles will reduce the general fatality rate but increases the fatality rate of people who aren’t generally negligent, is this technology ethical?
Who’s to Blame?

▪ “Driver” was watching Harry Potter!
▪ National Highways and Transport Safety Agency blamed “driver”
  ▪ “It notes that the driver, had he been concentrating, would have had seven seconds to react to the truck.”
▪ Who was the driver?
Questions to think about

▪ Should an autonomous car follow the law to the letter or obey social norms?
▪ Who is responsible for an accident?
▪ What ethics if any should be programmed into the system? Opt in? Opt out? No way out?
▪ How is trust achieved? How is social acceptance achieved?
▪ Others?