The importance of ethics in Engineering Education

Larry Shuman

University of Pittsburgh

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4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

How AVs Operate

- Must build a 3D map of the place. As cars drive on local roads, their lidar (light detection and ranging) devices collect data needed for the maps.

- Once complete, cars can use map to navigate on their own with lidar doing the tracking.

- Lidar alerts cars to nearby objects – other cars, pedestrians and bicylists.

Limitations of Lidar

- Provides information only about objects that are relatively close (limits speed of AVs).

- With multiple AVs on same rode, lidar signals can interfer with each other.

- Backups include cameras and radar that provide additional information about nearby pedestrians, bicyclists, cars and other objects. Cameras also recognize traffic lights, street signs and other signals.

- GPS antennas provide additional positioning data.

- Engineers write rules to define how cars should respond in particular situations, but must use "machine learning" to analyze large data sets and develop responses to varying situations.

LIDAR Unit: Constantly spinning, it uses laser beams to generate a 360-degree image of the car's surroundings.

CAMERAS: Uses parallax from multiple images to find the distance to various objects. Cameras also detect traffic lights and signs, and help recognize moving objects like pedestrians and bicyclists.

RADAR SENSORS: Measure the distance from the car to obstacles

ADDITIONAL LIDAR UNITS

MAIN COMPUTER: Analyzes data from the sensors, and compares its stored maps to assess current conditions.
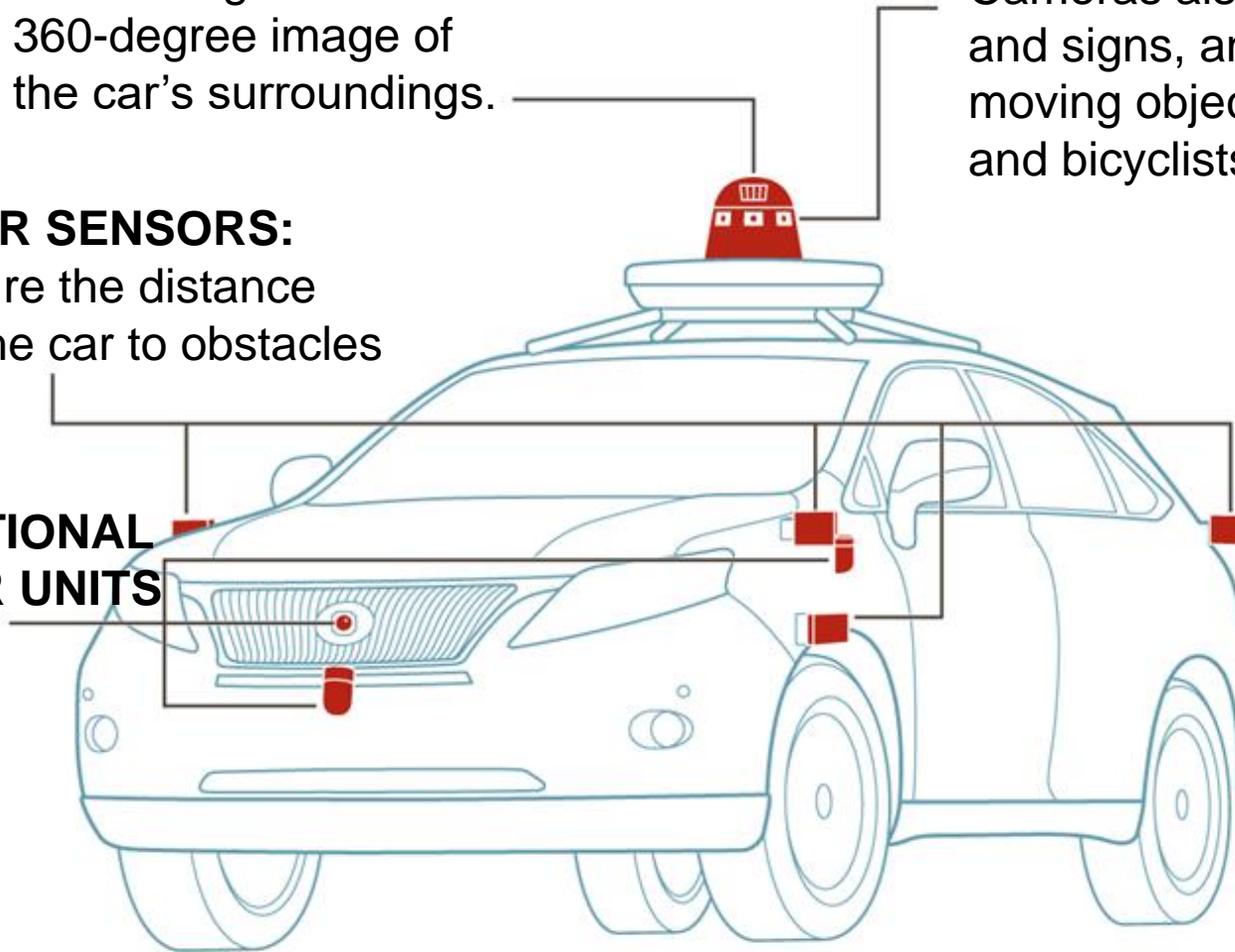
How Uber altered safety sensors on newest test cars

Uber's self-driving Volvo SUV that struck and killed a pedestrian last week in Tempe, Arizona, used fewer safety sensors than the self-driving Ford Fusions that Uber phased out of its test fleet last year.

UBER SELF-DRIVING VEHICLE SAFETY SENSOR SUITE

	LIDAR	RADAR	CAMERA
Volvo XC90	● 1	●●●●●●●●●● 10	●●●●●●● 7
Ford Fusion	●●●●●●● 7	●●●●●●● 7	●●●●●●●●●●●●●●●●●●●● 20

Side- and rear-facing cameras

Roof-mounted lidar sensor*

Front-facing cameras

Lidar sensors mounted on front, wing and rear

Ford Fusion ▲

Roof-mounted lidar sensor* provides 360° 3-dimensional scan of the environment

Front-facing cameras

Side- and rear-facing cameras

Volvo XC90 ▶

Radar with 360° coverage
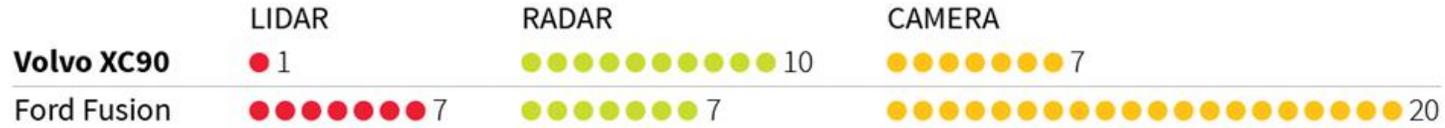
Source: Uber   Images: Uber

* Lidar uses laser light pulses to detect obstacles

Uber Self Driving Cars

- Program began in early 2015; Waymo began in 2009

- Management moved swiftly and confidently even as some car engineers voiced caution, according to former employees, in a rush to get more cars driving more miles.

- Decides to switch from Ford Fusion to Volvo XC90 SUV in 2016.

- Changes

  configuration of

  LIDAR, radar

  and sensors.

Comparison with other AVs

- Ford Fusion had seven lidar units

- Waymo uses six lidar units

- GM cars use five lidar units

- Scaling back to a single lidar "introduced a blind zone around the perimeter of the SUV that cannot fully detect pedestrians," Reuters quoting CMU's Raj Rajkumar (working on AVs for more than decade).
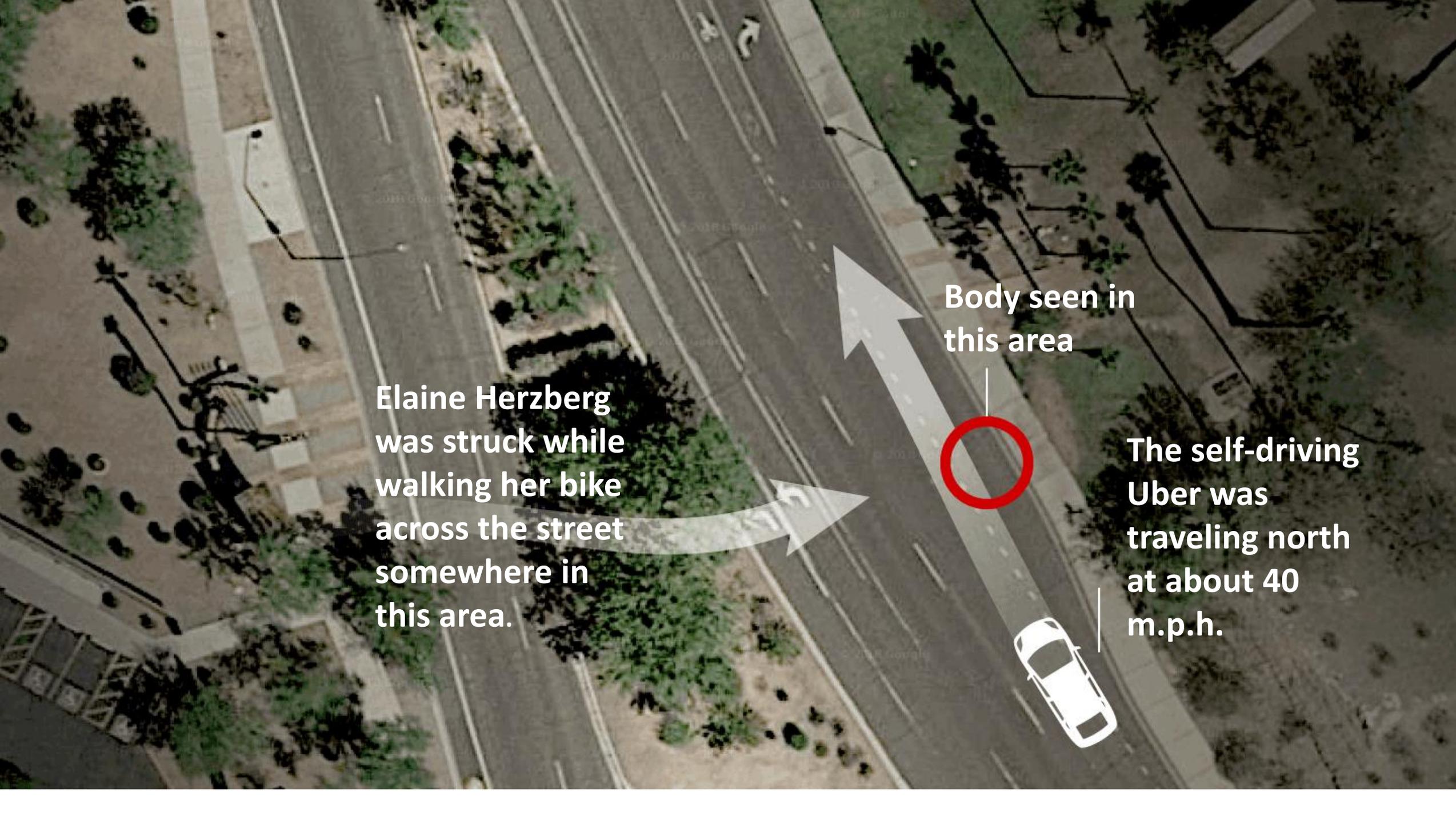
Elaine Herzberg was struck while walking her bike across the street somewhere in this area.

Body seen in this area

The self-driving Uber was traveling north at about 40 m.p.h.
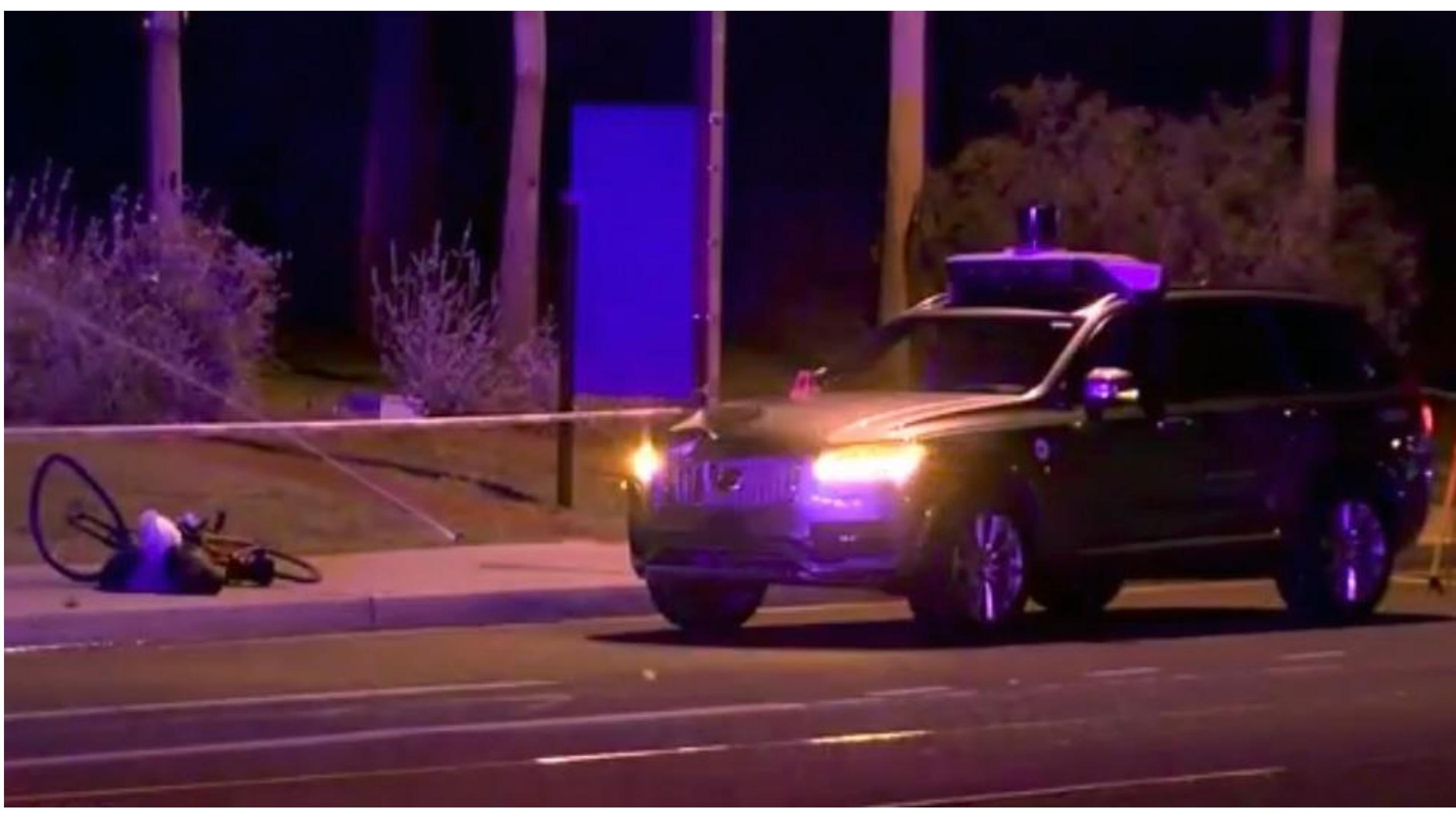
The accident

- Reducing the number of lidar units from 7 to 1 most likely created a blind spot; moving to a higher vehicle worsened the situation since the Velodyne lidar sees objects in a 360-degree circle but has only a 24.9 degree vertical range preventing it from detecting low to the ground obstacles.

- Turning off Volvo's crash-avoidance equipment didn't help the situation. (A simulated test found it would have detected the victim one second before the accident).

Tempe Police Chief Sylvia Moir:

- "I suspect preliminarily it appears that the Uber would likely not be at fault in this accident . . I won't rule out the potential to file charges against the [backup driver] in the Uber vehicle."

- Police have viewed footage from two of the vehicle's cameras, one facing forward toward the street, and the other inside the car facing the driver. Based on the footage, Moir said that the driver had little time to react. "The driver said it was like a flash, the person walked out in front of them," she said. "His first alert to the collision was the sound of the collision."

- Moir faulted Herzberg for crossing the street outside a crosswalk. "It is dangerous to cross roadways in the evening hour when well-illuminated, managed crosswalks are available," she said.

- Others noted that the street design where Herzberg was struck likely was sending pedestrians a mixed message. It features an inviting brick-paved walking path across the median, in addition to a sign warning pedestrians not to use it.

Anthony Levandowski

"We don't need redundant brakes & steering, or a fancy new car, we need better software," then-Google engineer Anthony Levandowski wrote in an email to Larry Page in January 2016. "To get to that better software faster we should deploy the first 1000 cars asap. I don't understand why we are not doing that. Part of our team seems to be afraid to ship."

Shortly thereafter, Levandowski would leave to found his own self-driving trucking company, which was quickly acquired by Uber.

"The team is not moving fast enough due to a combination of risk aversion and lack of urgency, we need to move faster," Levandowski told Page in another communication that was shown during the *Waymo* trial.

Waymo CEO John Krafcik said that Levandowski had vehemently held that redundant systems for steering and braking were unnecessary. "I think it's fair to say we had different points of view on safety," said Krafcik in court.

Collapse of Miami Bridge

Engineer issues a warning

Lead bridge engineer Denney Pate said in voicemail two days prior to installing the bridge:

"Calling to, uh, share with you some information about the FIU pedestrian bridge and some cracking that's been observed on the north end of the span, the pylon end of that span we moved this weekend," a

"From a safety perspective we don't see that there's any issue there, so we're not concerned about it from that perspective, although obviously the cracking is not good and something's going to have to be, ya know, done to repair that."

But the employee was away on assignment, and did not hear the message until after the bridge had fallen.

Cambridge Analytica and Facebook

- Cambridge Analytica gained access to private information on more than 50 million Facebook users [87 million]. The firm offered tools that could identify the personalities of American voters and influence their behavior.

- It has pitched its services to potential clients ranging from Mastercard and the New York Yankees to the Joint Chiefs of Staff.

The Data

- Included details on users' identities, friend networks and "likes." The idea - map personality traits based on what people had liked on Facebook, and then use that information to target audiences with digital ads.

- Researchers in 2014 asked 270K users to take a personality survey and download an app, which scraped some private information from their profiles and those of their friends, activity that Facebook permitted at the time and has since banned.

- The technique was developed at Cambridge University's Psychometrics Center. The center declined to work with Cambridge Analytica, but Aleksandr Kogan, a Russian-American psychology professor was willing.

- Kogan ultimately provided over 50 million raw profiles to the firm. Only those who participated in the survey had consented to having their data harvested, though they were all told that it was being used for academic use.

Schlitterbahn Waterpark Waterslide

From the Indictment

- Ride was created after Schlitterbahn co-owner Jeffrey Wayne Henry made a "spur of the moment" decision in 2012 to build the world's largest water slide to impress the producers of Travel Channel's Xtreme Waterparks.

- Henry and his business partner were in charge of designing the ride and making necessary calcuations even though neither had any credtials in math, physics or engineering.

- Henry's desire to "rush the project" and his and his designer's lack of expertise caused them to "skip fundamental steps in the design process."

- The ride complied with "few, if any" longstanding safety standards established by the American Society for Testing and Materials,

From the Indictment

- Not a single engineer was directly involved in Verruckt's engineering or slide path design.

- An engineering firm tests a week before grand opening showing that rafts carrying a weight of 400 to 550 pounds would likely go airborne, were ignored.

- Henry knew it was dangerous: "[Verrückt] could hurt me, it could kill me, it is a seriously dangerous piece of equipment today because there are things that we don't know about it," Henry said, according to the indictment. "Every day we learn more. I've seen what this one has done to the crash dummies and to the boats we sent down it … It's complex, it's fast, it's mean. If we mess up, it could be the end. I could die going down this ride."

Also from investigation

- Entire slide is covered with a net suspended by metal hoops. The ride begins with a nearly vertical drop. Rafts carrying riders then ascend about 50 feet above the ground, instead of sliding back down, the rafts go airborne — a major design flaw that investigators say the company had known about, tried to fix unsuccessfully, and eventually ignored.

- Whistleblowers: From grand opening (July 10, 2014), to fatal accident (Aug. 7, 2016), 13 people were injured largely because the rafts went airborne, causing some riders to hit the net and the suspended metal hoops enclosing the slide.

- Henry pushed for the entire project — from design to testing — to be done in seven months. Engineers would have needed three to six months just to create a prototype. Henry and his team completed a prototype in 36 days.

Fat Leonard and the 7th Fleet

Worst corruption scandal in Navy history – 16 have been charged with taking bribes from or lying about ties to Leonard Glenn Francis, a Singapore-based tycoon who held contracts to service Navy ships and subs in Asian ports.

Between 2006 and 2013, Francis doled out illicit gifts, hosted epicurean feasts and sponsored sex parties for Blue Ridge personnel.

Officers from the Blue Ridge consumed or pocketed about $1 million in gourmet meals, liquor, cash, vacations, airline tickets, tailored suits, Cuban cigars, luxury watches, cases of beef, designer handbags, antique furniture and concert tickets — and reveled in the attention of an armada of prostitutes,

Francis has pleaded guilty to bribery and defrauding the military of $35 million. He has been in jail in San Diego since his arrest in 2013 and is cooperating with authorities.

- https://www.washingtonpost.com/investigations/leaks-feasts-and-sex-parties-how-fat-leonard-infiltrated-the-navys-floating-headquarters-in-asia/2018/01/23/4d31555c-efdd-11e7-97bf-bba379b809ab_story.html?utm_term=.3b5812b84789

IP issues with China

- The U.S. Trade Representative's seven-month investigation into China's intellectual property theft found that "Chinese theft of American IP currently costs between $225 billion and $600 billion annually."

- Trade secrets: $180 to $540 billion per year.

- James Andrew Lewis, senior vice president at the Center for Strategic and International Studies:

    - "China has sought to acquire US technology by any means, licit or illicit,"

    - "Espionage and theft were part of this, but so were forced technology transfers or mandatory joint ventures as a condition for doing business in China."

Urbanization and the Poor

- The mass urbanization of the rural poor is placing an unusual burden on the urban infrastructure in China, India and also Vietnam.

- There are over 100 cities with more than a million people inhabiting them. As China continues to grow it will need to develop new waste management and treatment systems.

- China has some of the world's most polluted air, water and soil.

- China has 16 of the world's 20 cities with the most polluted air, according to the Worldwatch Institute, based in Washington

Other Ethical Issues

- Dealing with the loss of culture
- Environmental concerns
- Healthcare system
- Ethical issues – child labor
- Financial situation
- Relationships with its neighbors
- Population Diversity
- Need for more skilled and professional workers