THE COMING AGE OF AUTOMATED VEHICLES

BIKES & PEDESTRIANS

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REGIONAL TRANSPORTATION PLANNING

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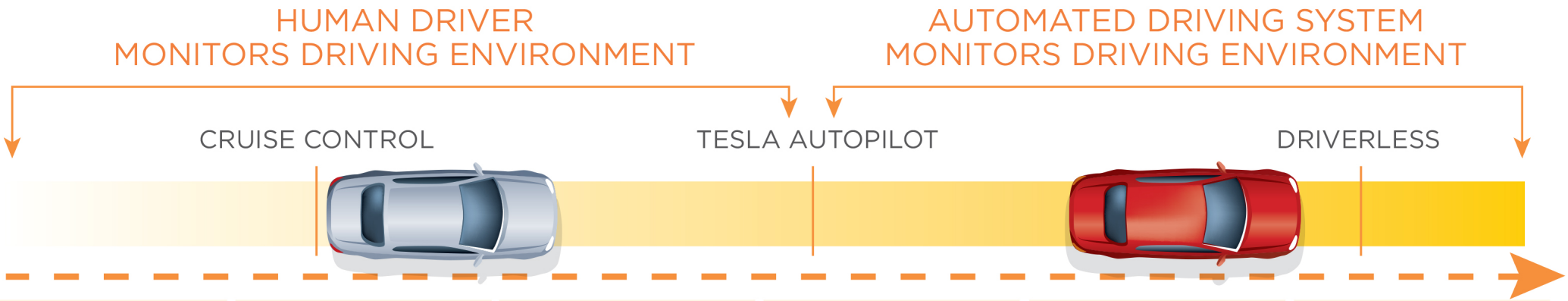
LEVELS OF AUTOMATION



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NO AUTOMATION

Zero autonomy: the driver performs all driving tasks.

1

DRIVER ASSISTANCE

Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design

2

PARTIAL AUTOMATION

Vehicle has combined automated functions, like acceleration and streering, but the driver must remain engaged with the driving task and the monitor the environment at all times.

3

CONDITIONAL AUTOMATION

Vehicle has combined automated functions, like acceleration and streering, but the driver must remain engaged with the driving task and the monitor the environment at all times.

4

HIGH AUTOMATION

The vehicle is capable of performing all driving functoins under certain conditions. The driver may have the option to control the vehicle.

5

FULL AUTOMATION

The vehicle is capable of performing all driving functoins under all conditions. The driver may have the option to control the vehicle.

For more information visit: SAI International

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FEDERAL ACTION

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A VISION FOR SAFETY 2.0

AUTOMATED DRIVING SYSTEMS (ADS)

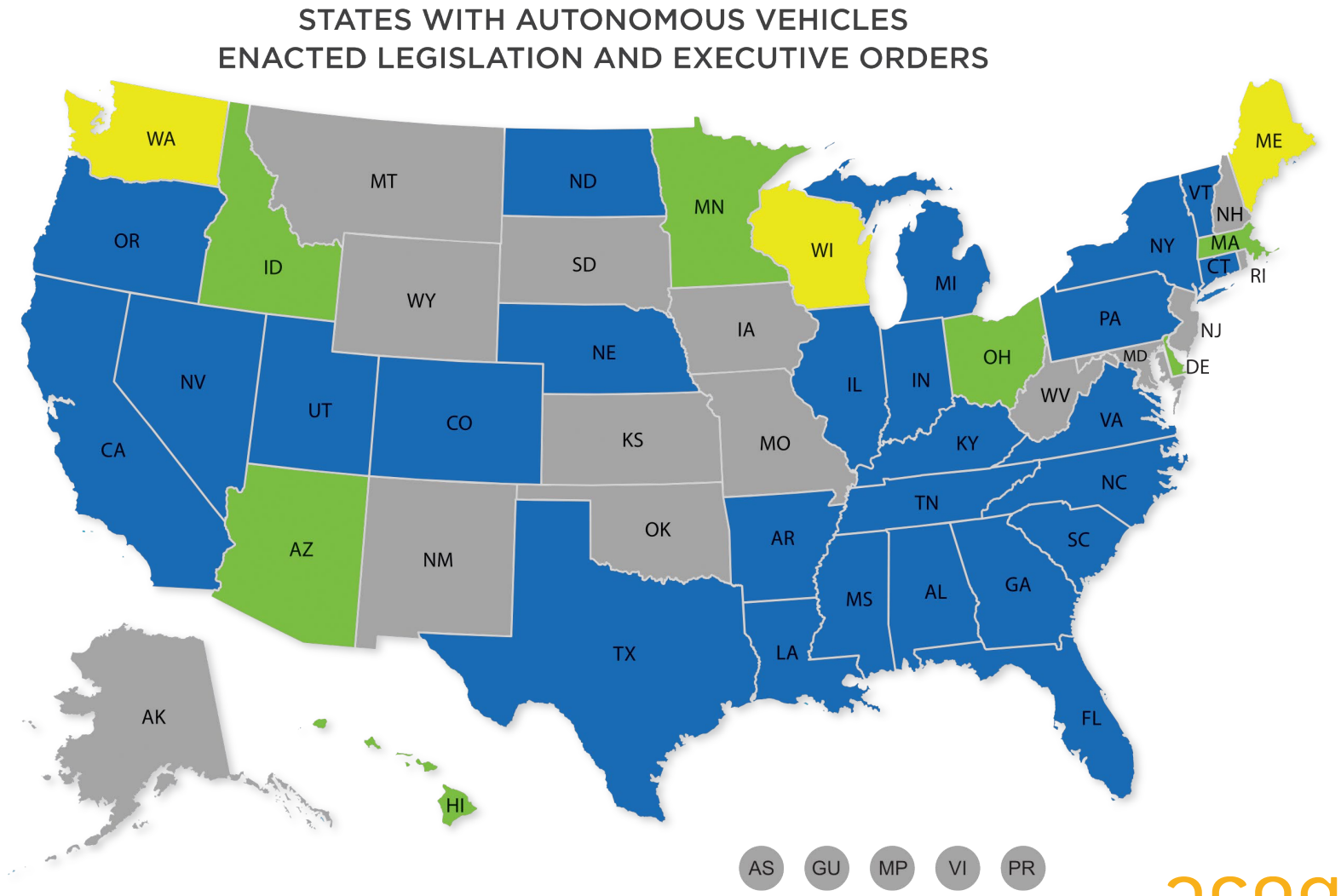
- USDOT and NHTSA guidelines
- Separates into 2 sections: voluntary guidance and technical assistance to states
- Focuses on Levels 3 through 5
- There are no additional compliance requirements
- Only encourages to have a documented process for assessment, testing, and validation of their ADS's OEDR (Object and Event Detection and Response) and behavior in traffic
- Expected to be able to detect and respond to other vehicles in and out of path, pedestrians, bikes, animals, and objects, but not required before being put on the streets

SB 1885 - AV START

- American Vision for Safer Transportation through Revolutionary Technologies
- Hugely unpopular with safety, consumer, law enforcement, bike advocates, and technology and automation experts
- This bill could enable mass deregulation of AVs, leaving cities in the dark about how to plan for these technologies
- The National Transportation Safety Board (NTSB) is still investigating some of the crashes involving AVs and 84% of people believe they should finish these before Congress acts according to a study published by Advocates for Highway and Auto Safety

STATE ACTIONS

- Nevada was the first state to authorize operation of AVs in 2011
- Currently, Oklahoma has no legislation



For more information visit:
[National Conference of State Legislatures]

THE CRASHES

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LIST OF CRASHES

- **May 7, 2016 -** Williston, FL, Tesla Model S: **Driver killed** when his vehicle, operating on "Autopilot," crashed into the side of a truck tractor combination, traveling underneath the trailer. (NTSB Investigation HWY16FH018)
- **November 8, 2017 -** Las Vegas, NV, Driverless Shuttle Bus: A driverless shuttle was involved in a crash during its first day of service. Fortunately, there were no deaths or injuries. (NTSB Investigation HWY18FH001)
- **January 22, 2018 -** Culver City, CA, Tesla Model S: The Tesla, reportedly on "Autopilot," was traveling at 65 mph when it crashed into the back of a parked fire truck that was responding to the scene of a separate crash. Remarkably, neither the driver nor the first responders were injured. (NTSB Investigation HWY18FH004)
- **March 18, 2018 -** Tempe, AZ, Uber Self-Driving Test Vehicle: The Uber vehicle, which was operating on "self-driving mode," **struck and killed a pedestrian walking a bicycle.** (NTSB InvestigationHWY18MH010)

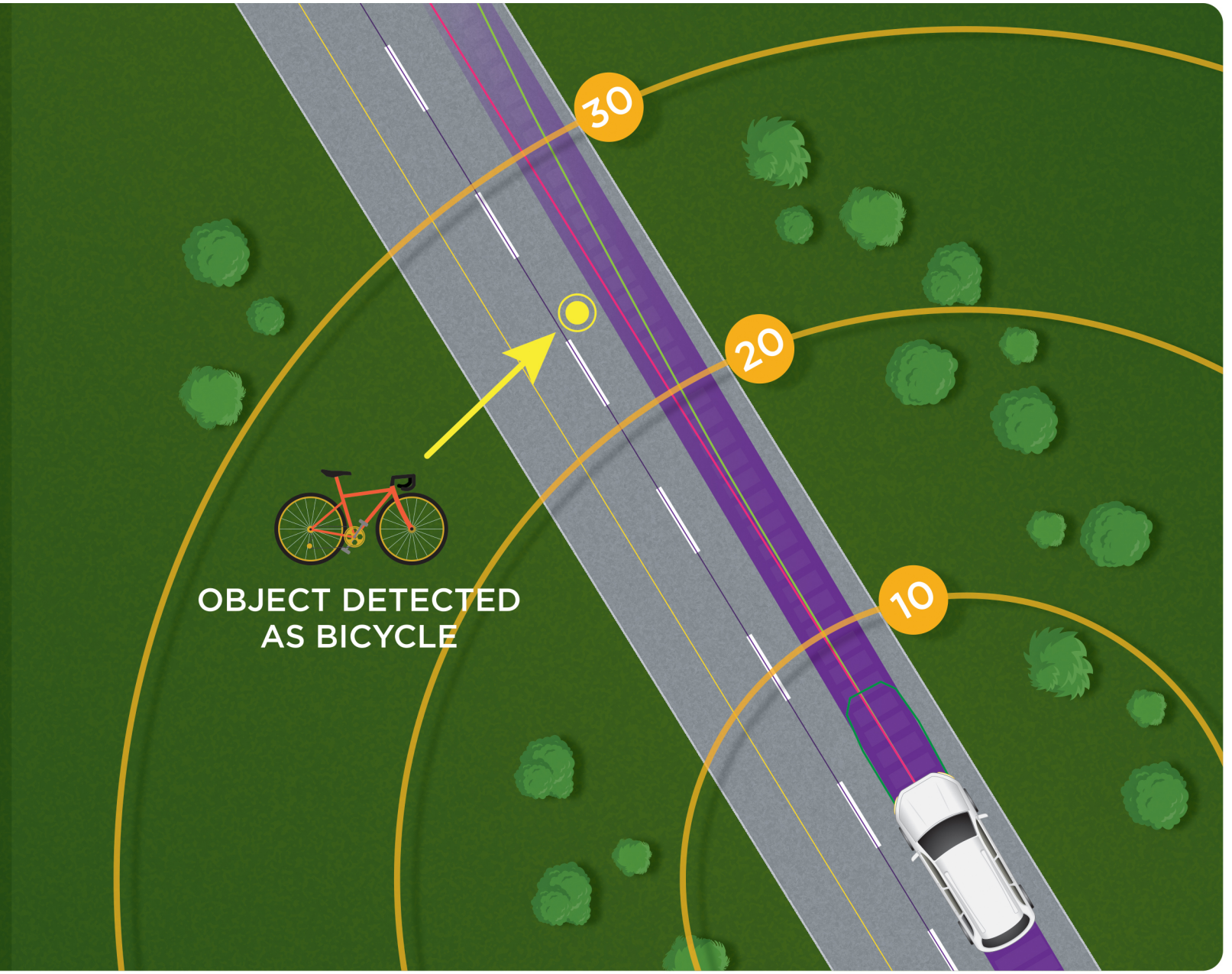
LIST OF CRASHES INVOLVING AVS

- March 23, 2018 - Mountain View, CA, Tesla Model X: While on “Autopilot”, the vehicle struck a safety barrier, causing the death of the driver. (NTSB Investigation HWY18FH011)
- May 8, 2018 - Fort Lauderdale, FL, Tesla Model S: The vehicle reportedly was traveling at a high rate of speed when it crashed into a wall. The resulting post-crash fire killed two teenagers and injured another. The NTSB is examining the electric vehicle battery fire and emergency response. (NTSB Investigation HWY18FH013)
- May 29, 2018 - Laguna Beach, CA, Tesla Model S: A Tesla reportedly in “Autopilot” crashed into a parked Laguna Beach Police Department Vehicle. The Tesla driver suffered minor injuries.

ELAINE HERZBERG

- March 18, 2018 at 9:58pm
- Tempe, AZ
- 49 years old

For more information visit:
NTSB preliminary report



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THOSE INVOLVED

THE UBER CAR

- Volvo XC90
- Traveling at 43mph
- Equipped with forward and side cameras and LiDAR
- Equipped with advanced driver assistance functions including collision avoidance with auto breaking – though this is disabled when the car is being operated by the computer

THE DRIVER

- Was monitoring the interface
- Personal and business phones in vehicles but not in use
- No toxicology information gathered at the scene but police stated she didn't show signs of impairment

THE PEDESTRIAN

- Dressed in dark clothes
- Pushing bike across the street not at a crosswalk
- The bike had no side reflectors but did have forward and rear lights
- Toxicology came back positive for methamphetamine and marijuana in her system

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SERIES OF EVENTS

TIME BEFORE CRASH	ACTION
19 minutes	Computer takes control of operations
6 seconds	Software detects Elaine but labels her as ‘unknown object’
	Software labels Elaine as ‘a vehicle’
	Software labels Elaine as ‘a bicycle with varying expectations of future travel paths’
1.3 seconds	System determines emergency braking is required, but has no way of alerting the driver
Less than 1 second before	Driver engages the steering wheel
Less than 1 second after	Driver brakes

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JOSHUA BROWN

- May 7, 2016 at 4:36pm EST
- Williston, FL
- 40 years old

For more information visit:
NTSB report

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THOSE INVOLVED

THE CAR

- 2015 Tesla Model S 70D
- Equipped with Traffic Aware Cruise Control and Autosteer lane-keeping features
- Driver was operating at the time of the crash, however the final report determined he was over-reliant on the autopilot system

THE DRIVERS

- Neither driver was using a cell phone at the time, however the Tesla driver was distracted
- Both drivers did have previous traffic violations, namely speeding and failing to obey a traffic signal
- Neither driver had been involved in previous crashes
- Toxicology indicated THC in the truck driver's blood sample taken at the scene

THE TRUCK

- 2014 Freightliner Cascadia, a utility semitrailer
- No mechanical issues in the truck-trailer and, after inspection, was put back into service
- The semitrailer was a refrigeration unit and was not required to have side underride protection guards

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SERIES OF EVENTS

- The truck was traveling westbound on US 27A and turning left onto NE 140th Ct across two eastbound traffic lanes
- The Tesla was traveling eastbound on US 27A and, while the driver was in control of the vehicle, he was also distracted by something and was relying on the autopilot system
- The truck turns in front of the Tesla, and the car strikes the right side of the semi, passing underneath it and shearing off the roof of the car
- The car continued to drive off the road, through a drainage culvert and two wire fences, and then struck and broke a utility pole before stopping

PUBLIC OPINION

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UMTRI 2014 STUDY

- University of Michigan Transportation Research Institute conducted a study on public opinion of AVs in the US, UK, and Australia
- 95% final response rate of the 1578 replies, 1533 were completed
  - 501 US respondents
  - 527 UK respondents
  - 505 Australians respondents
- All three countries had more respondents who felt positively about AVs than negatively, however the US had more concerned respondents than the other two countries
- Women express more concern than men
- Younger generations are less concerned about commercial AVs and expect more benefits, such as shorter travel time, less congestion, etc

GALLUP 2017 POLL

Between September 15 and October 10, 2017, Northeastern University and Gallup surveyed Americans' attitudes towards AI, including how AVs affect their life and work. The mail survey of 3,297 adults showed that women were more concerned than men and the younger generation was more accepting than older age groups. Other results found were:

- 54% not likely to use AVs
- 59% uncomfortable with the idea of riding in an AV on a daily basis
- 62% uncomfortable with sharing the road with a self-driving truck (platooning)

ETHICS

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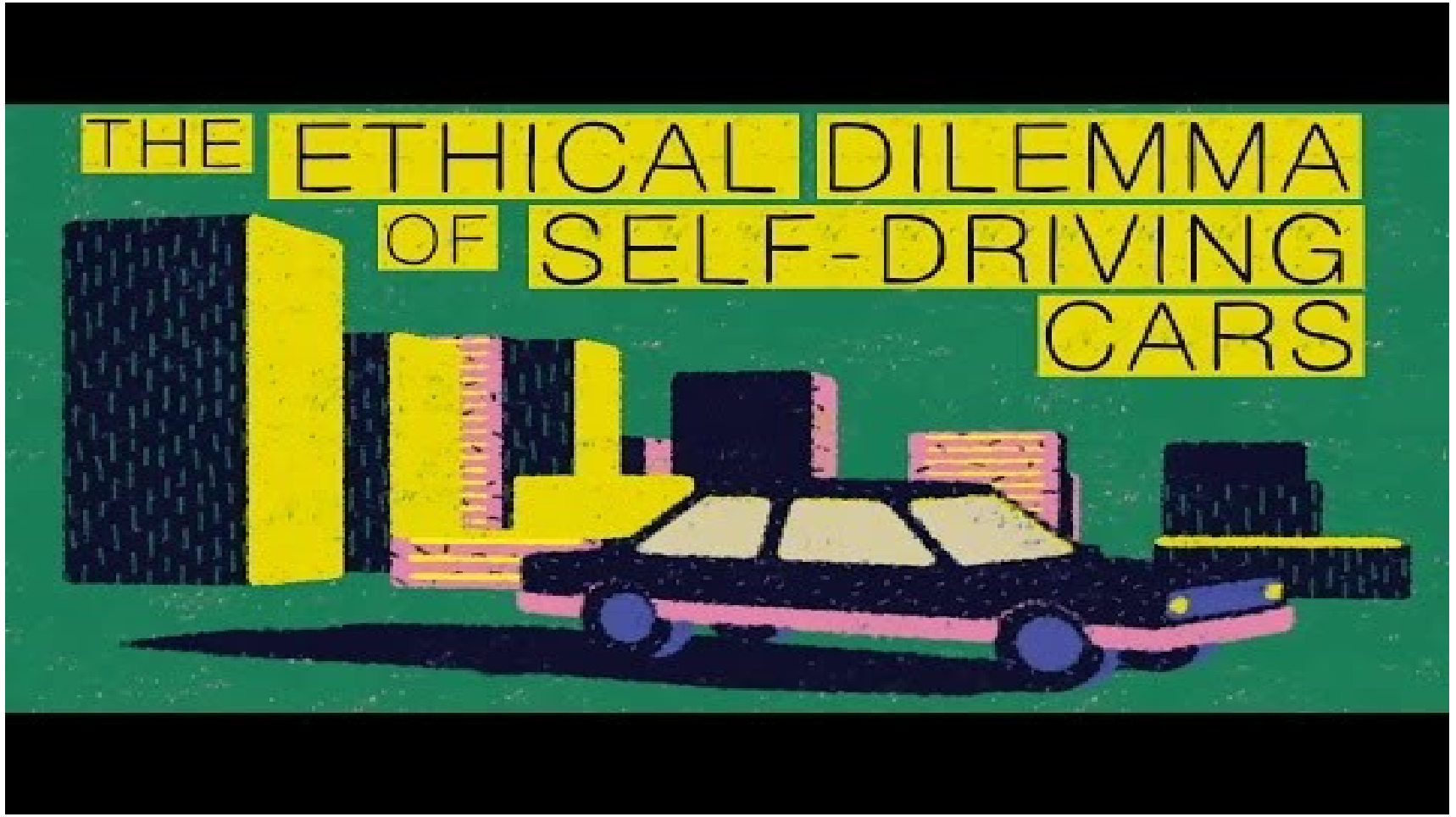
TEDEd TALK



For more information visit:
[TEDEd YouTube]

MIT'S MORAL MACHINE

- Presents participants with increasingly complex moral dilemmas involving AVs
- Launched 2016; in 1 year 4 million people answered questions around the globe
- Results: the more complex, the less clear
  - Hit a person vs a cat
  - Hit a person crossing legally vs 2 people crossing illegally

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QUESTIONS?

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