Psychological roadblocks to the adoption of self-driving vehicles

Submitted by
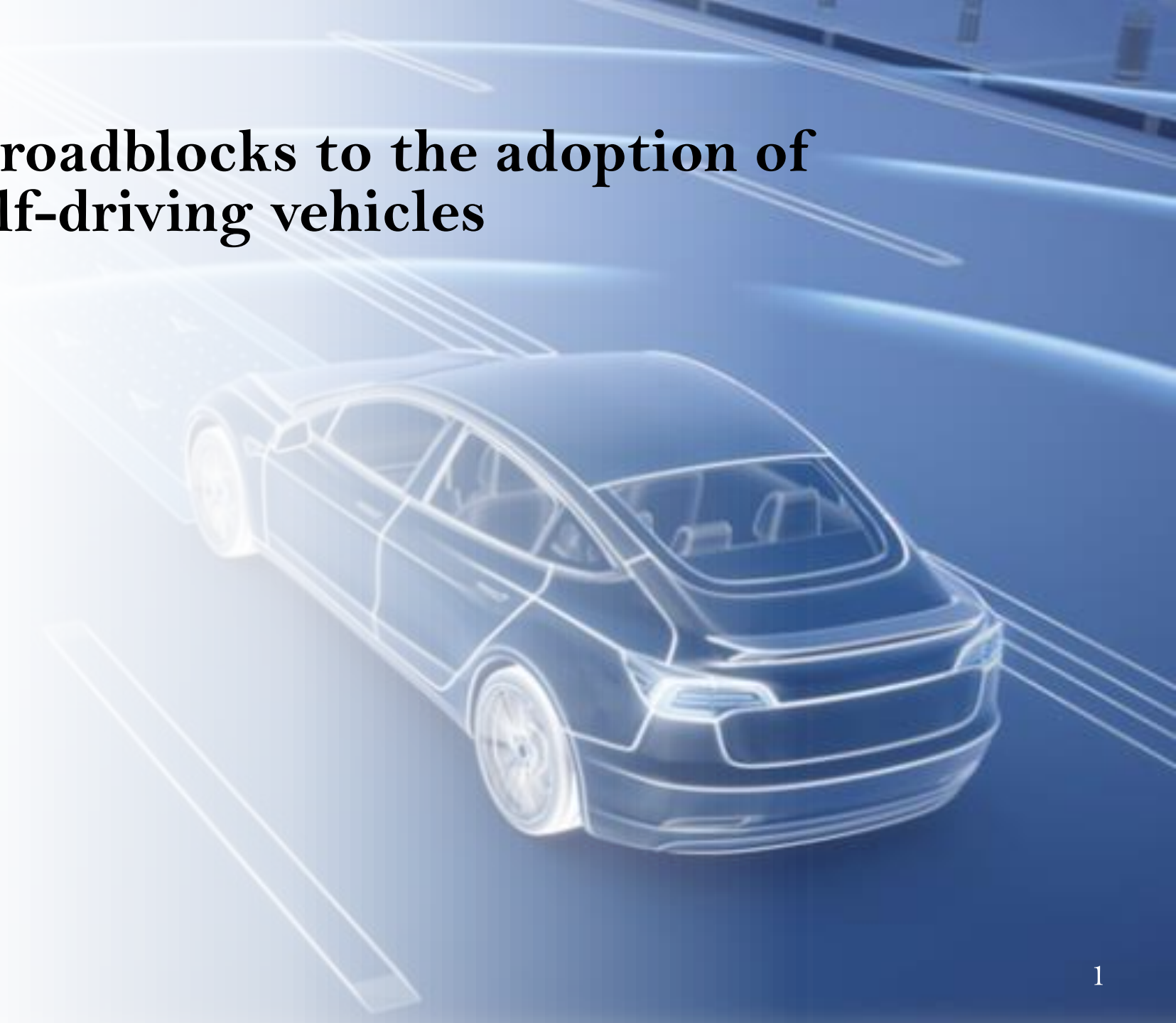
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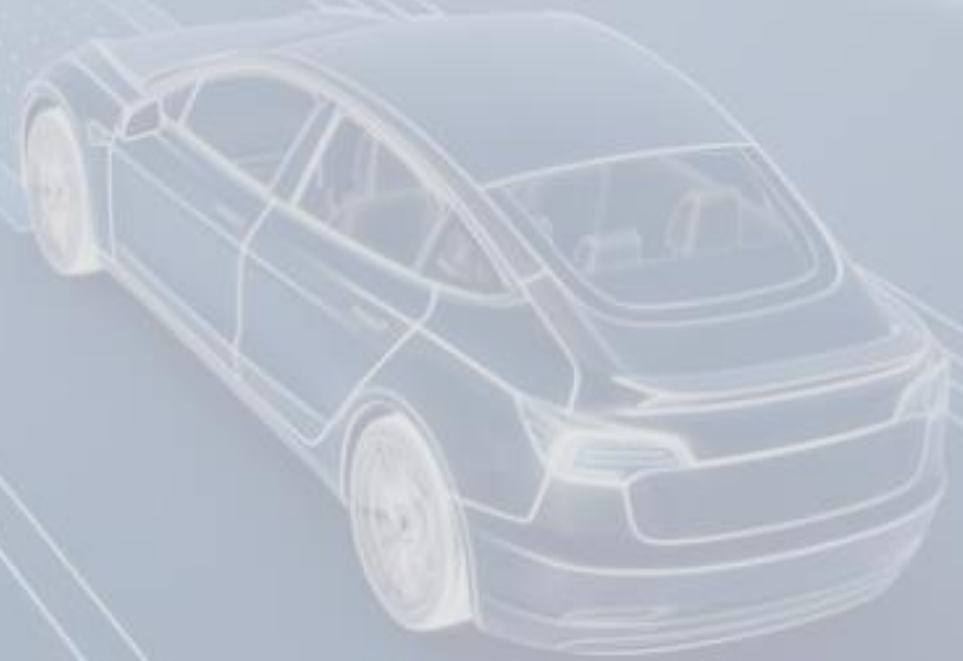
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Agenda

- ❑ What is Autonomous or Self Driving Vehicles?
- ❑ How much automated?
- ❑ Advancement on AVs Manufacturing and Research work
- ❑ Ethics in Autonomous Vehicles
- ❑ How people feel about AVs?
- ❑ Past Accidental Incidents
- ❑ Psychological Roadblocks to Adopt AVs
- ❑ Three factors of Psychological Resistance
- ❑ Plan of Actions to Overcome Resistance
- ❑ Implementing Ethics in Algorithm
- ❑ Decision Making Factors
- ❑ Regulations & Legislation
- ❑ New Social Contract
- ❑ Challenges to Overcome Psychological Roadblocks
- ❑ Conclusion

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What is an Autonomous or Self-Driving Vehicles?

- Operate without any human intervention
- Operates by sensing environment and detail 3D maps of roads
- Combined with a verity of sensors such as radar, lidar, sonar, GPS etc
- Advanced control systems interpret sensory information

Top 5 Autonomous Vehicle Companies
1. Tesla
2. Waymo
3. GM Cruise
4. Argo AI
5. Baidu

How much automated?

Six levels of Automations
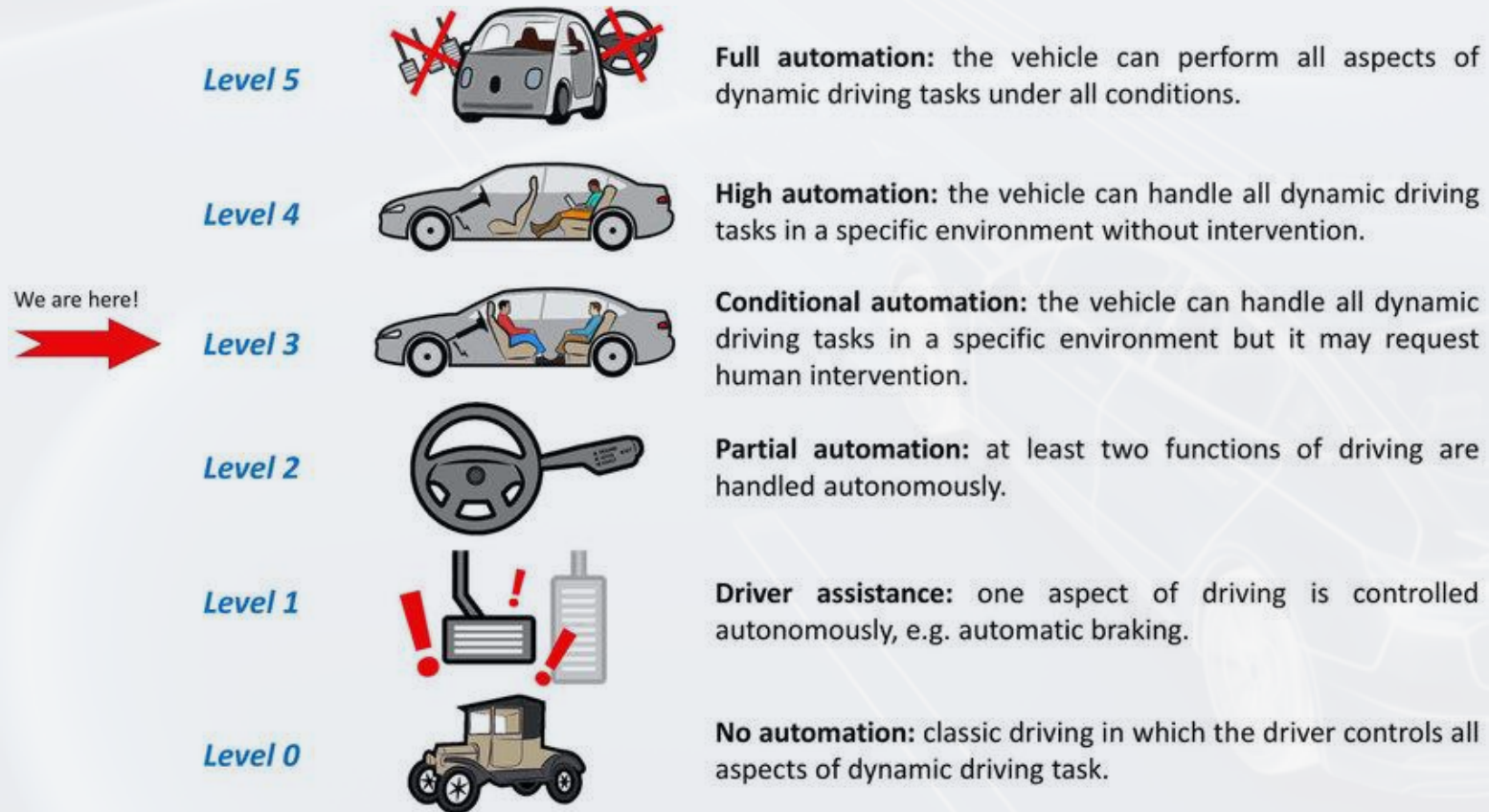

Level 5 — **Full automation:** the vehicle can perform all aspects of dynamic driving tasks under all conditions.

Level 4 — **High automation:** the vehicle can handle all dynamic driving tasks in a specific environment without intervention.

We are here! ➡ **Level 3** — **Conditional automation:** the vehicle can handle all dynamic driving tasks in a specific environment but it may request human intervention.

Level 2 — **Partial automation:** at least two functions of driving are handled autonomously.

Level 1 — **Driver assistance:** one aspect of driving is controlled autonomously, e.g. automatic braking.

Level 0 — **No automation:** classic driving in which the driver controls all aspects of dynamic driving task.

Image source: https://www.researchgate.net/

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Advancement on AVs Manufacturing and Research work

- Tesla, updated its Auto-Pilot systems and claimed hardware's are ready for AVs(Level-5)
- Baidu, BMW, Ford and VW would be ready to produce AVs in 2021
- Uber already tested on public roads
- Google continued testing
- Toyota announced investment to set up Toyota Research Institute
- In 2019, Ford's Argo AI invested $15 million to create an AV Research Center at Carnegie Mellon University
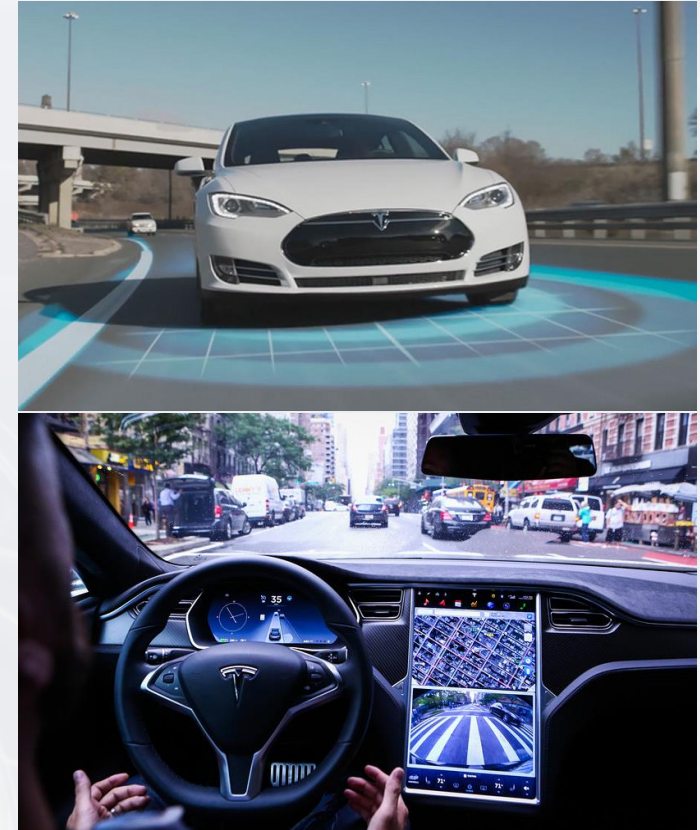
Ethics in Autonomous Vehicles(AVs)

What is Ethics?

- Standards of behavior that tell how to act in the many situations
- Set of rules, values and norms
- Refers to the theory of morality – theory of the right.
- Four types of theory of morality
  1. Utilitarianism
 2. Kantianism
  3. Virtue theory
  4. Casuistry

Utilitarianism - actions that produce the greatest amount of happiness

Ethics in Autonomous Vehicles(AVs)

How Ethics is correlated with Autonomous Vehicles (AVs)?

- While driving decision should be made based on ethics.
- To value human life, vehicle and environment.
- Decide who to live and who to die.
- What to do in "trolley problem" situation.
- Should AVs adopt utilitarian morality of ethics to choose who lives and who dies?
- However consumers prioritize own lives as passengers
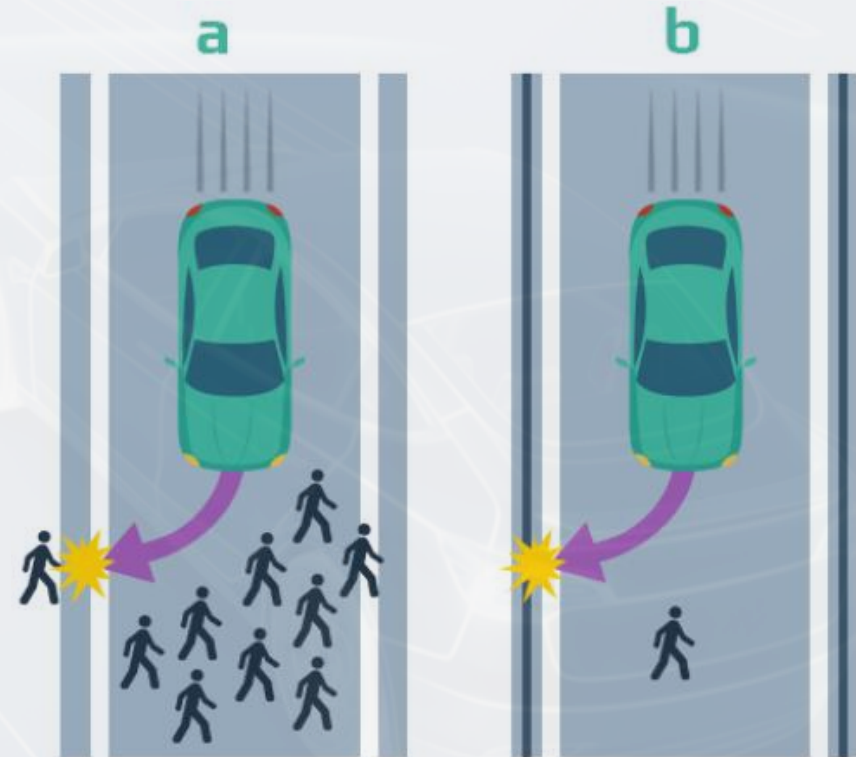
Ethics in Autonomous Vehicles(AVs)

Ethical Guidelines for AVs

- In 2017, the government of Germany released the world's first ethical rules for AVs
- Germany presented 20 ethical guidelines for AVs
- RAND Corporation from USA suggested an AV to drive 275 million miles without a fatality to prove safety
- Researchers also guide to be cautious to get ethical benefits from AVs

How people feel about AVs?

Belief	• Globally 71% of respondents believe AVs are better than human driven cars
Comfort	• Worldwide 77% would be comfortable riding in AVs during their lifetime
Fear	• 78% of Americans fear riding in AVs, only 19% would trust • 33% adults never want to switch to AVs on UK
Worry	• 39% of USA adults are worried than enthusiastic • 63% of women are worried, compared with 44% of men in USA
Trust	• 42% of those who would not want to ride in AVs have trust issues for life-or-death situation

Past Accidental Incidents

Number of accidents are small but generated a lot of media attention.

- In 2016, Tesla AV did not recognize a truck and killed the driver – first accident
- In 2018, Uber Volvo hit a woman crossing the road in Arizona.
- Another two fatal accidents happened with Tesla cars in 2018 in California.

Psychological Roadblocks to Adopt AVs

Thought that holds you back

Decisioning	Can AVs make right choice to ensure safety of life
Accidents	Accidental news make public uncertain
Artificial Intelligence (AI)	Public not aware with potency of Artificial Intelligence(AI)
New Standards	Standards and customs for AVs not fully developed yet

All of these thoughts evoke trust concerns

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Three factors of Psychological Resistance

The Dilemmas of Autonomous Ethics

- Fear of rightful decision execution

Risk Heuristics and Algorithm Aversion

- Fear of incompetence

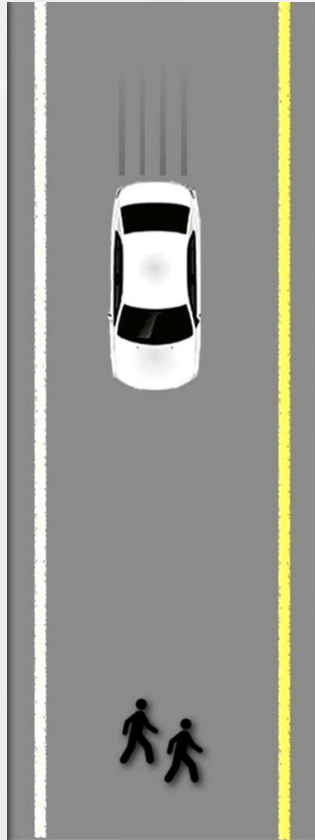**Asymmetric Information and the Theory of the Machine Mind**

- Fear of unknown
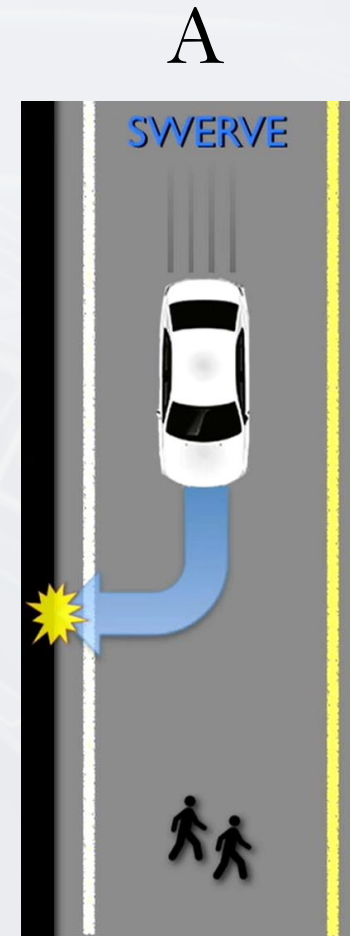
The Dilemmas of Autonomous Ethics

The Ethical Dilemma

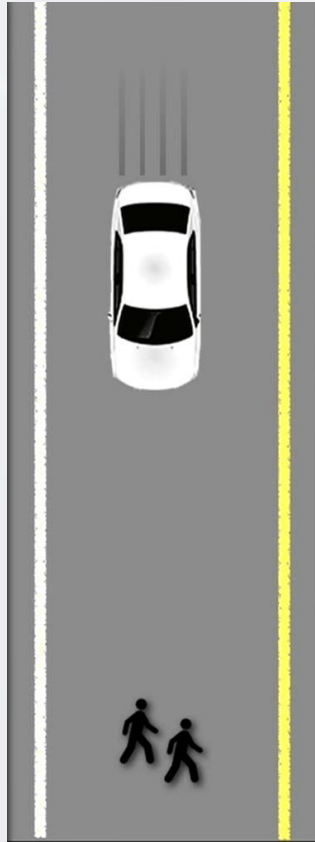# The Dilemmas of Autonomous Ethics

The Ethical Dilemma

A   B

What kind of car
would you want
on the road?

SWERVE
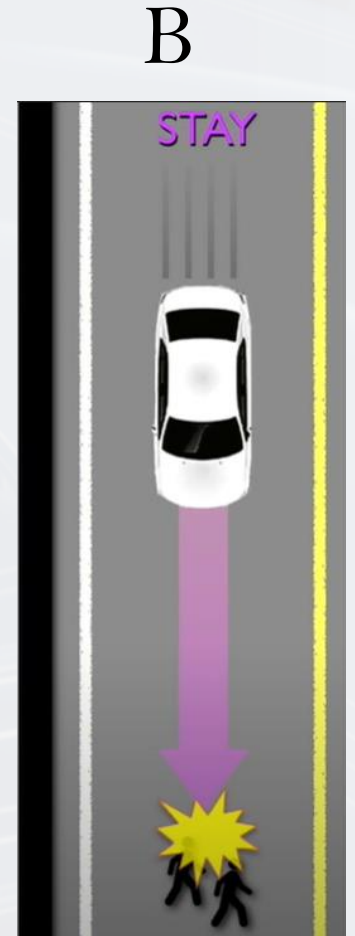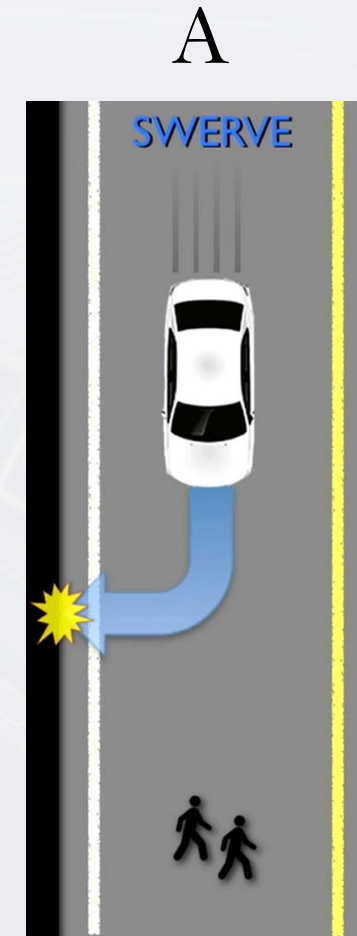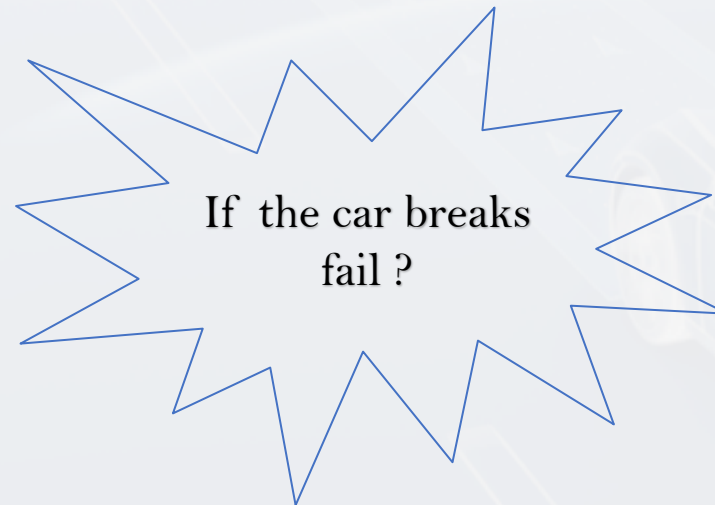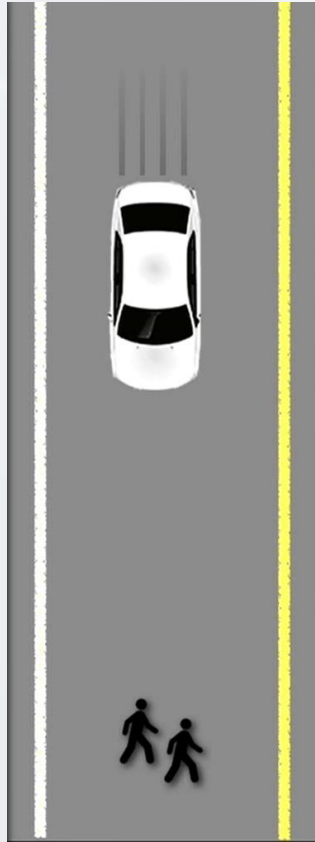
Bentham's Utilitarianism
Minimize the greatest harm

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The Dilemmas of Autonomous Ethics

The Ethical Dilemma

A   B

What kind of car
would you **BUY**?

Kant's Deontology
Categorical rules should never
be violated
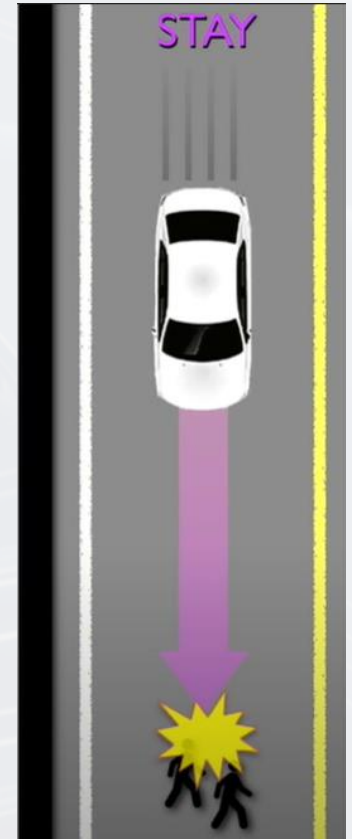
The Dilemmas of Autonomous Ethics

The Social Dilemma

Ethical dilemma

Social dilemma

Utilitarian approach to be the most ethical, and as citizens – save the greater number
But as consumers, they want self-protective cars

Risk Heuristics and Algorithmic Aversion

- Outsized media coverage overemphasize risk factors of AVs
- Increase in risk factors give rise to fear to adopt AVs
- Consumers make judgements on new, recent or dramatic information
- Lose faith in algorithm 's decision-making process
- Also leads to compromise the financial feasibility of AVs

Asymmetric Information and the Theory of the Machine Mind

- Asymmetry in information
- Larger psychological barrier to the trust
- Passengers are too much worried of the AVs' rare failures
- Unaware of AVs success and optimization
- Transparency lacking in decision-making processes

Plan of Actions to Overcome Resistance

| The Dilemmas of Autonomous Ethics	Risk Heuristics and Algorithmic Aversion	Asymmetric Information and the Theory of the Machine Mind
• Shifting from Utilitarianism principle to placing extra weight on safety of passengers • Meeting consumer's preference for virtue signaling	• Making people realize that accidents are not 100% unavoidable • Sharing improvements of algorithms • Managing overreaction and educating public of actual risks	• Public communication with actual information to foster trust. • Presenting AVs' real perception and decision-making rules by more researching • Everyone in the roads need to adjust

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Implementing Ethics in Algorithm
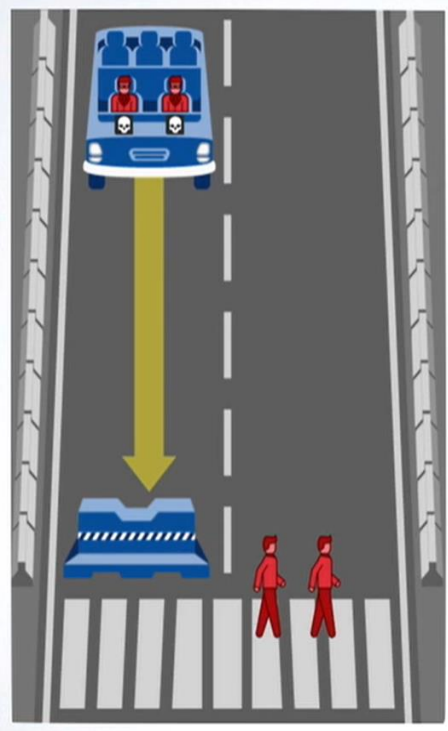
What should AV do?

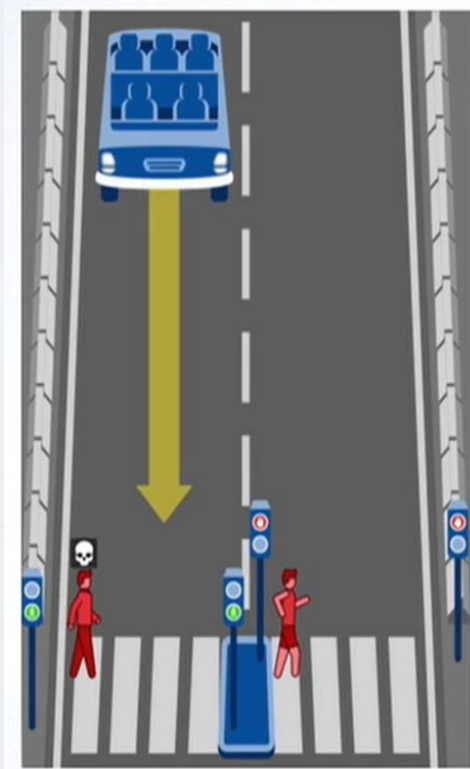A   B
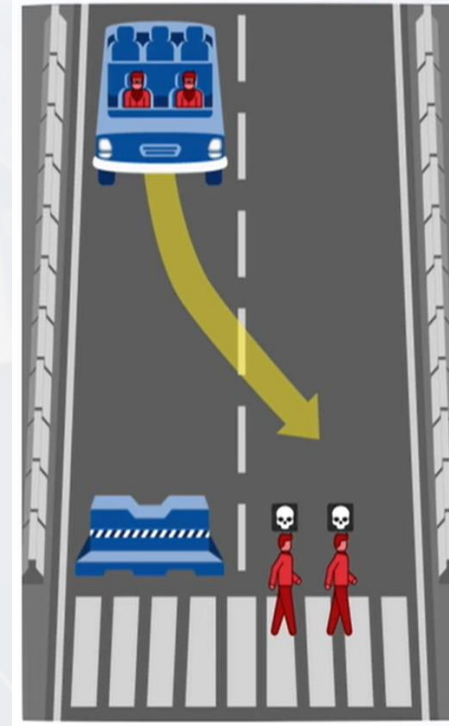
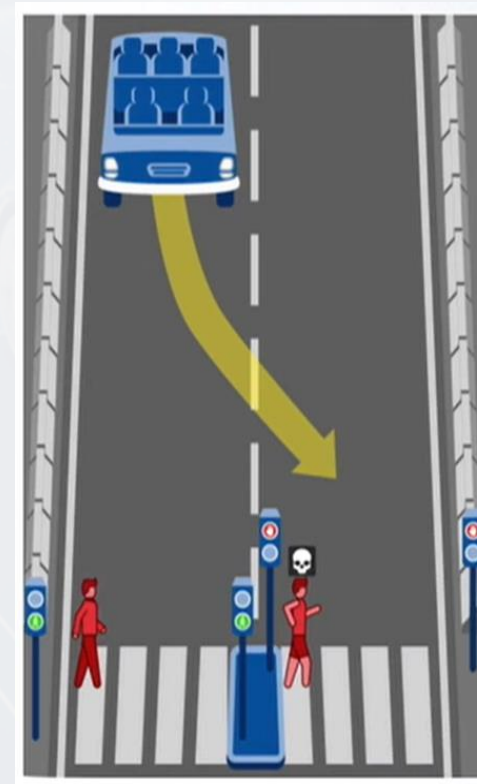**Protect passengers or pedestrian**

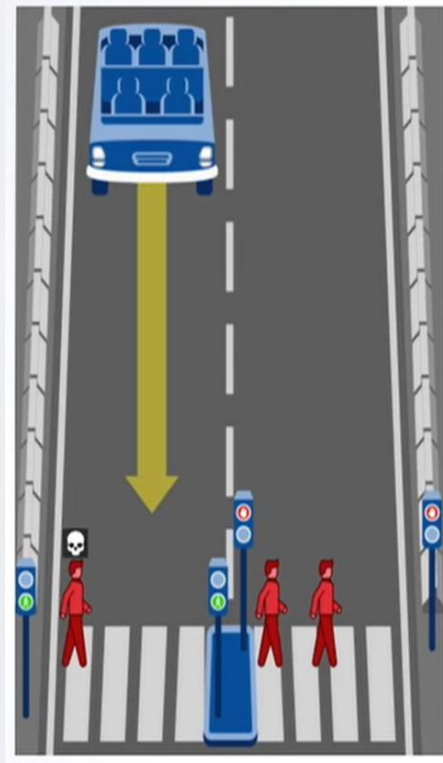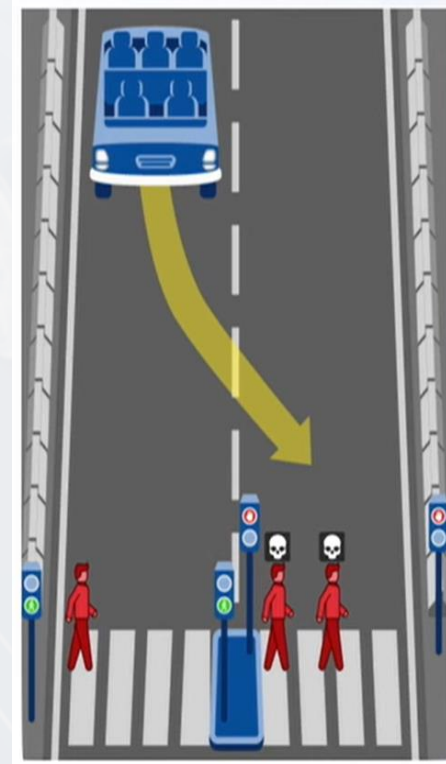# Implementing Ethics in Algorithm

What should AV do?

A   B

Uphold the law

Implementing Ethics in Algorithm

What should AV do?
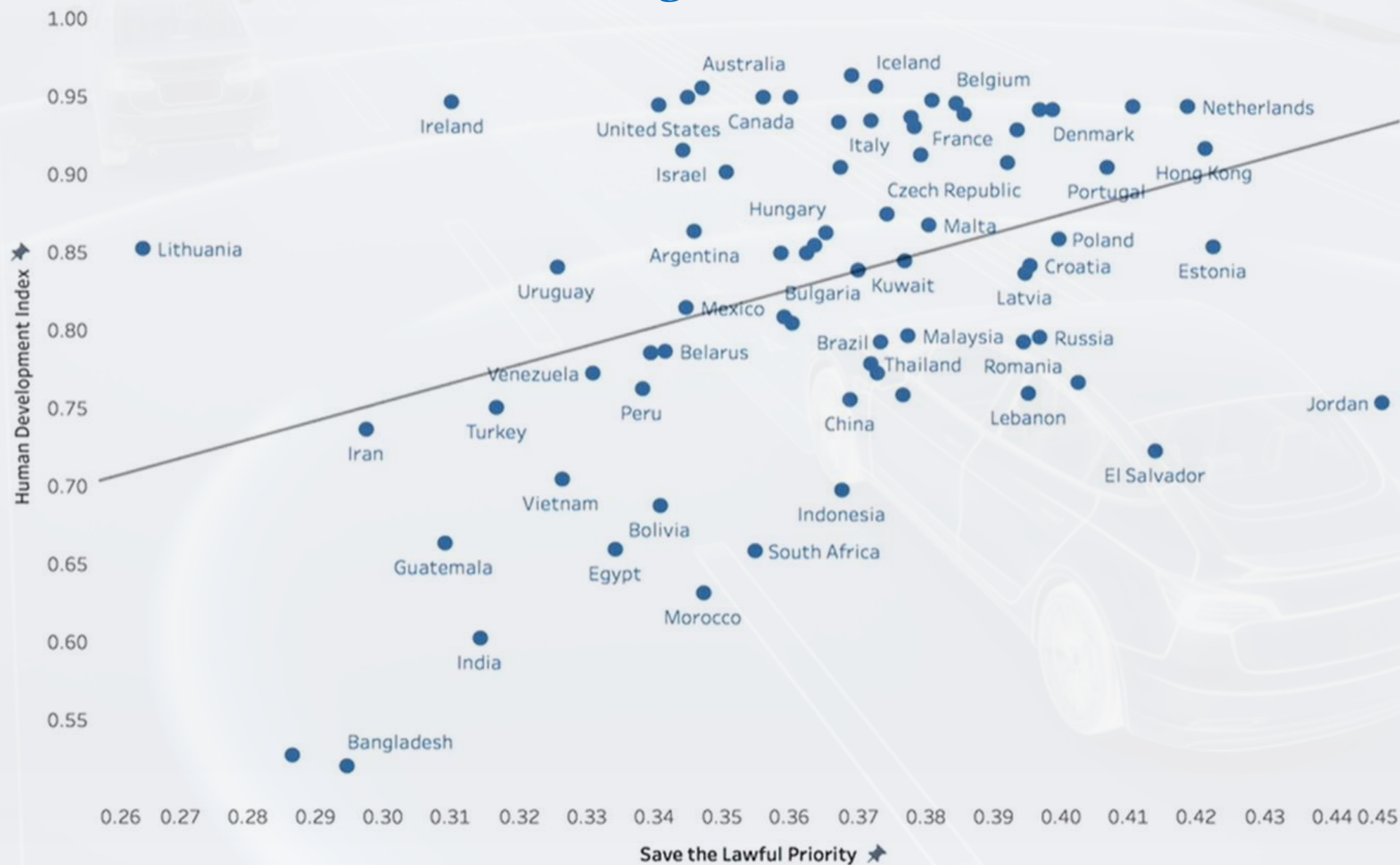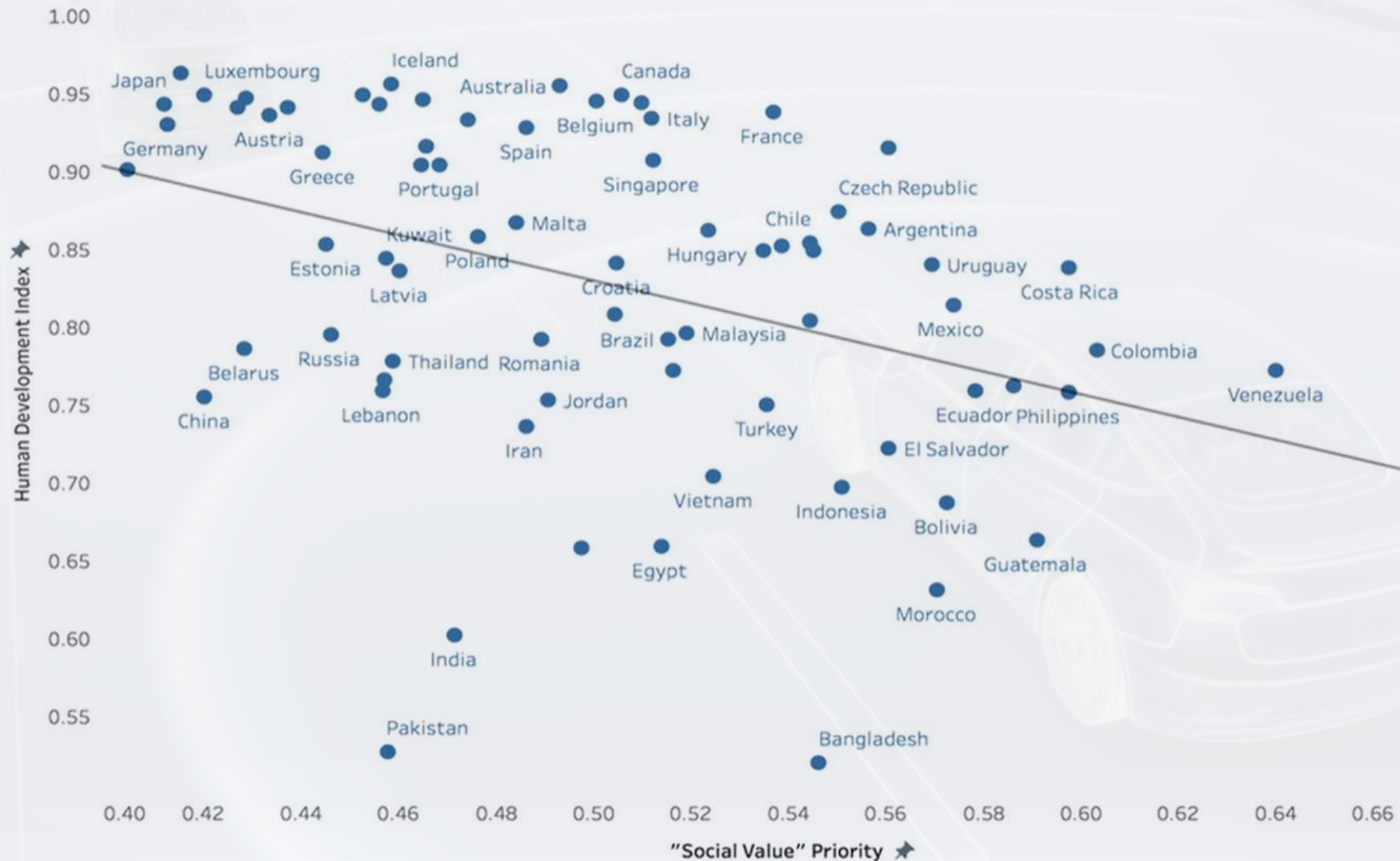

A   B

Save more lives

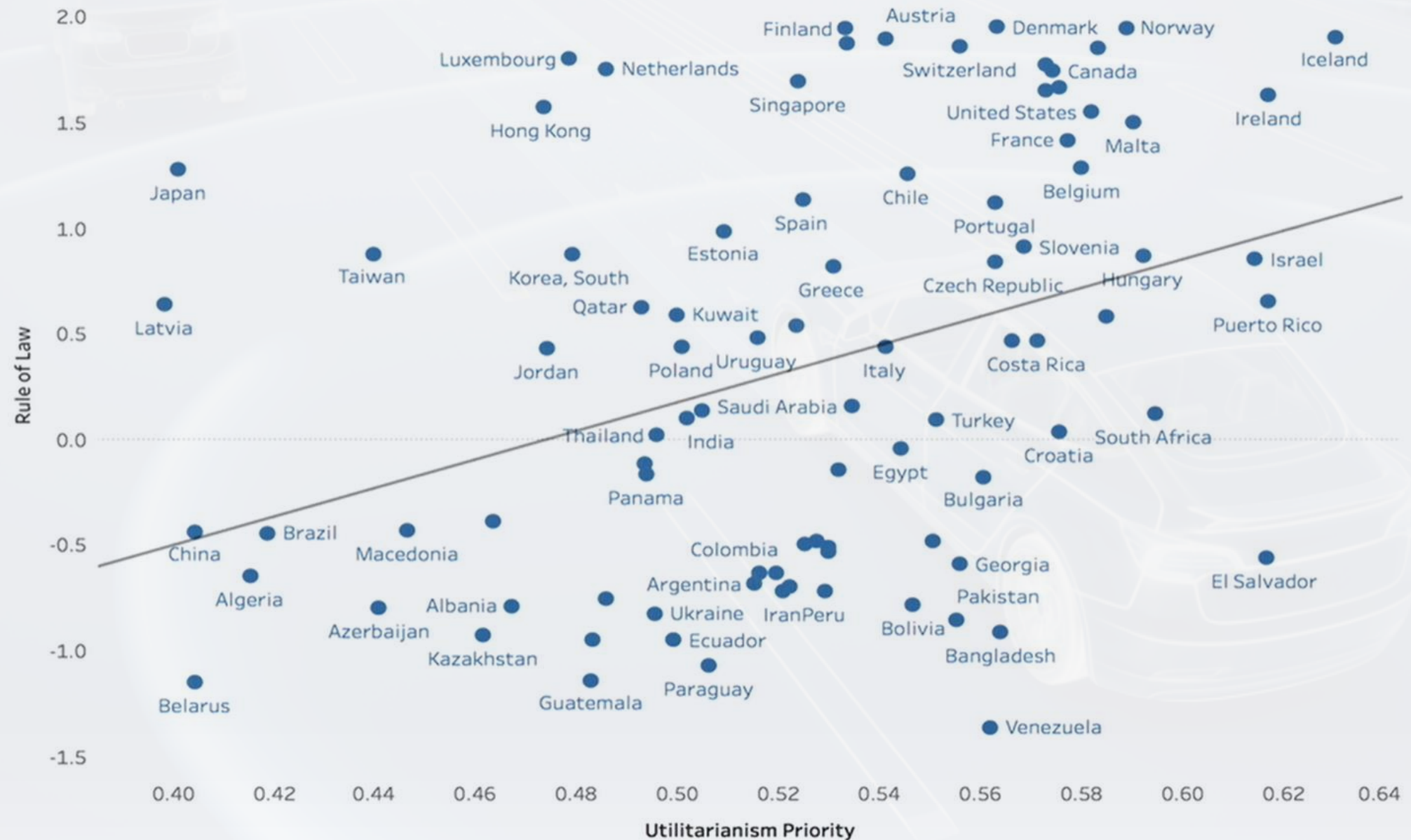# Decision Making Factors – on upholding laws

Decision making factors – for social values priorities

Decision making factors – for Utilitarianism priorities

Regulations & Legislations

- In 2016 NTC of Australia initiated to develop legislative automated and connected vehicles.
- In 2018 USA passed a bill for AVs called AV START to ensure road safety.
- NHTSA of USA proposed guidelines for AVs.
- Germany developing CAV testing regulations.
- China and Japan took legislative action to control privacy and cybersecurity risks

New Social Contract

- Guideline to determine who is responsible for different kinds of accidents
- Decide procedure of monitoring and enforcement of regulation
- Process of gaining trust of all stakeholders.
- Emphasize more on psychological realities rather than technological and legal ones.
- Contribution from behavioral scientists of all disciplines is needed

Challenges to Overcome Psychological Roadblocks

- Frequency of updating detailed maps with Realtime road scenarios
- Ensuring correct functioning of all the sensors all the time
- Detailed 3D maps of all roads not built fully yet
- Weather changing challenges not overcome yet
- Shifting control from vehicle to human can be dangerous sometimes to handle emergency situations
- Cyber Security issues

Challenges need to be resolved first to overcome psychological barrier from adopting AVs

Conclusion

- With all automatic features AVs could be better than Human Driven vehicles
- However Ethical guidelines, Rules & regulations need to be fully developed to gain public trust and ensure road safety
- People need to feel that **Great Intelligence Not Always Comes With Great Risk**

"Every day the adoption of autonomous cars is delayed is another day that people will continue to lose their lives to the non-autonomous human drivers of yesterday"

References

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