



Asia-Pacific
Economic Cooperation

Advancing
Free Trade for Asia-Pacific
Prosperity

Transportation and Society in the Era of AV (Autonomous Vehicle)

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Editor-in-Chief, Int'l J of Sustainable Transportation

World Road Association PIARC Korean Chair

Transportation



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- Movement from A to B with a purpose
- 3 elements: Vehicle, T Infrastructure and People and Goods
- **Vehicle evolution**
- Infra accommodation
- P & G behavior change

**3 Elements:
V, I, P&G**

Major Future Themes



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Future Transportation

Intelligent
Transportation
Technology

Eco-friendly
Transportation
Technology

Sustainable
Transportation
Technology

AV
Accident

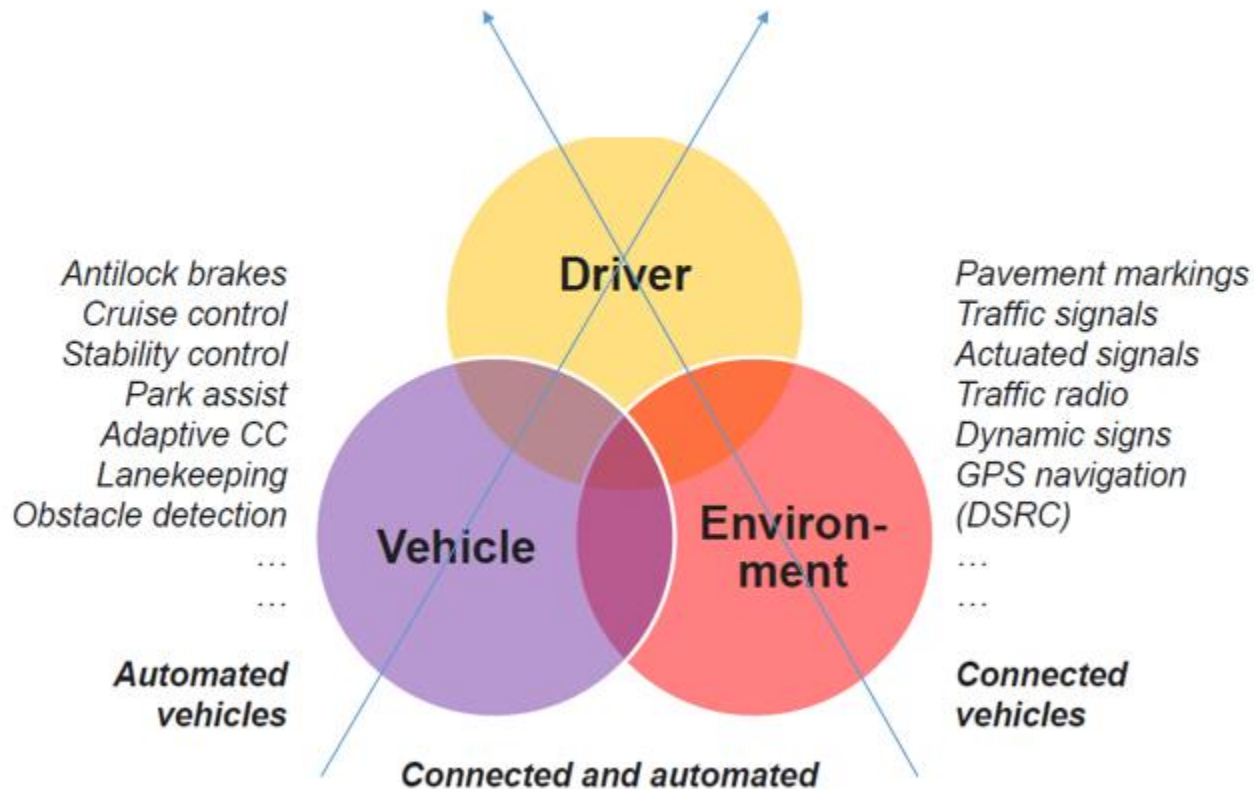
EV
PM etc.....

Connected vs Autonomous



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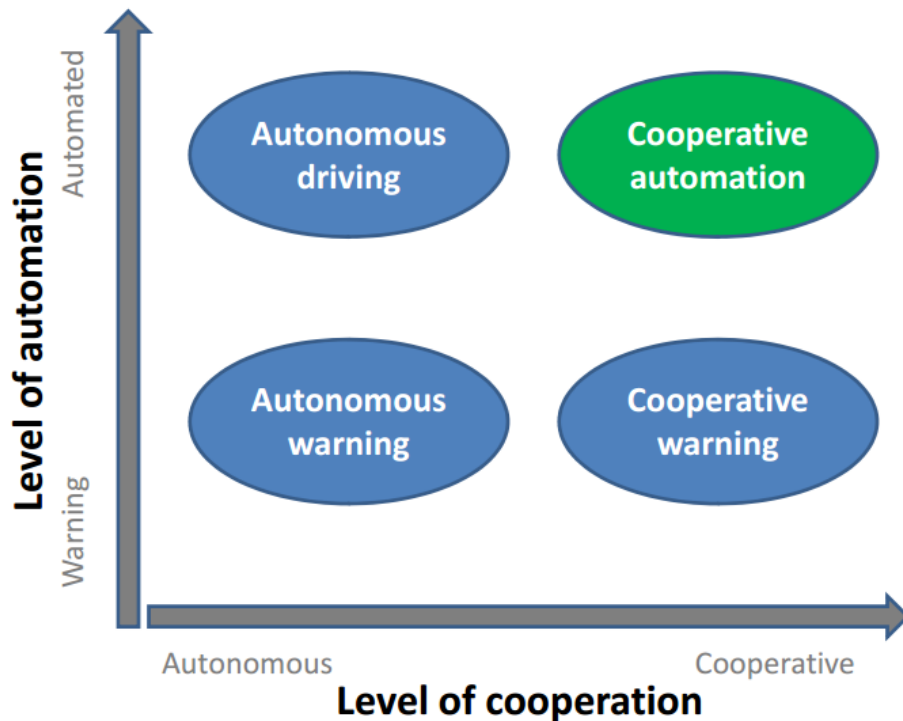
CV vs AV



AV, CV Relation and Convergence

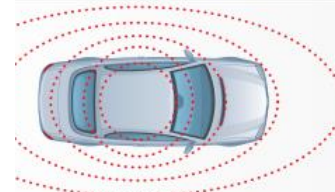


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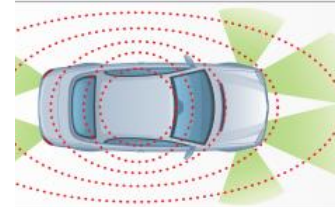
Sensor-Based Solution Only

- Cannot sufficiently mimic human senses
- Not cost-effective for mass market adoption
- Lack of adequate 360° mapping of environment in urban grids



Connected Vehicle Solution Only

- DSRC does not currently work with pedestrians, bicyclists, etc.
- DSRC-based V2I might require significant infrastructure investment
- V2V requires high market penetration to deliver value reliably



Converged Solution

- Convergence will facilitate adequate mimicking of human senses
- Convergence will reduce need for an expensive mix of sensors and reduce the need for blanket V2I investment
- Convergence will provide the necessary level of functional redundancy to ensure that the technology will work 100 percent of the time

AV is and requires...

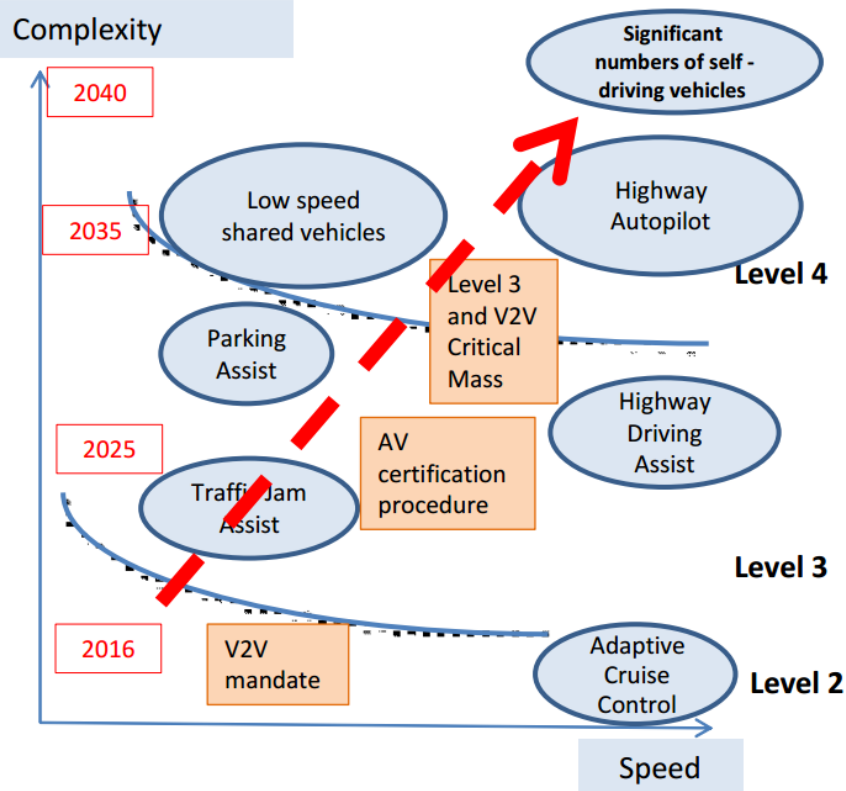


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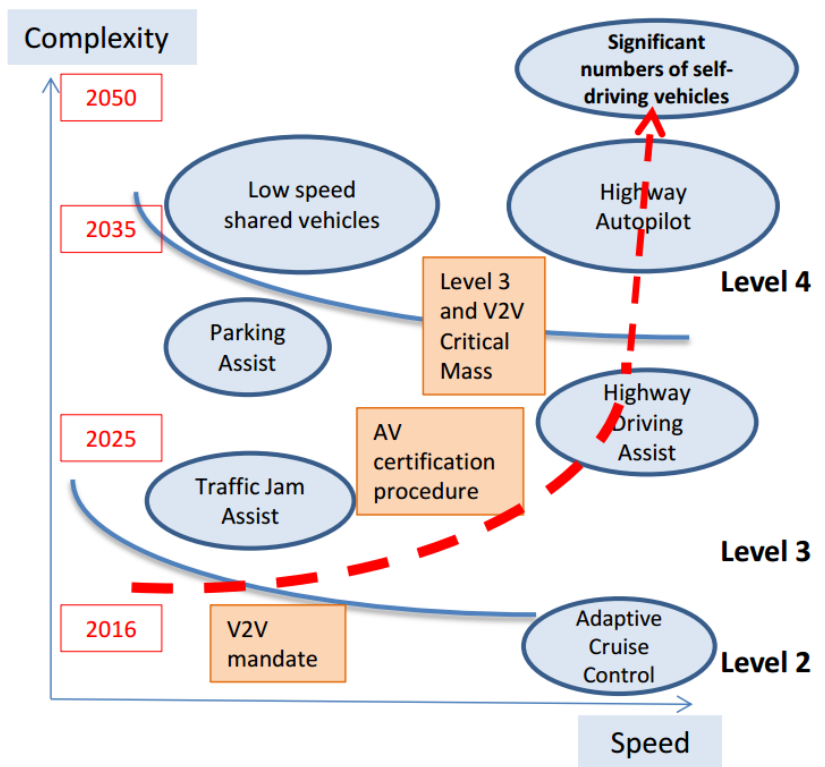
- A New Paradigm
- AV technology deployment driven by OEMs, suppliers, and technology firms
- Like a smart phone
- Market forces and consumer demand place technology ahead of policy
- Sometimes called as 'automated driving'
- Regulations (in Korea since 2015)

..... but only in designated roads...

2 Possible Scenarios... Revolutionary vs Evolutionary



Source: Adapted from European Technology Platform on Smart Systems Integration 2015.



Source: Adapted from European Technology Platform on Smart Systems Integration

Challenges



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- Data Security
- Legal Issues- detangling and abandoning
- Vienna Convention 1968
 - Article 8 *"Every moving vehicle or combination of vehicles shall have a driver"*
 - Article 13 *"Every driver of a vehicle shall in all circumstances have his vehicle under control..."*
- Liability and Safety
- Rebounded Effects – efficient but farther, faster, more driving
- Validation
- Economic Aspects
- Ethics...select a path with the lowest damage or likelihood of collision.

Research Needs



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- What is the business case for V2I?
- To what degree is V2I technology necessary for AV deployment?
- Infrastructure change and adaptation
- What can we start monitoring now to understand future market development (i.e., private vehicle ownership or vehicle-on-demand fleets)?
- How do regulatory issues for AVs differ between models of private vehicle ownership or vehicle-on-demand fleets?
- What role will after-market play in AV deployment?
- People's behavior change and social adaptation

More Specifically...



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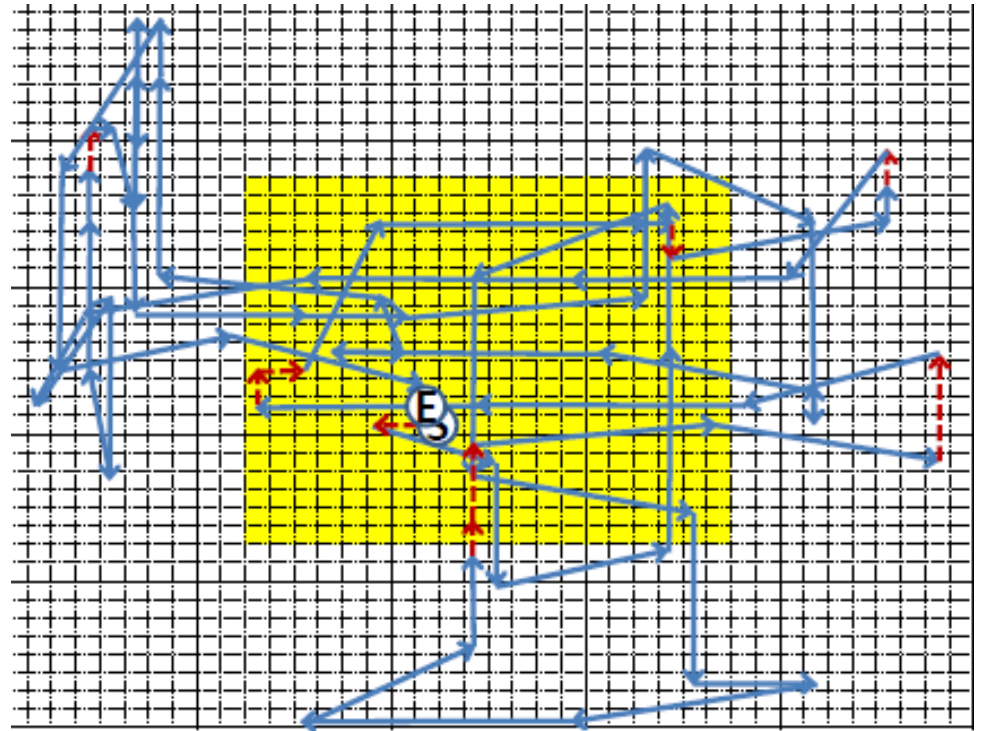
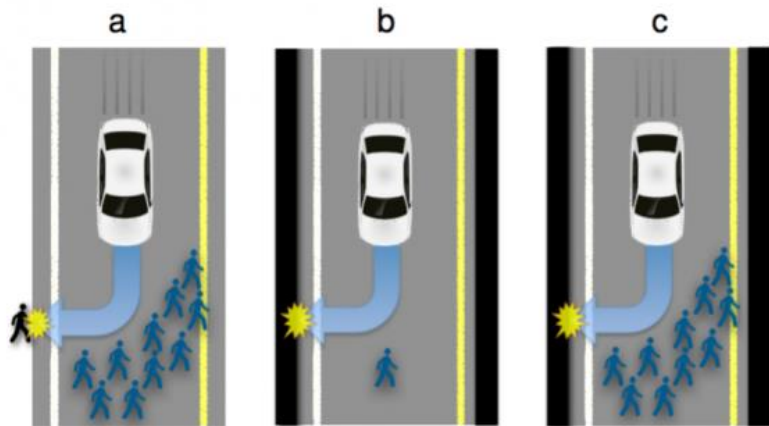
- How likely are people to use self-driving vehicles?
- What are the factors that influence acceptance and intent to use?
- What is the appeal of self-driving vehicles for people?
Especially for Handicapped, Minors, etc ?
- In what ways would people change current travel behavior because of access to self-driving vehicles?
- How might self-driving vehicles on roadways impact traffic, safety and congestion?
- **What changes for traffic flow, capacity, car-following ?**
- **MUTCD, HCM, HSM, AASHTO Green Book,**

Driving Ethics and Rich Data



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THE ETHICAL DILEMMA OF SELF-DRIVING CARS



We Don't Know What We Want

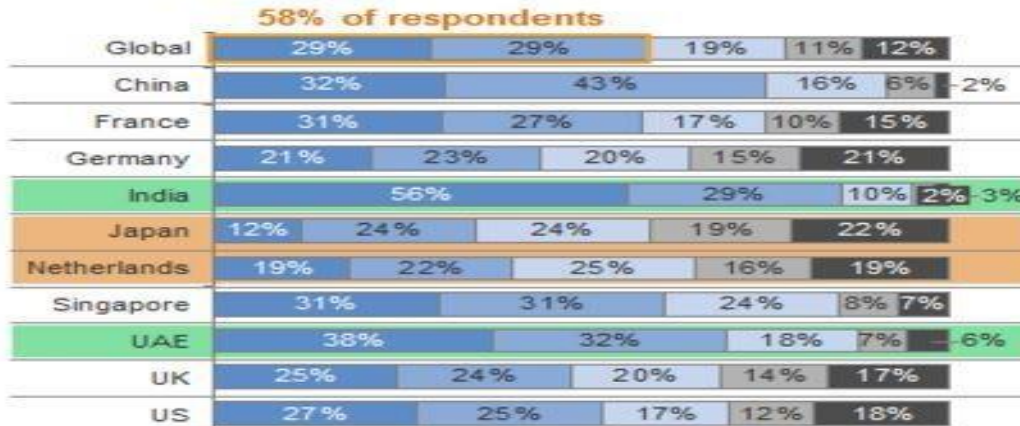


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Many consumers are very open to trying a self-driving car

58% say they would take a ride in a fully self-driving car

In % of respondents per country



■ Very likely
 ■ Likely
 ■ Neutral - Neither likely nor unlikely
 ■ Unlikely
 ■ Very unlikely

Q: Imagine that the fully self-driving vehicle became available in the market. How likely would you be to consider taking a ride in it (for example as a test drive, taxi or rental car)?

n=5,635

Note: This survey was prepared with the support of The Boston Consulting Group
 Source: World Economic Forum, BCG analysis, consumer survey August 2015
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Work on Wheels and IVTT



(design by IDEO)

Refrigerator, AV and Home



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Car = Hub of Personal Smart Grid



Vehicle-to-grid (V2G) systems conceptualize how smart cars could be incorporated into the extended power grid. Cars of the future will share, store and produce our energy.

The Wall Street Journal



Source : Kinder Baumgardner, Beyond Googles's Cute Car

AV with Urban Retrofitting



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Urban Land Magazine | Americas | Asia Pacific | Europe | Foundation

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Urban Land > Infrastructure > Imagining the Driverless City

Imagining the Driverless City

By Patrick J. Kiger
October 2, 2015

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Necessary?

Weekends:
empty parking lot

Smaller cars = smaller lanes

New Parking Paradigm



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THE NEW METRICS OF PARKING

1 NARROWER AISLES

Perfect alignment and optimized spacing through parking technology



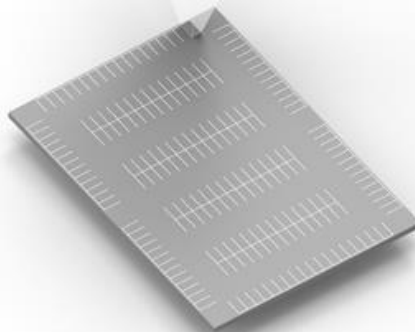
2 STALL STACKS

Flexible re-configuration of parking space - tight parking scenarios are conceivable

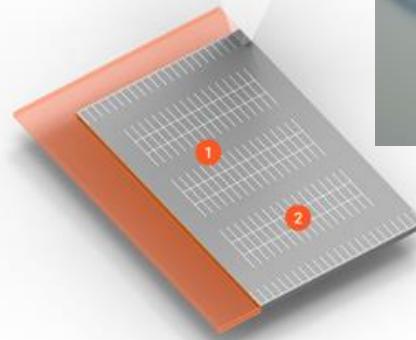


3 SMALLER STALLS

The required parking footprint per car can shrink to a minimum



Without Piloted Parking Technology



With Piloted Parking Technology

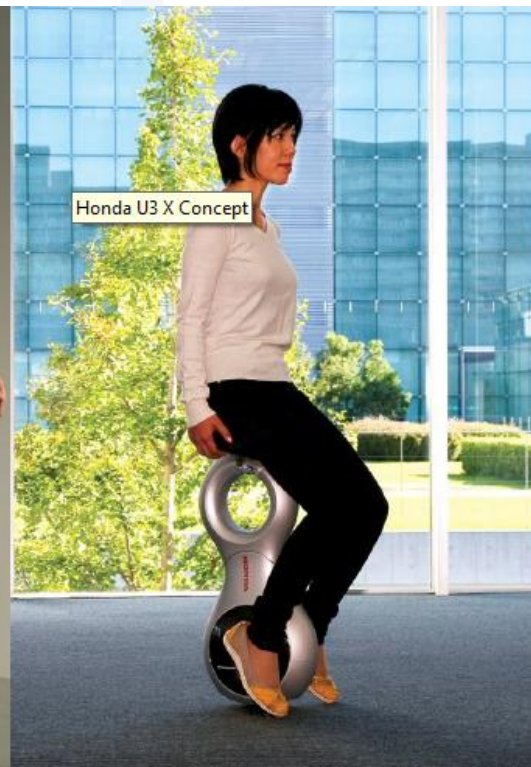


26 %
parking space
reduction

Redistribution of Road Spaces



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Design for Driveless



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2 Traffic Lanes / On-Street Parking



Street Car / Bus / RC Lane
/ Enhanced Sidewalk Promenade

3 Traffic Lanes / On-Street Parking



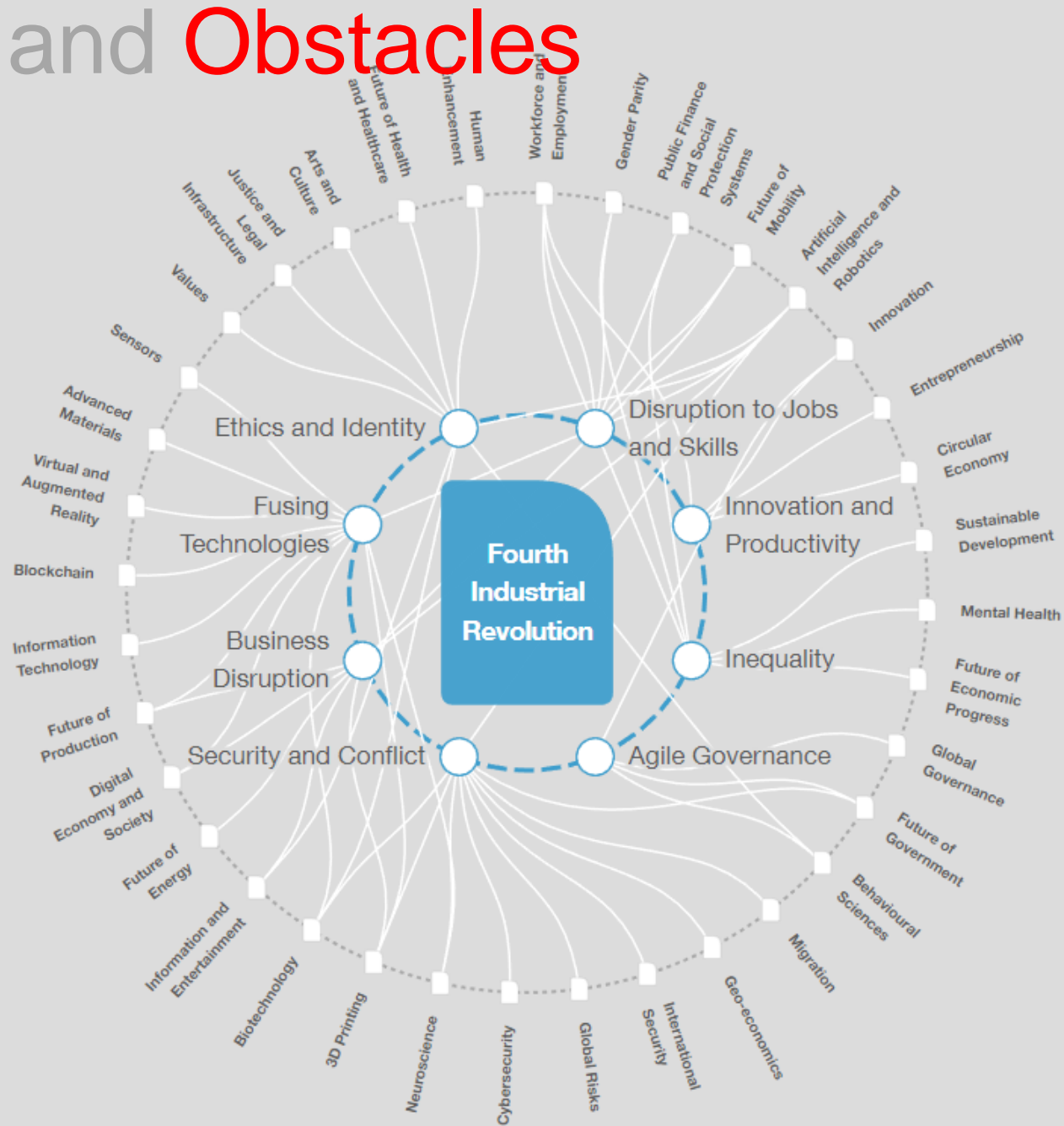
2 Traffic Lanes / Dedicated Bike Way
/ Terraced Parklette

6 Traffic Lanes / On-Street Parking



1 Dedicated RC Lane / 1 Shared Bike Car Lane
/ Bio-Infiltration Gardens / Transit Plazas

Challenges and Obstacles



<https://toplink.weforum.org/>

Conclusions



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- AV will bring changes
- Transportation, Urban System, (and Architecture, Social Life etc)
- Need to research
 - 1) Safety, Mobility, Capacity and Infra Needs
 - 2) Traffic Flow, Car-following, Lane-Changing models....
Infra Invest and Revision
 - 3) Behavior Change - LU (activity) & transport
 - 4) Price of V, Level of I, Collaboration
 - 5) People's Changes and Effects on AV and Transport
Policy and vice versa

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