Automated Vehicle Strategy

Bryant Walker Smith

Assistant Professor

University of South Carolina School of Law

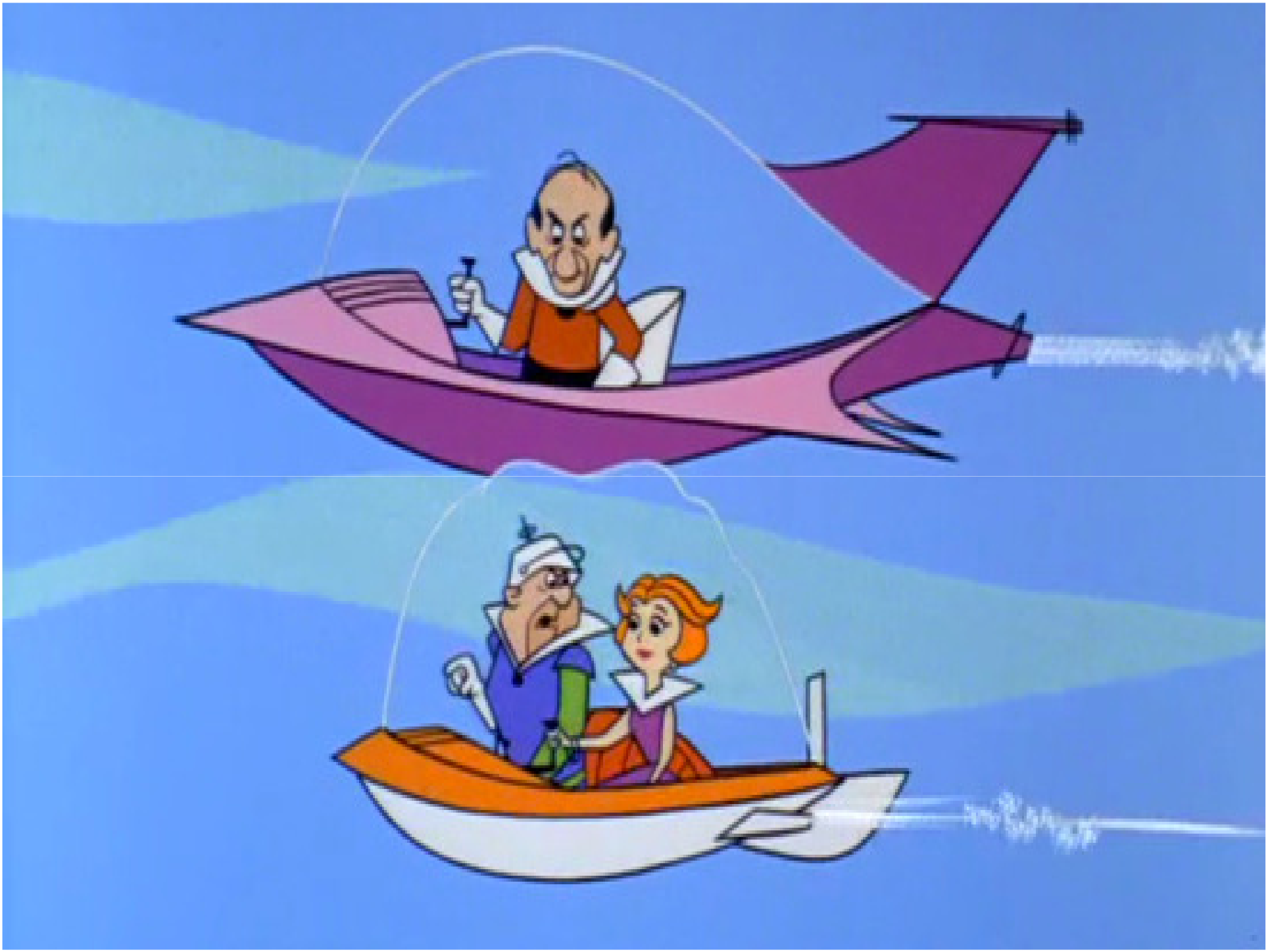
and (by courtesy) School of Engineering

Affiliate Scholar

Center for Internet and Society at Stanford Law School

law of the newly Possible

newlypossible.org



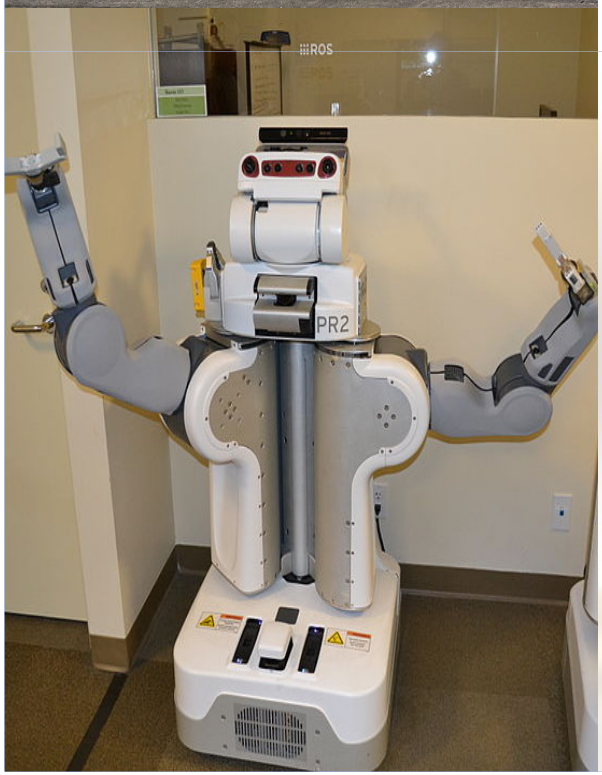

D MR 1359

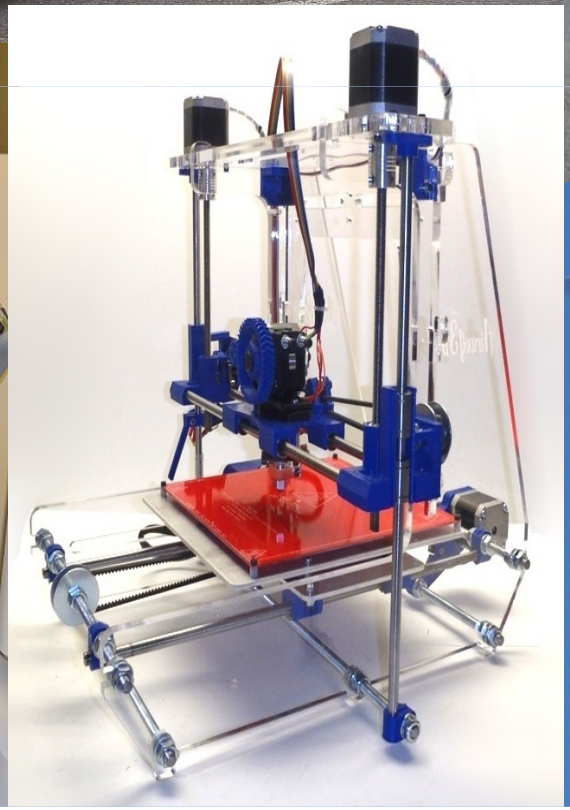

D MR 1359


D MR 1359
ROS
PR2

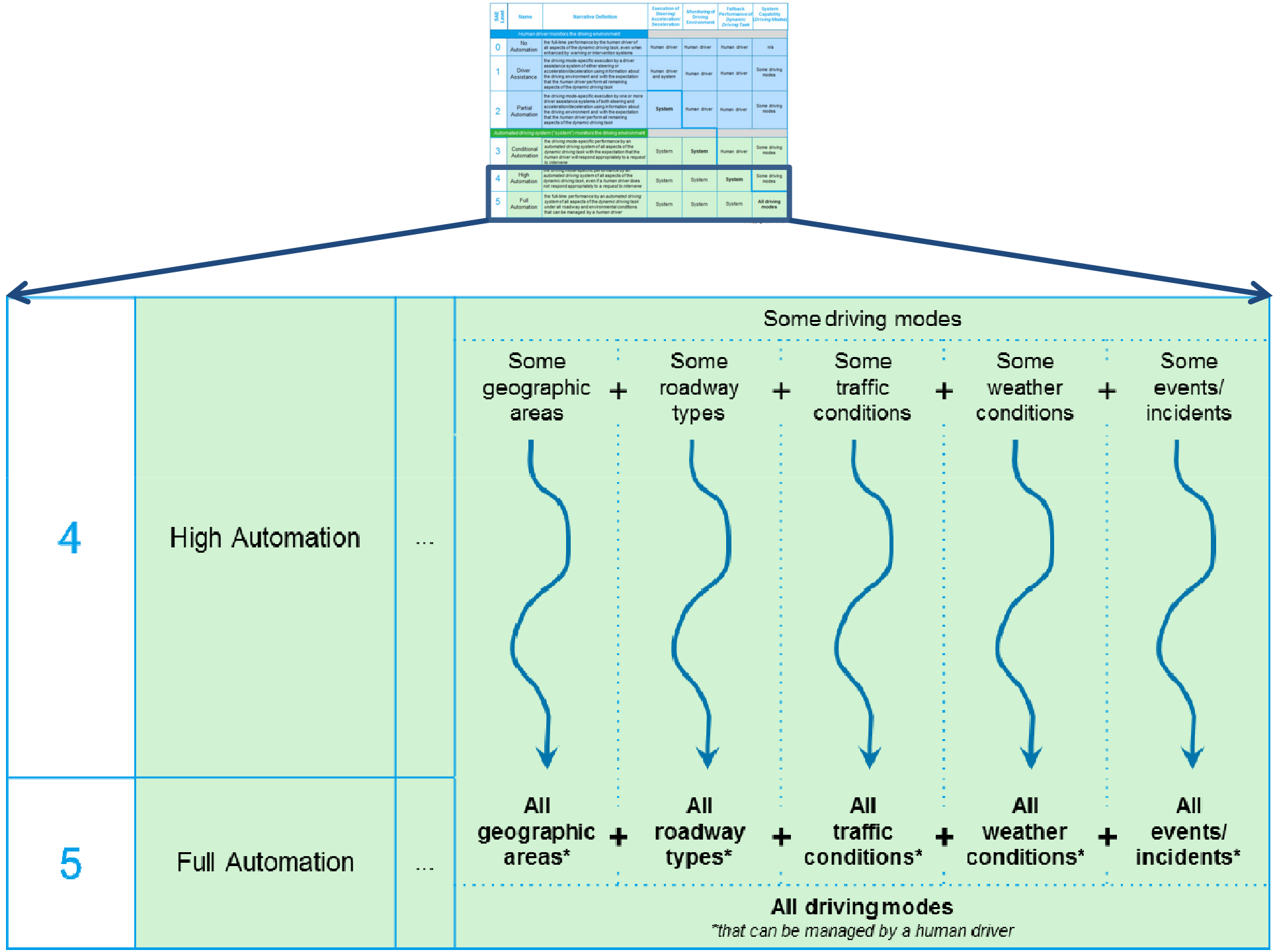

D MR 1359
ROS
PR2


D MR 1359


ROS
PR2



SAE Level	Name	Narrative Definition	Execution of Steering/ Acceleration/ Deceleration	*Monitoring* of Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability (*Driving Modes*)
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
Automated driving system ("system") monitors the driving environment						
3	Conditional Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	High Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	Full Automation	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**


SAE Level
Name
Narrative Definition
Execution of Steering/ Acceleration/ Deceleration
Monitoring of Driving Environment
Fallback Performance of Dynamic Driving Task
System Capability (Driving Modes)
Human driver monitors the driving environment
0 No Automation
1 Driver Assistance
2 Partial Automation
Automated driving system ("system") monitors the driving environment
3 Conditional Automation
4 High Automation
5 Full Automation
4
High Automation
...
5
Full Automation
...
Some driving modes
Some geographic areas
+
Some roadway types
+
Some traffic conditions
+
Some weather conditions
+
Some events/ incidents
All geographic areas*
+
All roadway types*
+
All traffic conditions*
+
All weather conditions*
+
All events/ incidents*
All driving modes
*that can be managed by a human driver

Driver Assist

SAE Level	Name	Narrative Definition	Execution of Steering/ Acceleration/ Deceleration	*Monitoring* of Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability (*Driving Modes*)
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
Automated driving system ("system") monitors the driving environment						
3	Conditional Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	High Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	Full Automation	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

Driverless

			Some driving modes				
			Some geographic areas	Some roadway types	Some traffic conditions	Some weather conditions	Some events/ incidents
4	High Automation	...	↓	↓	↓	↓	↓
5	Full Automation	...	**All geographic areas***	**All roadway types***	**All traffic conditions***	**All weather conditions***	**All events/ incidents***
			All driving modes				

*"that can be managed by a human driver"

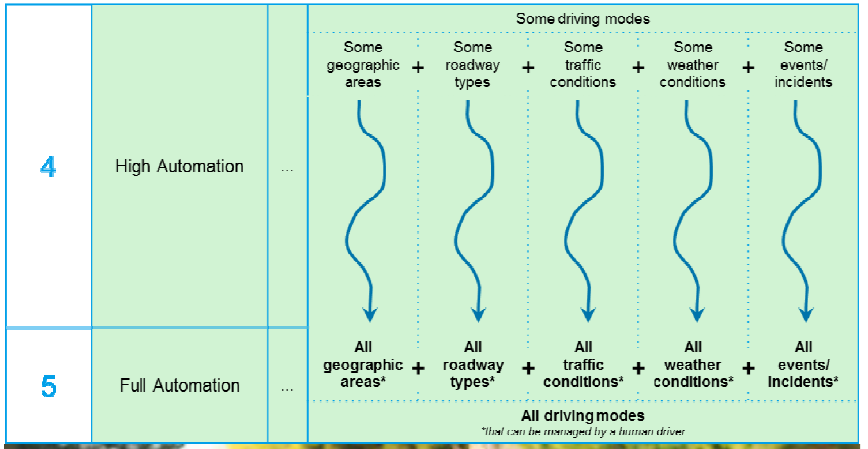
Driver Assist

SAE Level	Name	Narrative Definition	Execution of Steering/ Acceleration/ Deceleration	*Monitoring of* Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability *(Driving Modes)*
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
Automated driving system ("system") monitors the driving environment						
3	Conditional Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	High Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	Full Automation	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

Large markets

vs.

Driverless



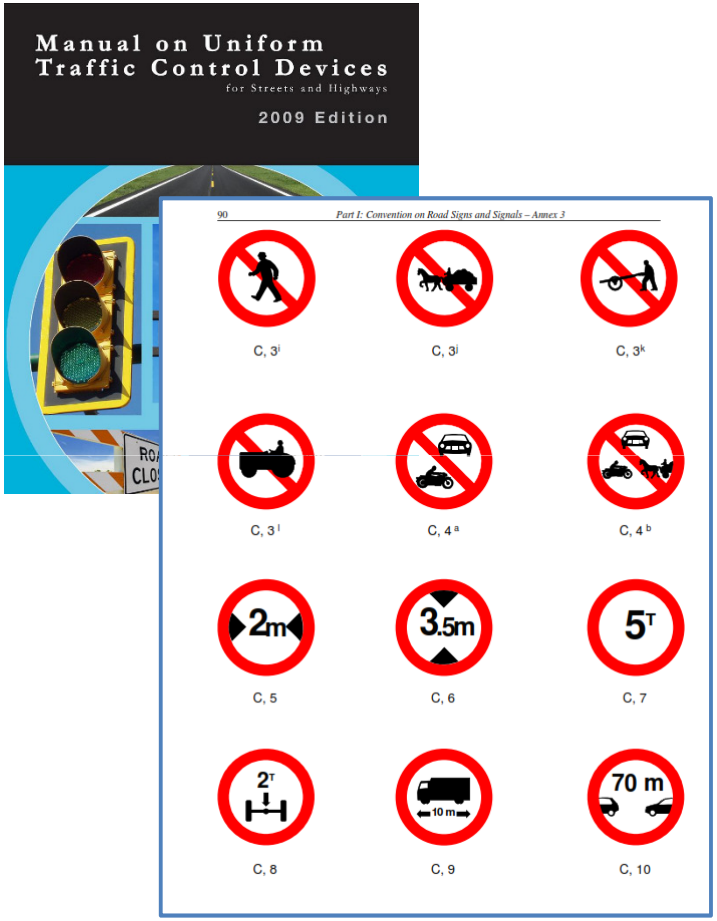
Local conditions

Strategies for Driver Assist

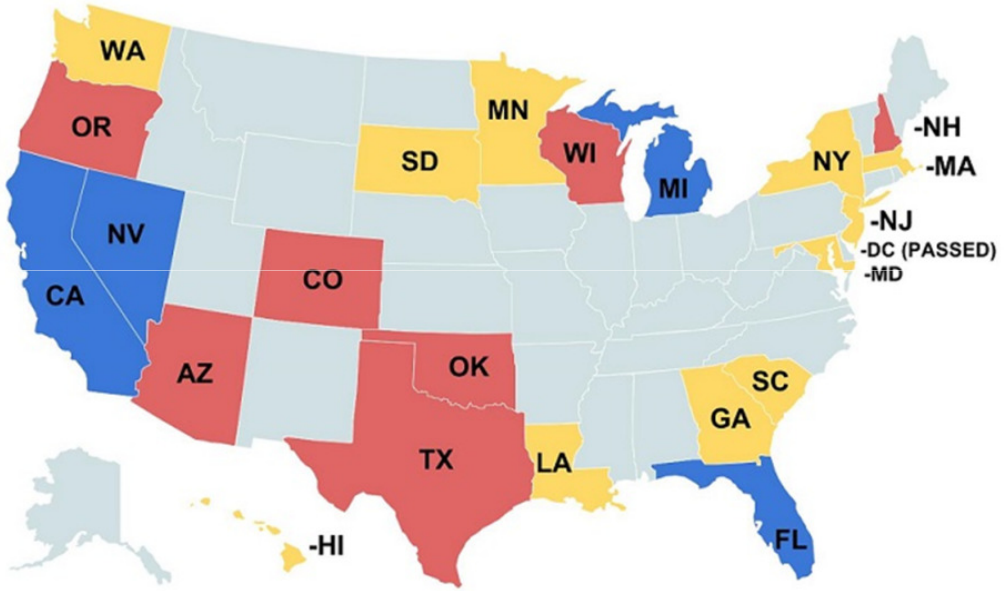
SAE Level	Name	Narrative Definition	Execution of Steering/ Acceleration/ Deceleration	*Monitoring of* Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability (*Driving Modes*)
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
Automated driving system ("system") monitors the driving environment						
3	Conditional Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	High Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	Full Automation	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

- Ensure that physical, digital, and legal infrastructures are clear and consistent
- Internalize the costs of driving
- Enforce the law
- Rationalize insurance

Ensure clarity and consistency



http://www.unece.org/fileadmin/DAM/trans/conventn/Conv_road_signs_2006v_EN.pdf



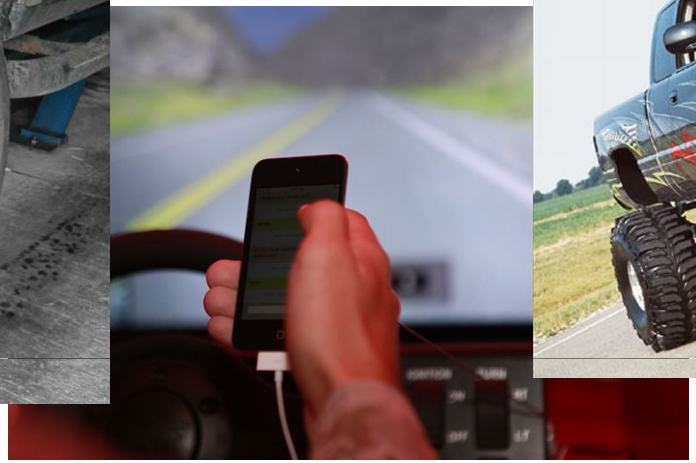
Bryant Walker Smith, *Automated Vehicles Are Probably Legal in the United States*, 1 Tex. A&M L. Rev. 411 (2014), *newlypossible.org*

Internalize the costs of driving

- Fuel taxes
- Insurance requirements

http://upload.wikimedia.org/wikipedia/commons/7/78/Car_accident_-_NSE_Malaysia.jpg

Enforce the law



Rationalize insurance

- Facilitate access to data

- Provide flexibility to insurers and customers
  - Rate-relevant characteristics
  - Usage-based pricing
    (pay as you drive / pay how you drive)

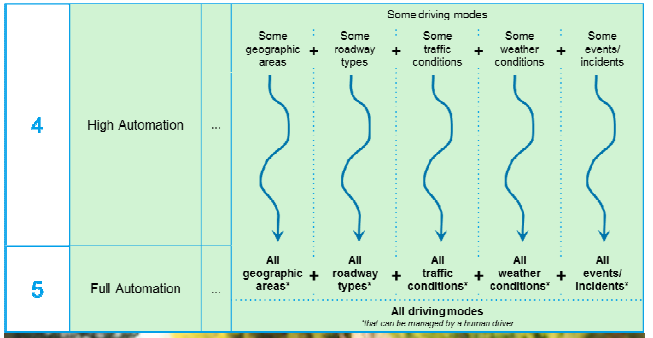
Strategies for Driver Assist

SAE Level	Name	Narrative Definition	Execution of Steering/ Acceleration/ Deceleration	*Monitoring of* Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability (*Driving Modes*)
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
Automated driving system ("system") monitors the driving environment						
3	Conditional Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	High Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	Full Automation	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

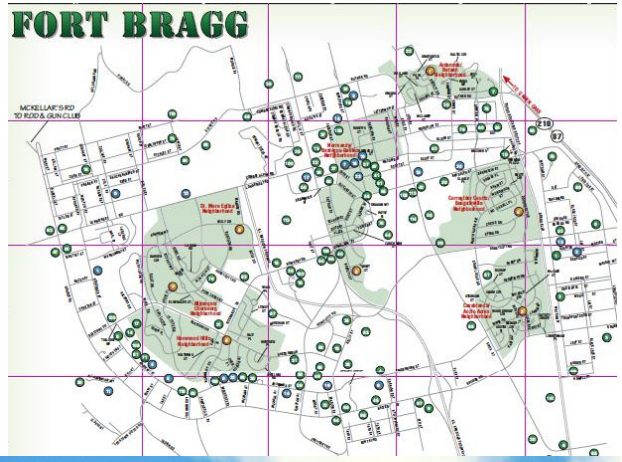
- Ensure that physical, digital, and legal infrastructures are clear and consistent
- Internalize the costs of driving
- Enforce the law
- Rationalize insurance

Strategies for Driverless

- Identify local needs/opportunities
- Deploy local resources strategically
- Prepare physical/digital infrastructures
- Clarify the legal status of nonconventional vehicles/services
- Embrace flexibility



Identify local needs and opportunities



Deploy local resources strategically

Prepare infrastructure

Clarify the legal status of nonconventional vehicles and services

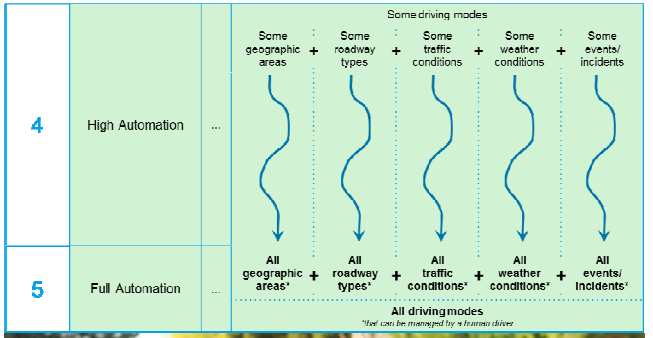
UBER

lyft

Embrace flexibility

Strategies for Driverless

- Identify local needs/opportunities
- Deploy local resources strategically
- Prepare physical/digital infrastructures
- Clarify the legal status of nonconventional vehicles/services
- Embrace flexibility



Appreciate the risks of automated and nonautomated motor vehicle travel

- 5,000,000,000,000 km driven annually
- 30,000 direct deaths annually
  (plus another 50,000 through pollution)
- 1,300,000 direct injuries annually

http://ec.europa.eu/transport/facts-fundings/statistics/doc/2010/pb2010_3_transport.pdf
http://ec.europa.eu/transport/road_safety/pdf/statistics/dacota/dacota-3.5-asr-2012.pdf
http://www.sciencedirect.com/science/article/pii/S1352231013004548
(EU-27, with pollution deaths assumed equivalent to United States)

Expect more from *all* motor vehicles and their drivers

Councilmember Mary M. Cheh

A BILL

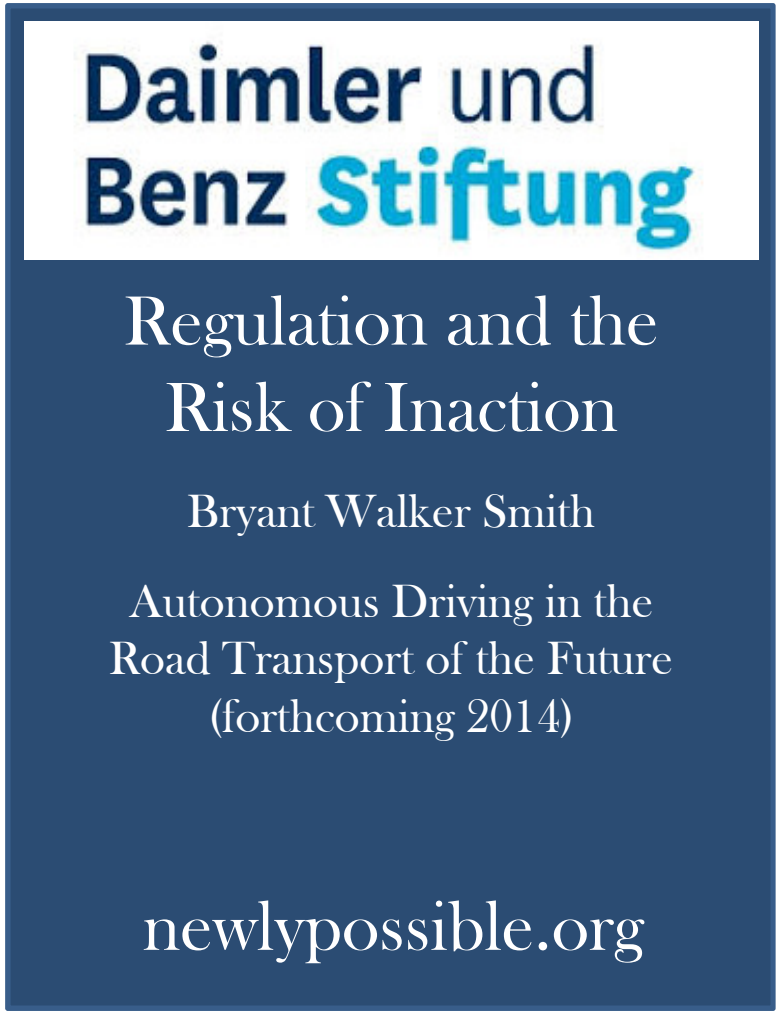
IN THE COUNCIL OF THE DISTRICT OF COLUMBIA

Councilmember Mary M. Cheh introduced the following bill, which was referred to the Committee on _____.

To authorize autonomous vehicles to operate on the roadways of the District, to establish a system of user taxation for autonomous vehicles based upon vehicle miles traveled, to require the Department of Motor Vehicles to create an autonomous vehicle designation; and to establish safe operating protocols for such vehicles.

BE IT ENACTED BY THE COUNCIL OF THE DISTRICT OF COLUMBIA, That this act may be cited as the "Autonomous Vehicle Act of 2012".

Public Sector Strategies



Public Sector Strategies

Daimler und Benz Stiftung

Regulation and the Risk of Inaction

Bryant Walker Smith

Autonomous Driving in the Road Transport of the Future (forthcoming 2014)

newlypossible.org

Private Sector Strategies

THE GEORGETOWN LAW JOURNAL

Proximity-Driven Liability

Bryant Walker Smith

102 Geo. L.J. 1777 (2014)

newlypossible.org

Public Sector Strategies

Daimler und Benz Stiftung

Regulation and the Risk of Inaction

Bryant Walker Smith

Autonomous Driving in the Road Transport of the Future (forthcoming 2014)

newlypossible.org

Private Sector Strategies

THE GEORGETOWN LAW JOURNAL

Proximity-Driven Liability

Bryant Walker Smith

102 Geo. L.J. 1777 (2014)

newlypossible.org

law of the newly Possible

newlypossible.org


law of the
newly
Possible
newlypossible.org