

Performance-Based Planning For Connected & Automated Vehicles

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Overview

- Connectivity and Automation are a Big Deal
- Disruptive Technologies are... Disruptive!
- Performance-Based Planning to the Rescue
- A Small Toolbox to Keep the Wheels Turning

Connected and Automated Vehicles

- Distinct but complementary technologies
- Connected vehicles
 - Right around the corner
 - Potential incremental benefits as “ITS 2.0”
- Automated vehicles
 - Farther off
 - Could revolutionize the transportation system

Connected Vehicles

- Use various communication technologies
 - Dedicated Short-Range Communication (DSRC)
 - Also potentially Cellular, WiFi
- Transmit and receive status information
 - Vehicle to Vehicle, to Infrastructure, to Other Users
 - V2V, V2I, V2X
- Key benefits
 - Collision avoidance, traffic flow, roadway conditions

Automated Vehicles 1

- Vehicle makes operating decisions on its own
 - Adaptive “goal seeking” behavior
- Different levels of automation
 - Driver assistance (Adaptive cruise / Lane following)
 - Supervised self-driving (Tesla AutoPilot)
 - Fully self-driving (No driver required: Google etc.)
 - Various formal levels (NHTSA, SAE)

Automated Vehicles 2

- Technology of automation
 - Primarily based on autonomous sensors
 - Connectivity is secondary
- Reduction of driver involvement
 - Makes driving available to more people
 - Reduces issues with driver impairment
 - Turns driving time into free time

Deployment Status

- Connected Vehicle Guidance is Imminent:
 - Mandate for CV hardware in all new cars (NHTSA)
 - Guidance on deploying V2I infrastructure (FHWA)
- Automated Vehicles “coming soon”
- **Widespread deployment of either CV or AV is probably still 10-30 years away**

Disruptive Technologies

- “Disruptive” = threat to “business as usual”
 - CV and AV could up-end how transportation works
- Most disruptive elements:
 - Little or no idea how or when it will happen
 - Little or no idea what the net effects will be
 - Have no idea what to do now (or next)

What makes CV and AV Disruptive?

- Behavior
 - Drive farther, buy fewer cars, use more taxis
- Infrastructure
 - Better/different markings, less new road capacity, fewer parking spaces, “internet of cars”
- Agency roles
 - Transit vs. shared mobility, “hands on” system management & operations

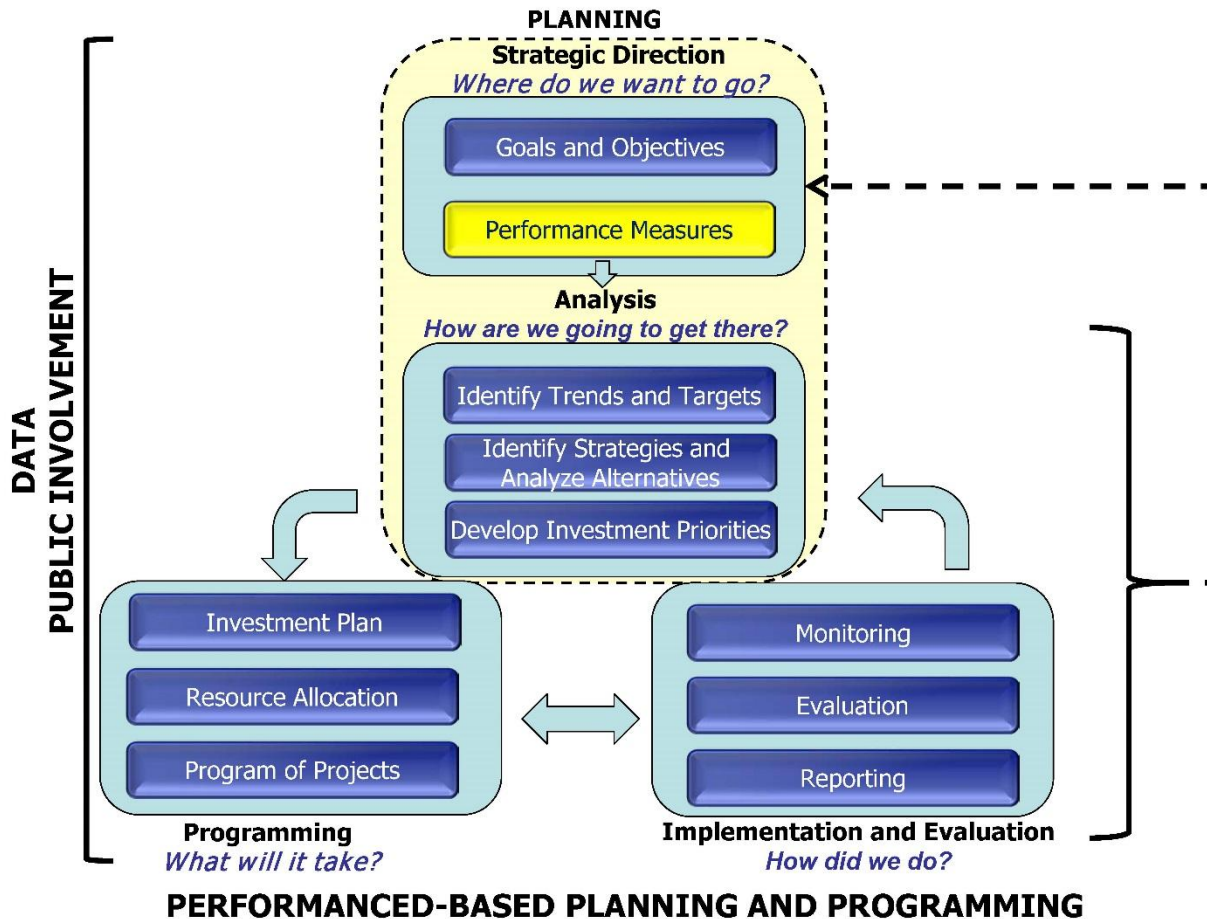
What Else is Disruptive?

- Self-driving cars are not the only thing
 - Shared Mobility (Uber/Lyft)
 - Freight Management (self-driving trucks, drones, 3D printing)
 - Bicycle and pedestrian travel (“Return to the City”)
 - Generational shifts (“Millenials hate driving”)
 - Externalities (new energy sources, climate change)

The Future...

- ... is **Wide Open**
 - More opportunity than ever to improve
- ... is **Radically Uncertain**
 - Know less than ever about what will happen
- ... calls for **New Planning Strategies**
 - Extrapolate less, experiment more, get more data

Performance-Based Planning to the Rescue



Handling the Unknown with Performance-Based Planning

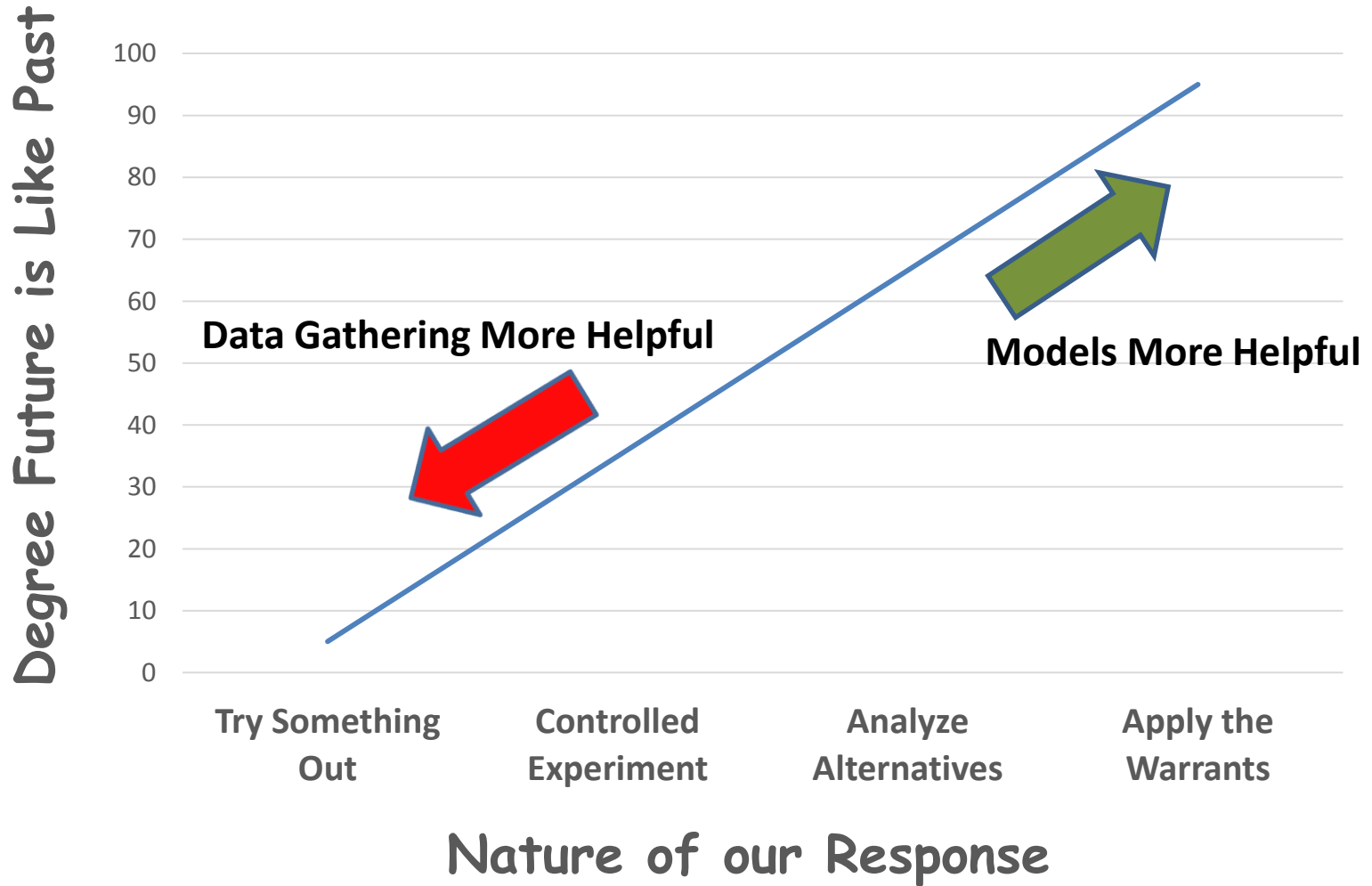
- Scenario Development and Visioning
- Performance Measure Development
 - Performance Targets
 - Data Collection
- Try Things and Evaluate Them
- Revisit Assumptions Regularly

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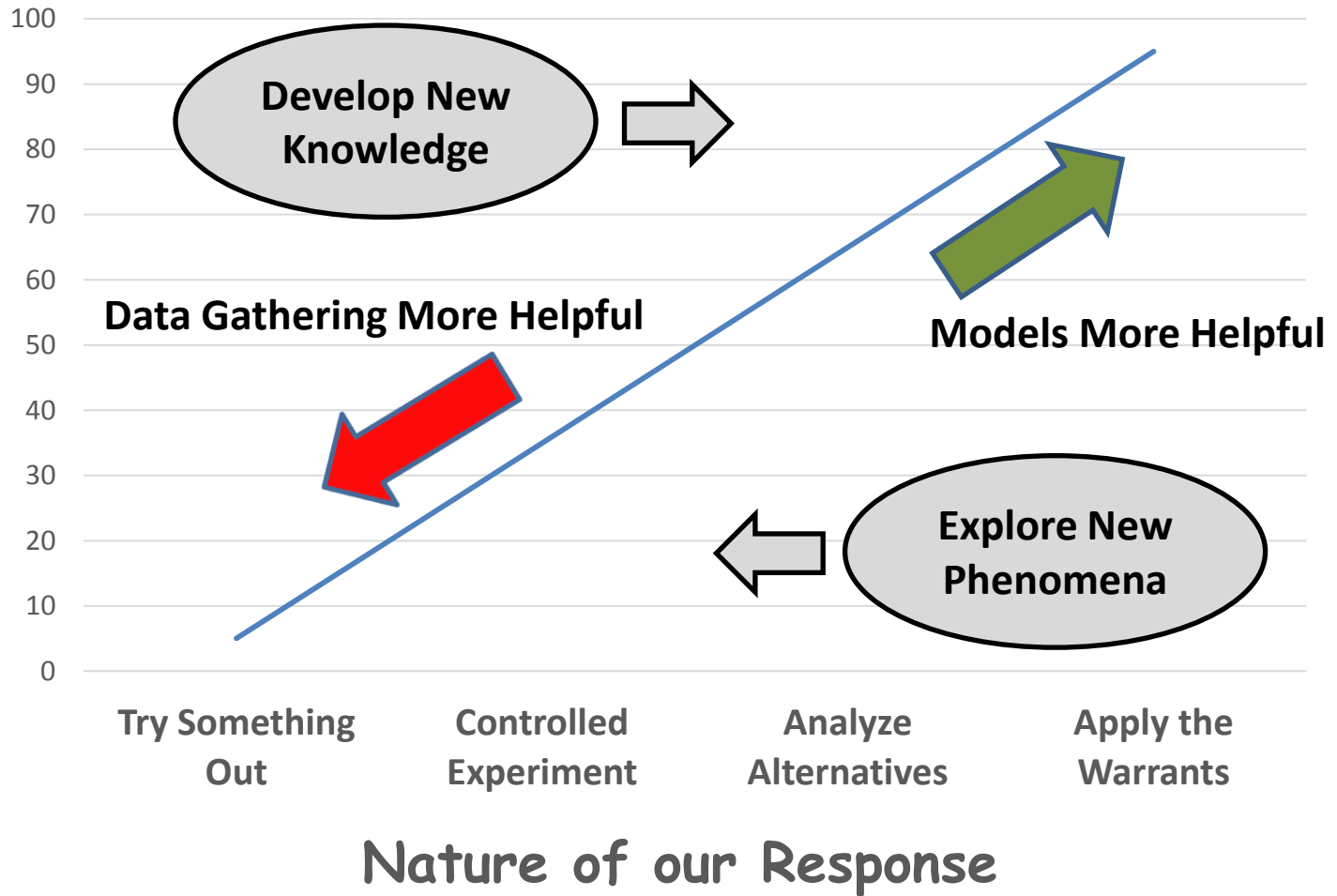
What should we try?

From Chaos to Confidence



From Chaos to Confidence

Degree Future is Like Past



A Small Toolbox

- So practically, what does this mean?
- Watch what is happening
- Follow the policy debates
- Gather data
- Imagine the Possibilities

Watch What is Happening

- Pay attention new technology deployments
 - CV Pilots (New York City, Tampa, Wyoming)
 - Smart Cities effort (Columbus, OH)
- Self-Driving Car Deployments
 - Test beds
 - Ad hoc pilots (e.g. Uber in Pittsburgh)
- Emerging working groups (AASHTO, AMPO)

Follow the Policy Debates

- Many constraints on AV are policy-based
 - Insurance and Liability
 - Licensing
 - Regulation of new services (e.g. Uber)
- These are expected to influence
 - how deployment happens
 - how fast it happens
 - what it means

Gather Data

- Goal is to detect new phenomena, using:
- Good old household surveys
- New data sources (including V2I)
- System operations data
- Your own pilot CV implementation

Imagine the Possibilities

- Use planning cycles (TIP / LRP) to review
 - Use Scenario Planning, early and often
- Don't neglect the visioning
 - Now more than ever, the future is ours to define
- Transition from “Necessity” to “Free Will”