A LATENT-VARIABLE AND LATENT-CLASS APPROACH

EVALUATING CONSUMER'S PERCEPTIONS OF SAFETY AND INTENTION TO ADOPT AUTONOMOUS VEHICLE TECHNOLOGY
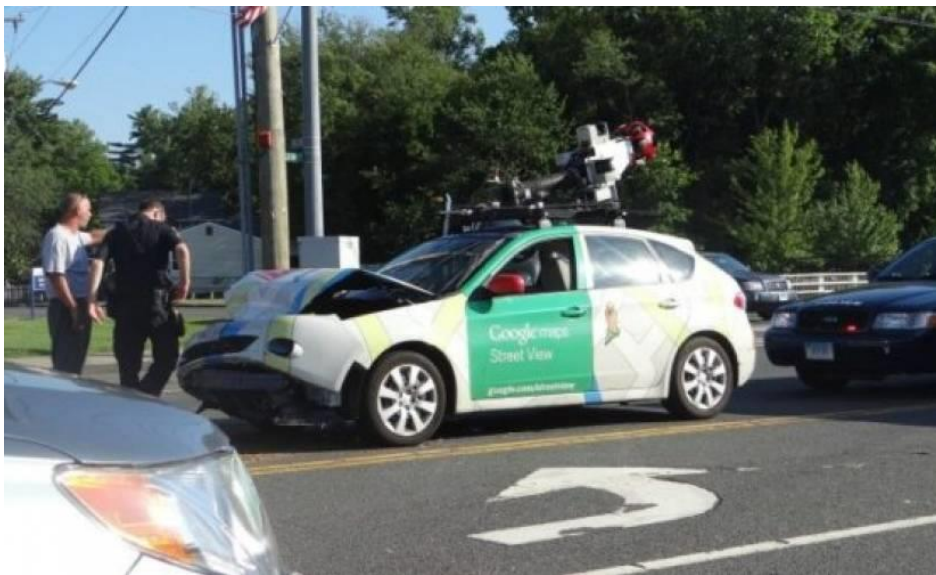
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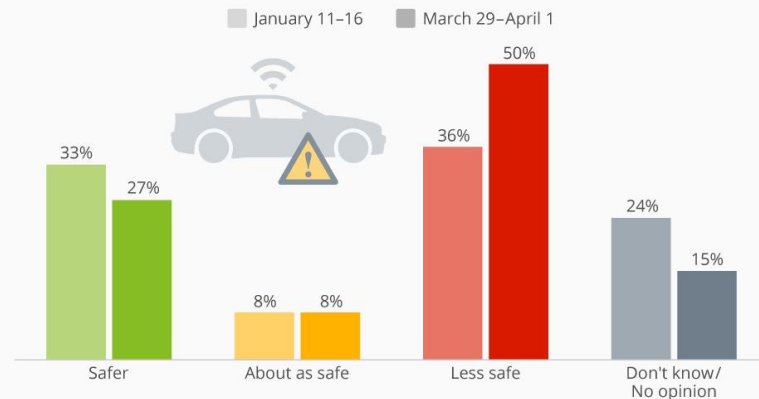The University of Texas at Austin

Current Scenario

Fatal Accidents Damage Trust in Autonomous Driving
Would you say that self-driving cars are more or less safe than vehicles driven by humans?

January 11–16 ▪ March 29–April 1

- Safer: 33% / 27%
- About as safe: 8% / 8%
- Less safe: 36% / 50%
- Don't know/ No opinion: 24% / 15%

Based on two polls among roughly 2,000 U.S. adults, each with a margin of error of +/-2%
@StatistaCharts Source: Morning Consult

statista

- 2016: First death involving an autonomous car

- 2018: Autonomous Uber killed a woman who was walking outside of the cross-walk

- Nissan 4%
- Cruise Automation 4%
- Delphi 4%
- GM Cruise 4%
- Google 84%
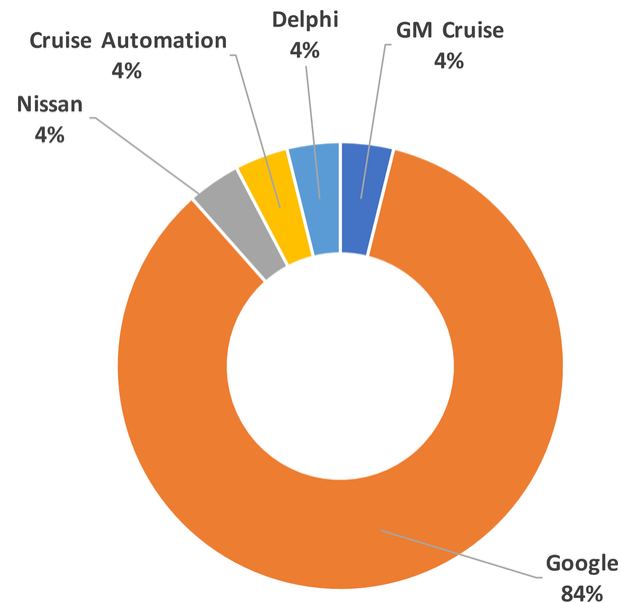
Public opinion

- Interest and trust in AVs has dropped in the past two years (Abraham et al., 2017; J.D. Powers, 2017; Deloitte, 2017)

- Could "safety perception" be a reason to hold back a buyer? (Becker and Axhausen, 2017)

- Increased disbelief in AV safety and skepticism toward the ability of this technology to work perfectly

Age differences in willingness to use automation in vehicles: (Abraham et al., 2017)

		16-24	25-34	35-44	45-54	55-64	65-74	75+
2016	No Automation*	12%	8%	10%	6%	5%	4%	3%
	Emergency Only	18%	11%	16%	16%	15%	12%	17%
	Help Driver*	27%	25%	21%	41%	44%	56%	52%
	Partial Autonomy	16%	15%	19%	13%	17%	14%	15%
	Full Automation*	26%	40%	34%	23%	19%	14%	13%
2017	No Automation	0%	3%	4%	3%	2%	2%	1%
	Emergency Only*	24%	15%	11%	13%	10%	10%	10%
	Help Driver*	46%	43%	49%	55%	63%	64%	69%
	Partial Autonomy	16%	19%	15%	14%	13%	14%	10%
	Full Automation*	14%	20%	21%	15%	12%	10%	10%

*: Age differences significant at α=0.05

Latent Segments based on lifestyle

❑ Endogenous latent-class segmentation to account for group taste heterogeneity

❑ Assumption: Groups of individuals with contrasting tech-savviness, time-sensitivity and car-dependency may differ in future AV adoption

❑ Examples:
   o The intensity with which the perception of AV safety might impact preferences toward AV adoption might also differ across these groups.

   o The level of tech-savviness of an individual is expected to influence both his/her car-dependency style and AV preference

❑ Latent classes based on:

- Tech Savviness
  - I frequently use online banking services,
  - I frequently purchase products online,
  - Learning how to use new smartphone apps is easy for me

- Time Sensitivity
  - Even if I can use my travel time productively, I still expect to reach my destination as fast as possible;
  - With my schedule, minimizing time traveling is very important to me.

- Car Dependency
  - Car availability,
  - Mileage driven in the past year
  - Commute mode
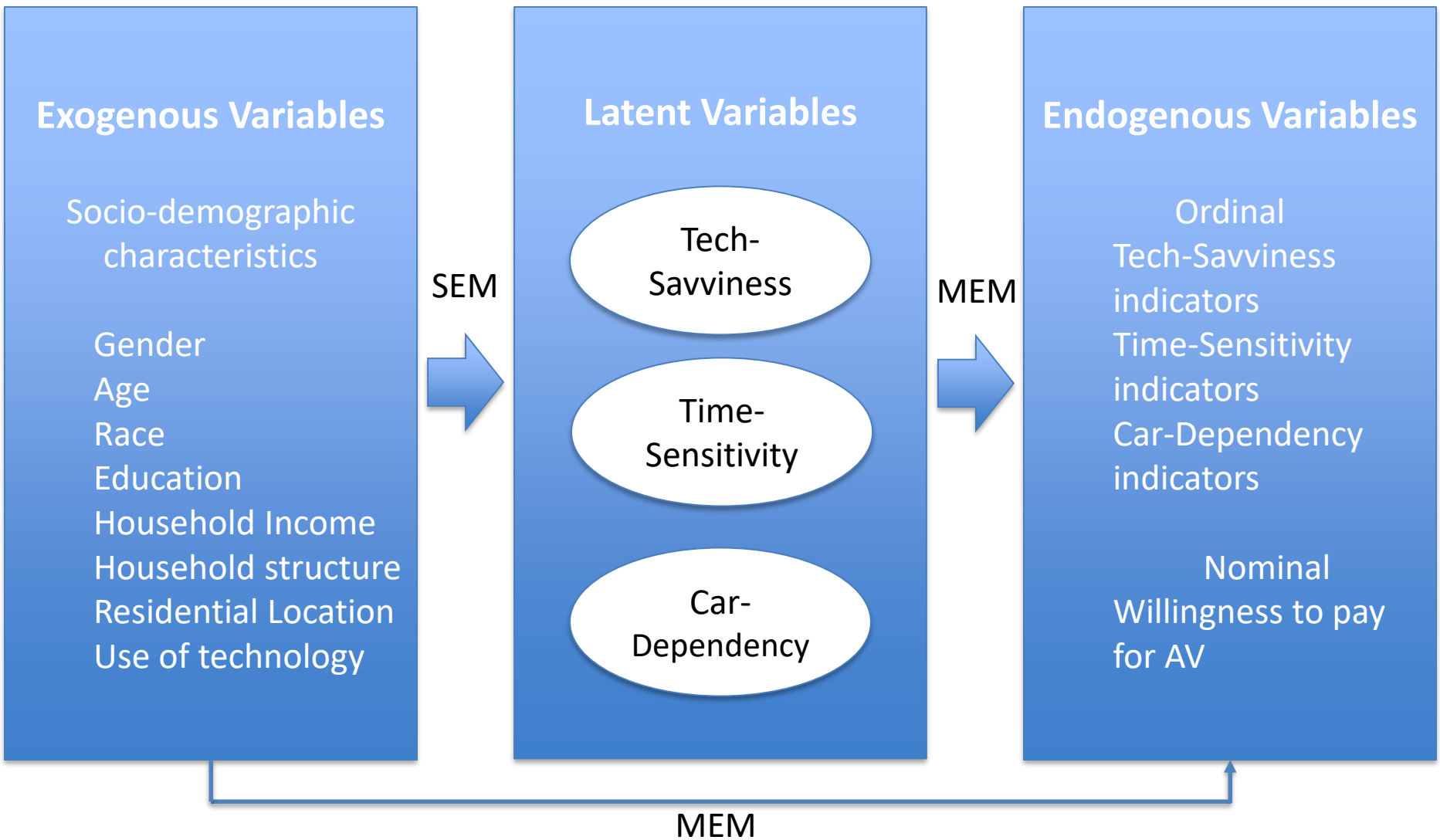
Main Outcome

Imagine that you are planning to buy a car and self-driving cars are an available option. Consider also that ride-sourcing services already operate with self-driving cars. Which of the following options would you choose?			
value	N	%	cumu. %
I would buy a regular vehicle (that is not self-driving). I still want to drive myself.	625	40.09	40.09
I would buy a self-driving car only if it was exactly the same price as a regular vehicle (that is not self-driving).	420	26.94	67.03
I would buy a self-driving car only if it was no more than $5,000 (five thousand) dollars more expensive than a regular vehicle (that is not self-driving).	392	25.14	92.17
I would buy a self-driving car even if it was more than $5,000 (five thousand) dollars more expensive than a regular vehicle (that is not self-driving).	122	7.83	100
Total	1559	100	

Results

Variables (base category)	Structural Equations Model Component Results					
	Tech-savviness		Time-sensitivity		Car-dependency	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Gender (male)						
Female	--	--	0.181	2.76	--	--
Age (≥55 years)						
18 to 34	1.068	10.7	--	--	-0.289	-3.89
35 to 44	0.839	9.53	0.271	3.47	-0.289	-3.89
45 to 54	0.437	5.38	--	--	--	--
Race (other races)						
Non-Hispanic White	--	--	--	--	0.207	2.36
Education (≤ undergraduate degree)						
Graduate degree	--	--	--	--	-0.184	-2.27
Employment (full-time or self-employed)						
Part-time employee	-0.374	-3.27	-0.377	-3.25	--	--

Variables (base category)	Structural Equations Model Component Results					
	Tech-savviness		Time-sensitivity		Car-dependency	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Household income (< $50,000)						
$50,000-$99,999	0.272	2.3	--	--	0.519	3.88
$100,000-$149,999	0.441	3.75	--	--	1.004	6.83
$150,000-$199,999	0.664	5.06	--	--	1.004	6.83
$200,000 or more	0.797	5.81	--	--	1.424	7.53
Household composition (multi-worker)						
Single person	0.632	6.17	--	--	--	--
Single worker multi-person	1.904	12.45	--	--	--	--
Correlations between latent variables						
Tech-savviness	1	n/a				
Time-sensitivity	0.174	4.02	1	n/a		
Car-dependency	--	--	--	--	1	n/a

SEGMENTS IDENTIFIED

Group 1:

❑ Tech-savvy

❑ Do not feel constrained by time

Group 2:

❑ Non tech-savvy

❑ Feel constrained by time

Tech-savvy group

❑ Higher the perception of safety, higher is the WTP for AVs

❑ Higher the appeal of AVs to inspire productive use of travel time, higher is the WTP for AVs

❑ Owning a vehicle with more than three automated features increases the WTP for AVs

❑ Higher income increases the WTP for AVs

❑ No apparent distinction observed between not buying an AV and buying an AV at the same cost as a regular vehicle

Non tech-savvy group

❑ Higher the perception of safety, higher is the overall intention to adopt AVs, but no distinction in WTP for various automation levels

❑ Higher the appeal of AVs to inspire productive use of travel time, higher is the overall intention to adopt AVs, but no distinction in WTP for various automation levels

❑ Owning a vehicle with automated features decreases the intention to adopt AVs

Implications

❑ Need to be careful about AV knowledge of the population.

❑ Perception of safety plays an important role in the overall intention to adopt AVs.

❑ Self-driving vehicles are appealing because they allow the use of travel time more effectively.

❑ Current ownership of partially automated vehicles may not inform future choice of AVs.

Thank You!