

Autonomous Vehicles

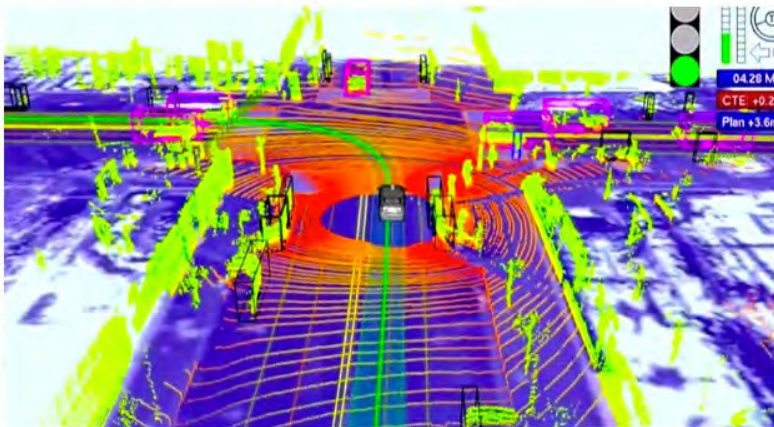
An Empirical Assessment of Intended Adoption from Consumers' Perceptions



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INTRODUCTION

- 90% of all traffic crashes due to **human error** (NHTSA, 2008)
- R&D in auto & tech industries → bringing **automation into our vehicles**
 - newer car models include advanced features such as ACC, parking assist, lane keeping systems → **enhance safety**
 - **objective**: computerize driving process – eliminate need for human driver



[Source: IEEE Spectrum, 2011]

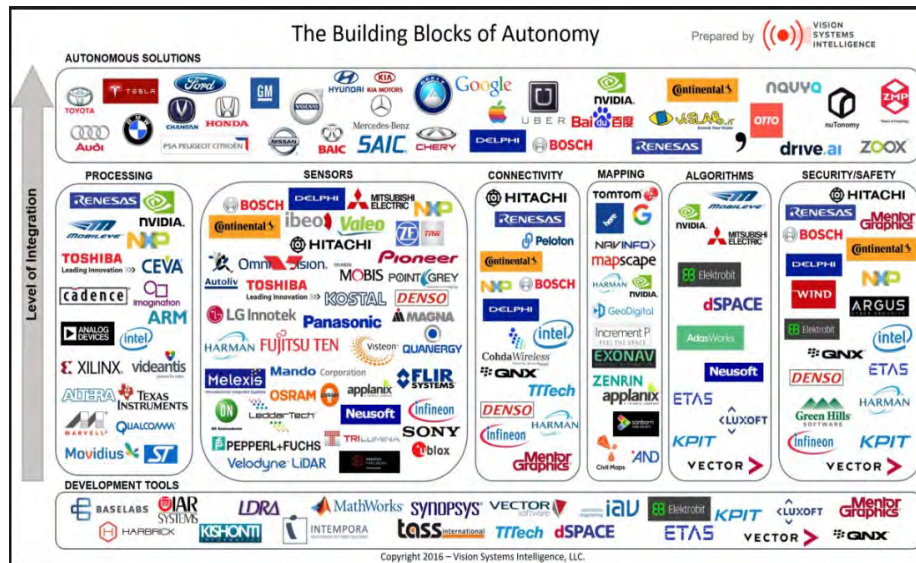


[Source: Austincc]

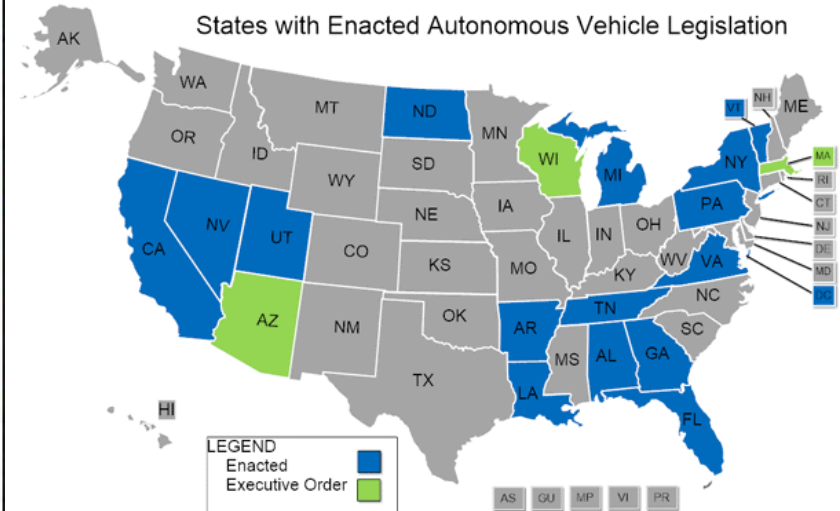
- **Autonomous Vehicles (AVs)** – category of vehicles that can drive by themselves with little to no need of a human driver

INTRODUCTION

- Many **auto & tech majors** involved in rolling out their version of autonomous vehicles (Smiechowski, 2014; Dowling, 2015; Tesla, 2016)



[Source: Vision Systems Intelligence, 2016]



- 15** states + D.C. passed **legislation** related to AVs
 - Cities such as **Pittsburgh & San Francisco** opened doors for **testing of autonomous vehicles** (Lomas, 2017)
 - wide speculations on **market penetration** – dates range from 2025 to 2040/2050

MOTIVATION

- Not all emerging technologies are welcomed by the **general public**
 - most technologies – decades of **development + market growth** → **market penetration**
 - except **early adopters**, most consumers – **close minded** about emerging tech
(Moore, 2002; Heffner, 2007)
- AVs → **tech barriers + consumer social issues** → success
 - descriptive, univariate nature of previous studies
 - conventional studies → **influencing factors** for adoption (non-adoption) – **same for all consumers**
 - **current study** – attempts to untangle the **influence of multiple agents on each market segment** → intended adoption of AVs

MOTIVATION

- Understanding **generational-level influences** – important
 - recent discussions – **millennials** get **fewer driving licenses** (UMTRI, 2011), **own fewer cars** (Badger, 2014) – contrast to older generations (**car = freedom**) (MIT, 2015)
 - possible presence of **different triggers towards adoption** for diff generations – interesting insights considering vast potential for AVs
- **Generational-level similarities** in behavior – broad **assumption**
 - **past research** – identifies **market segments** – subgroups with similar behavioral characteristics
 - lot of merit in enhancing understanding of such market segments – **better analyze triggers for adoption (or non-adoption)** – guide tomorrow's policies

STUDY OBJECTIVES

- Assess **public opinions** of autonomous vehicles (AVs)
 - **multi-population surveys** – elicit opinions on **familiarity, benefits & concerns**, intended **adoption, use of AVs** + others
 - **Current study** → in-depth understanding of public opinions – generational-level → **deeper insights into respondent attitudes & preferences**
- Understanding **consumers' perceptions & intended adoption** of AVs
 - **first stage:** identification of AV **consumer market segments** (two-step cluster analysis) → subgroups with similar behaviors + **econometric modeling** – probability of a respondent belonging to a particular market segment → **makeup of AV consumer market segments**
 - **second stage:** **intended adoption of autonomous vehicles** (econometric models) **for each consumer market segment** – uncovering different triggers

RESEARCH DESIGN

- Questionnaire Design & Data Collection

- **multi-population surveys** – **USF system** (4/15) + **AAA membership** (6/15)
- 94 & 75 questions respectively, divided into the following sections:
 - **Part 1 – General Information:** **respondent demographics** (such as age, gender, HH size & annual HH income), **current travel characteristics** (such as average one-way distance, total daily time spent on travel), **crash history** (such as vehicle damage level, injury-severity level), and **vehicle purchase inventory** (such as HH vehicles, available safety/automation features)
 - **Part 2 – Consumer Perception of Autonomous Vehicles (AVs):** **respondents' familiarity with AVs**, their perception on the **benefits and concerns**, their **likelihood of using AVs** (**before & after** being queried on the benefits and concerns), **preferred way of use** (such as own, rent, use as transportation service), **willingness to include safety and automation features**
 - **Part 3 – Anticipated Impacts of Autonomous Vehicles (AVs):** **potential impacts of AVs on future travel** (such as future vehicle size, impact on future housing location), and **future transportation systems** (such as their willingness to use different types of shared AVs)

RESEARCH DESIGN

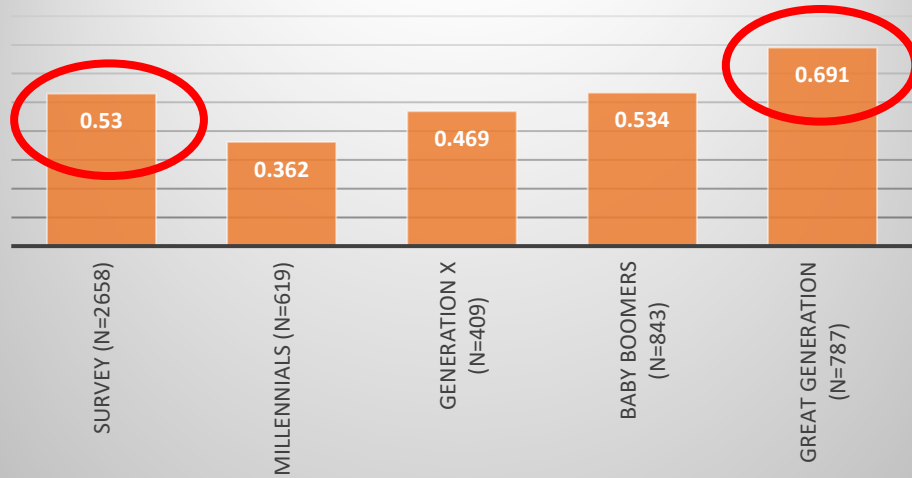
- Quality Control Procedures and Sanity Checks Employed

Parameter	USF Survey	AAA Survey	Research Database (USF+AAA)
Total Recorded Responses (Initial Sample Size)	1156	2338	3494
Quality Control Measures (indicates number of responses removed during various checks applied)			
Respondent age < 18 years	4	-	4
Respondents refused consent to take the survey	-	26	26
Incomplete responses (failed to complete even one part of the survey)	225	198	423
Premature completion (respondents who spent less than 7 mins in answering the surveys; average time for completion = 15 mins)	2	48	50
Erroneous responses (respondents answering most questions with the same categorical response – all As, all Bs, etc.)	2	41	43
Missing entries in any of the variables of interest	122	168	291
Total Useful Responses (Final Sample Size)	801	1857	2658

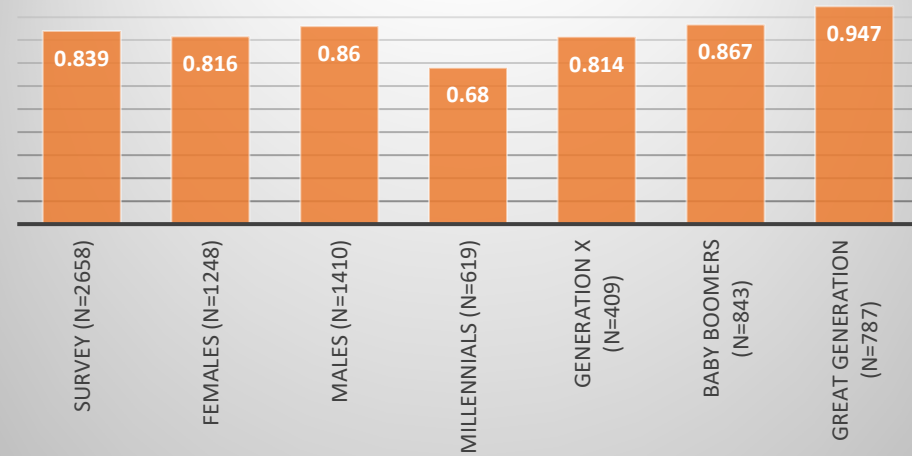
PRELIMINARY RESULTS

■ Respondent & Household Demographics

Male Respondents



White Respondents



Hispanic/Black Respondents



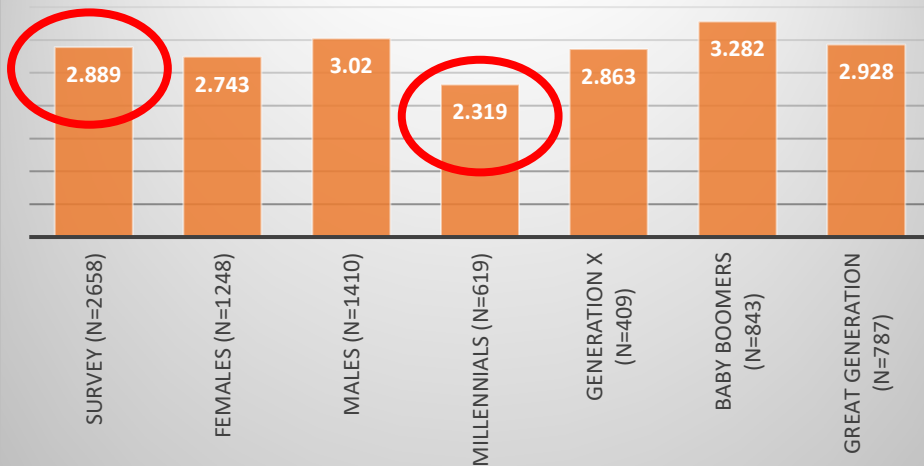
Low-Income Households (< \$50,000)



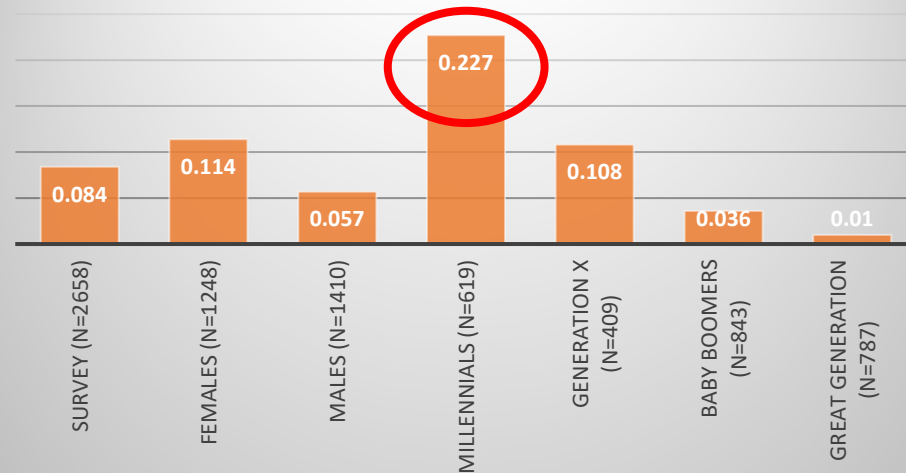
PRELIMINARY RESULTS

■ Respondent & Household Demographics

Household Vehicle Ownership



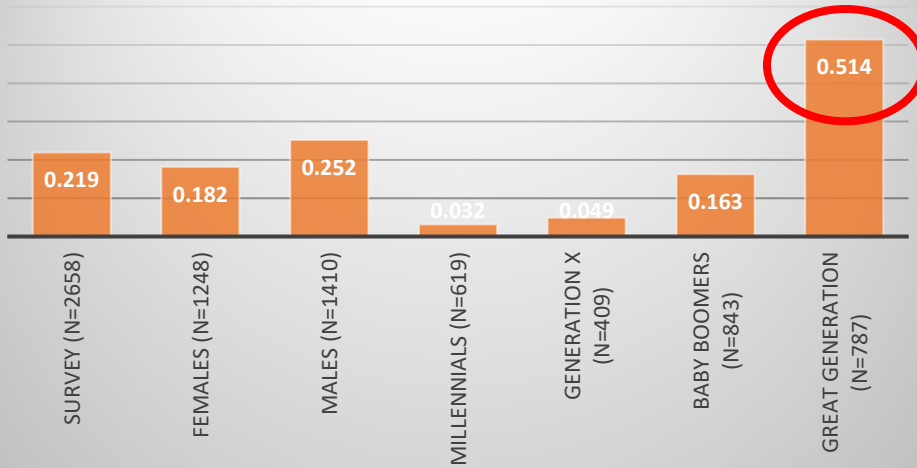
Zero Vehicle Households



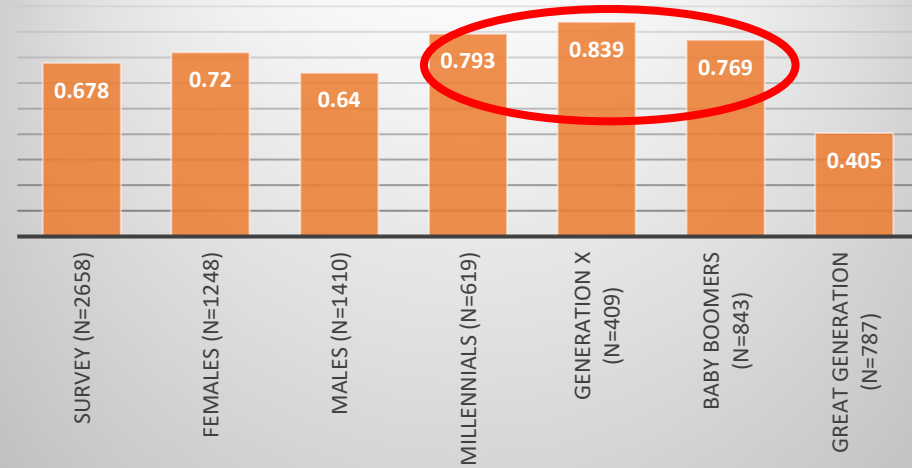
PRELIMINARY RESULTS

■ Current Travel Characteristics & Crash History

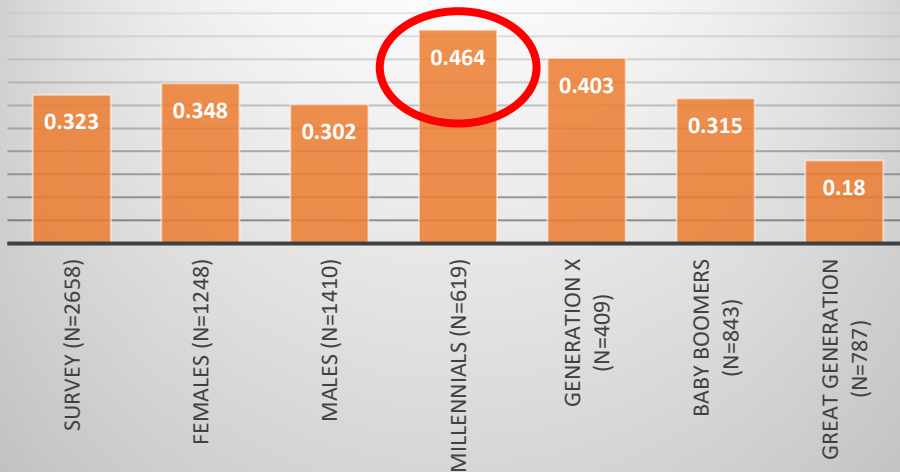
Non-Commuters



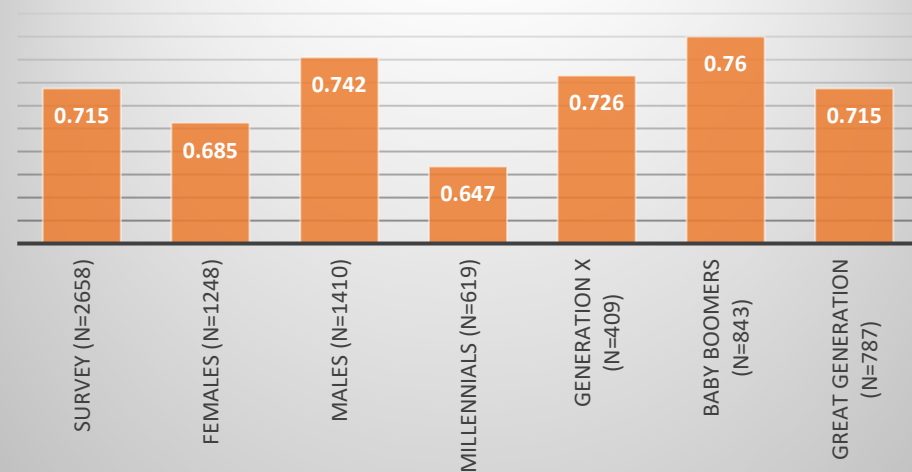
Drive Alone Commuters



Total Daily Travel Time 60+ minutes



Crash Involvement



PRELIMINARY RESULTS

- Higher shares of millennials “not at all familiar”..??

Familiarity with AVs



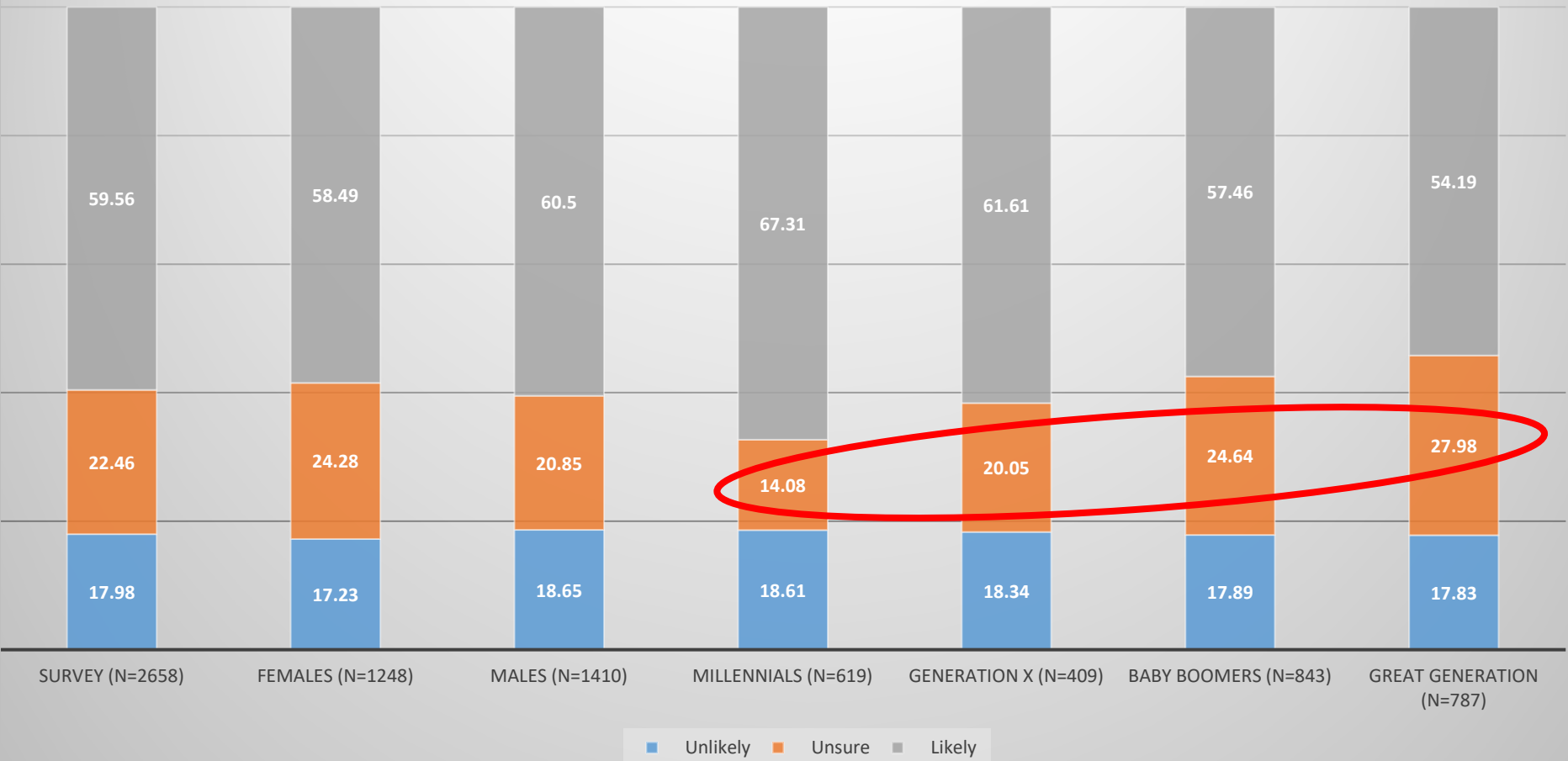
PRELIMINARY RESULTS

Consumers' Opinions on Potential Benefits with AVs (n=2658)



PRELIMINARY RESULTS

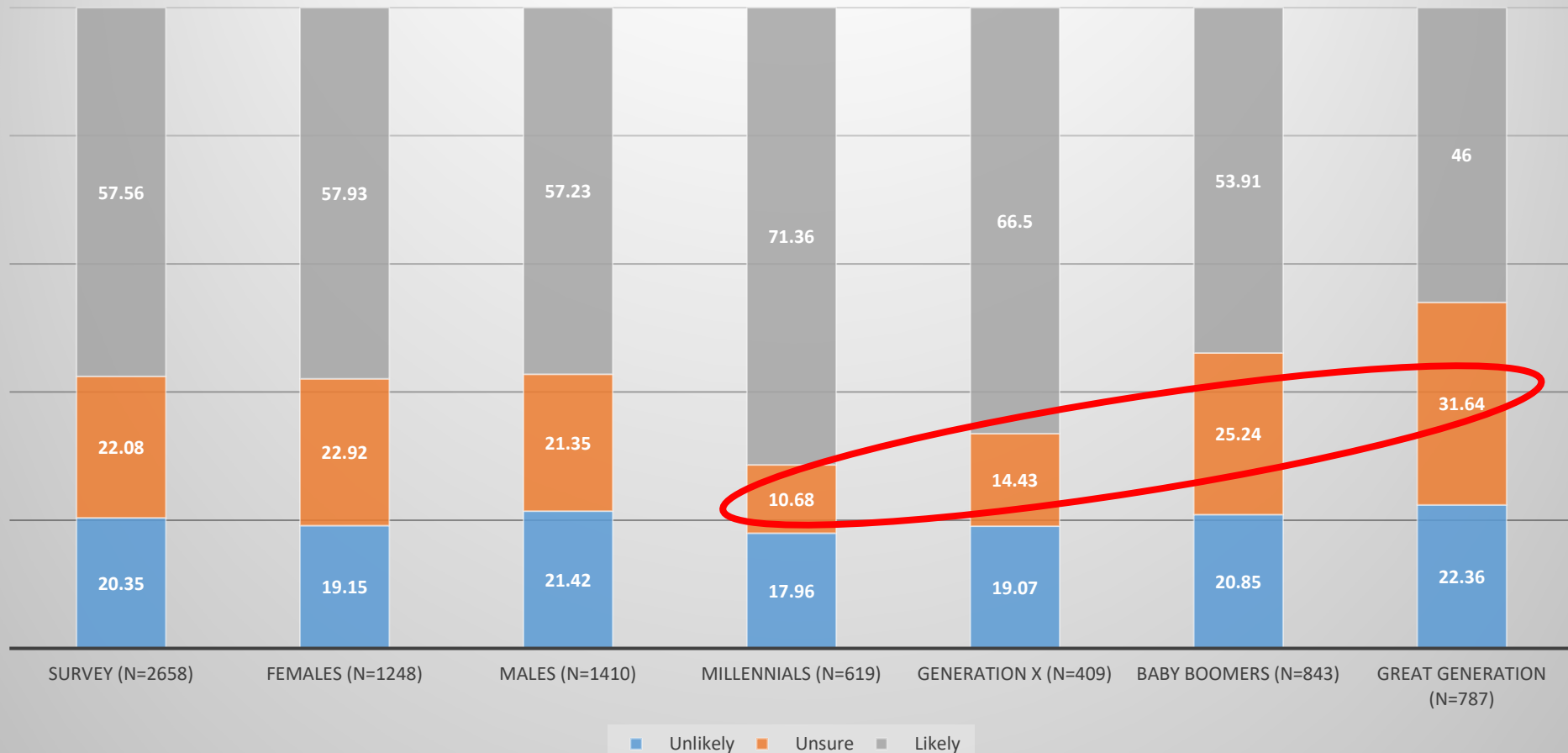
Fewer traffic crashes/increased roadway safety



PRELIMINARY RESULTS

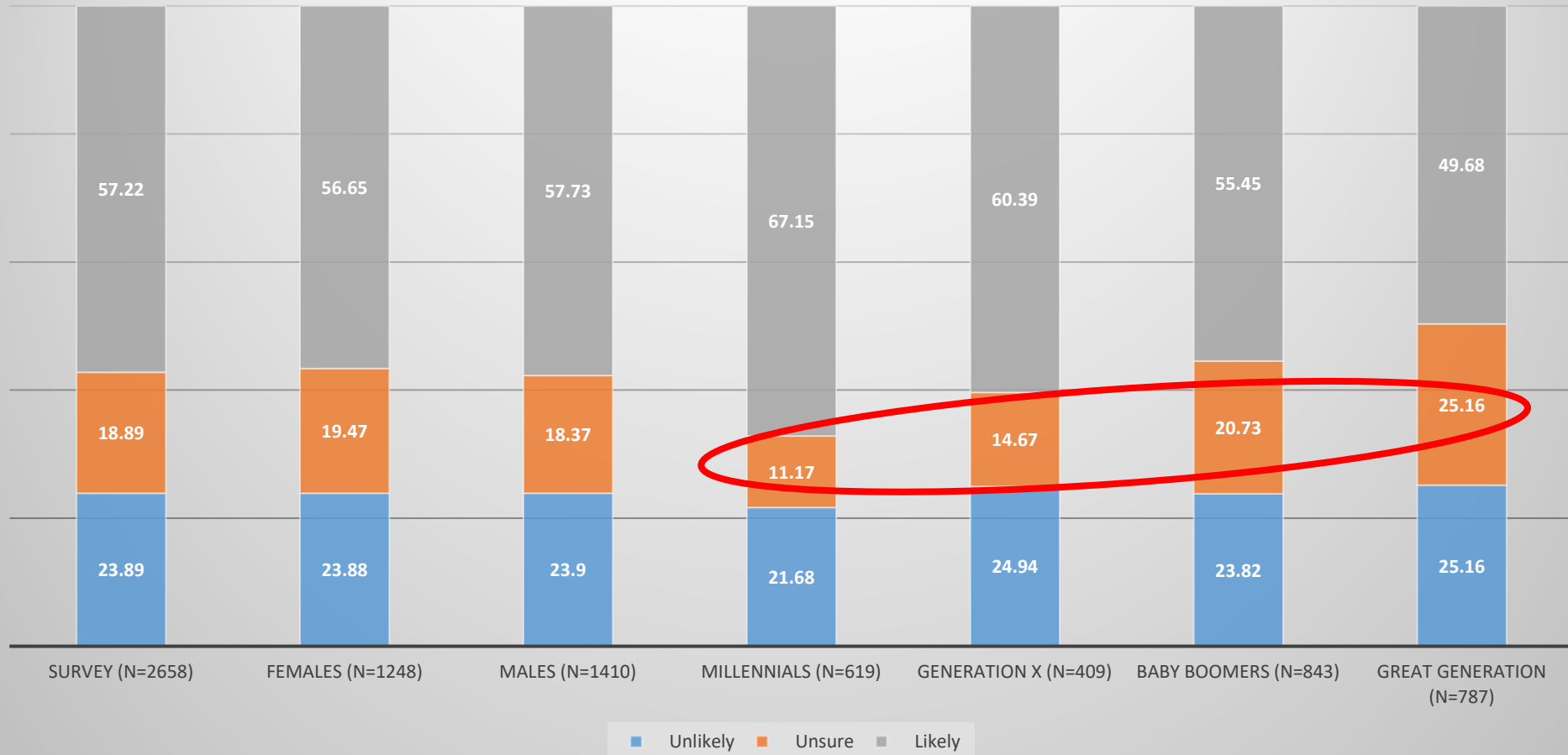
- Higher ages → higher uncertainty regarding AV benefits

More productive (than driving) use of travel time



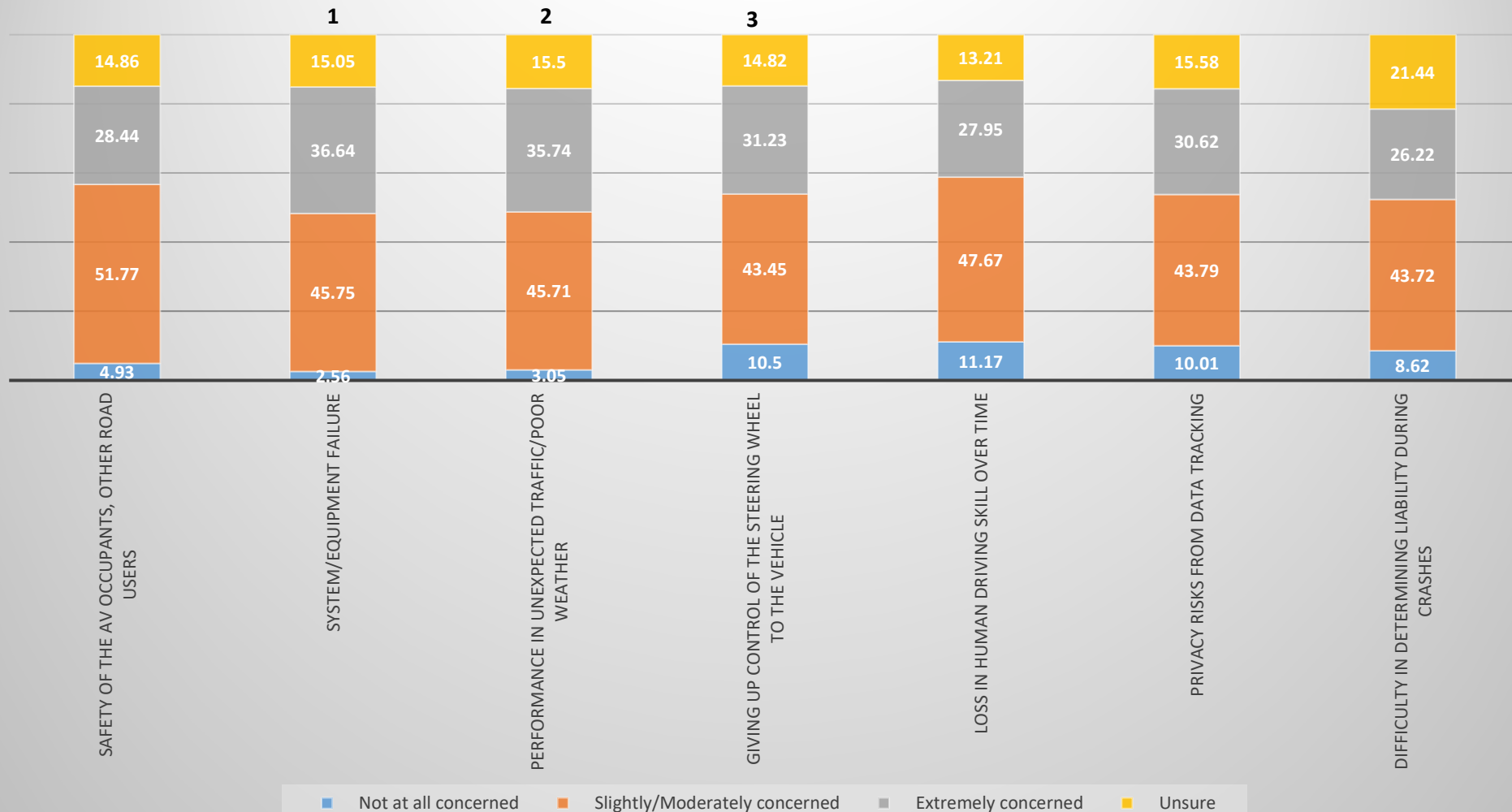
PRELIMINARY RESULTS

Less stressful driving experience



PRELIMINARY RESULTS

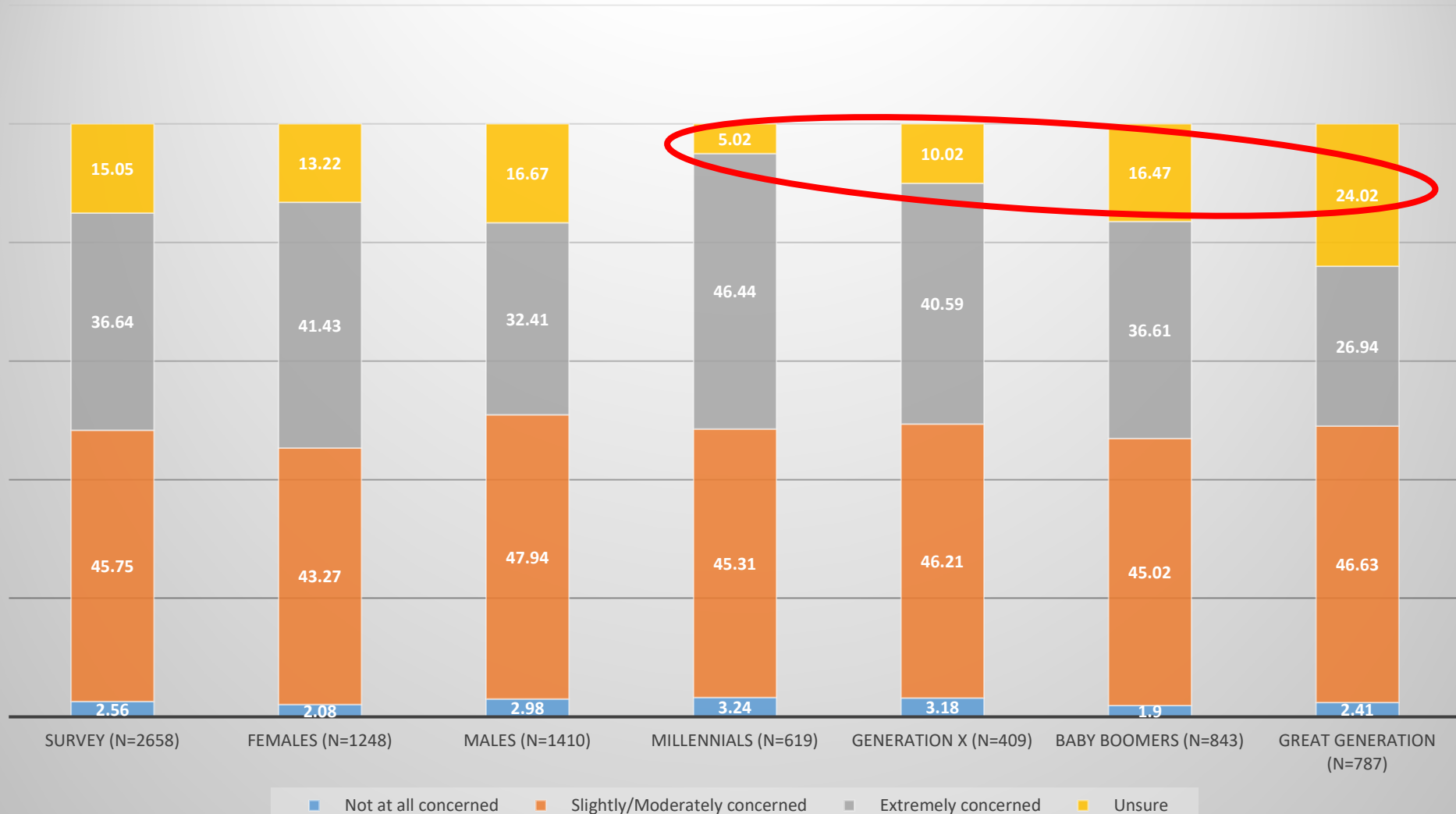
Consumers' Opinions on Potential Concerns with AVs (n=2658)



PRELIMINARY RESULTS

- Gen-X-ers and Boomers most concerned about safety

System/equipment failure



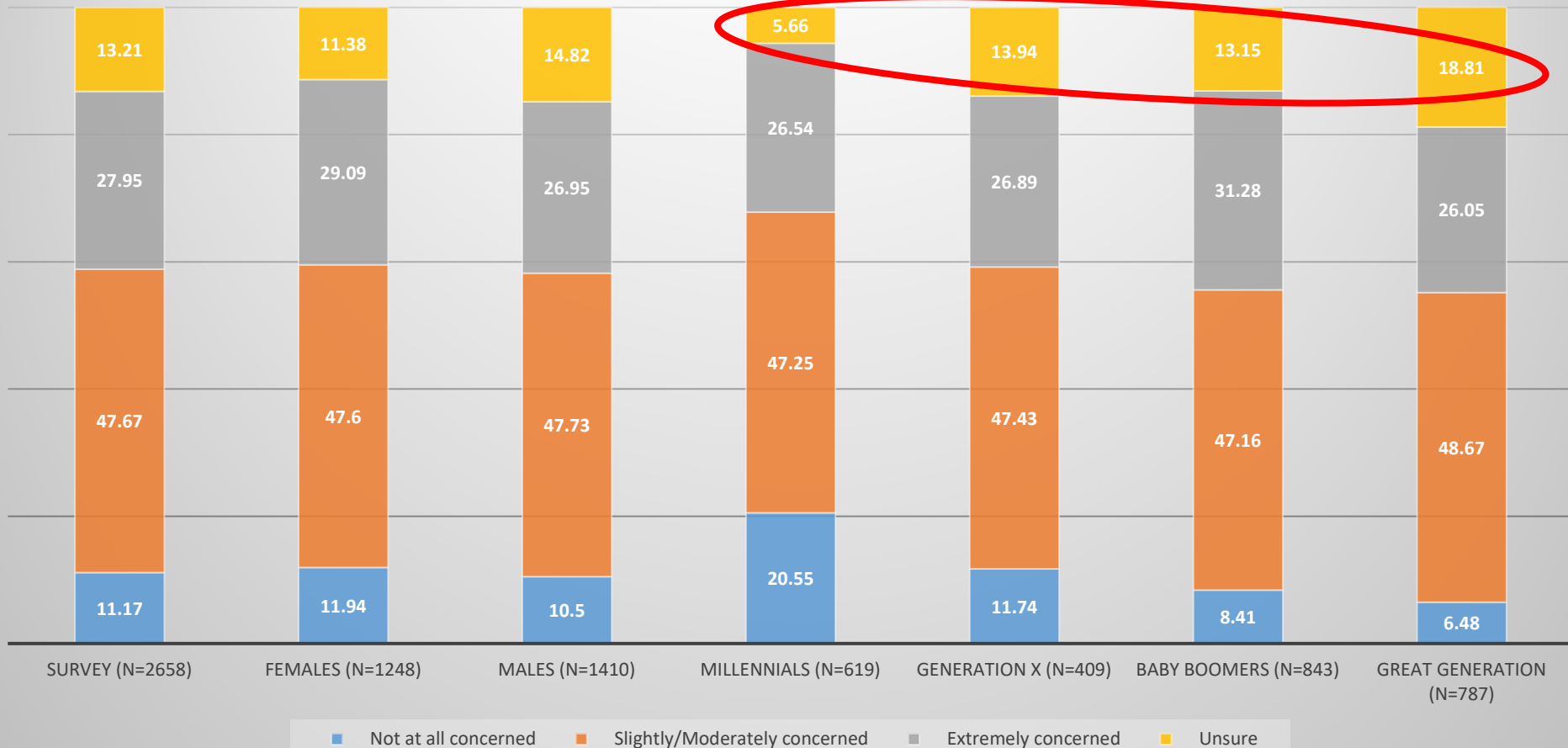
PRELIMINARY RESULTS

Performance in unexpected traffic/poor weather



PRELIMINARY RESULTS

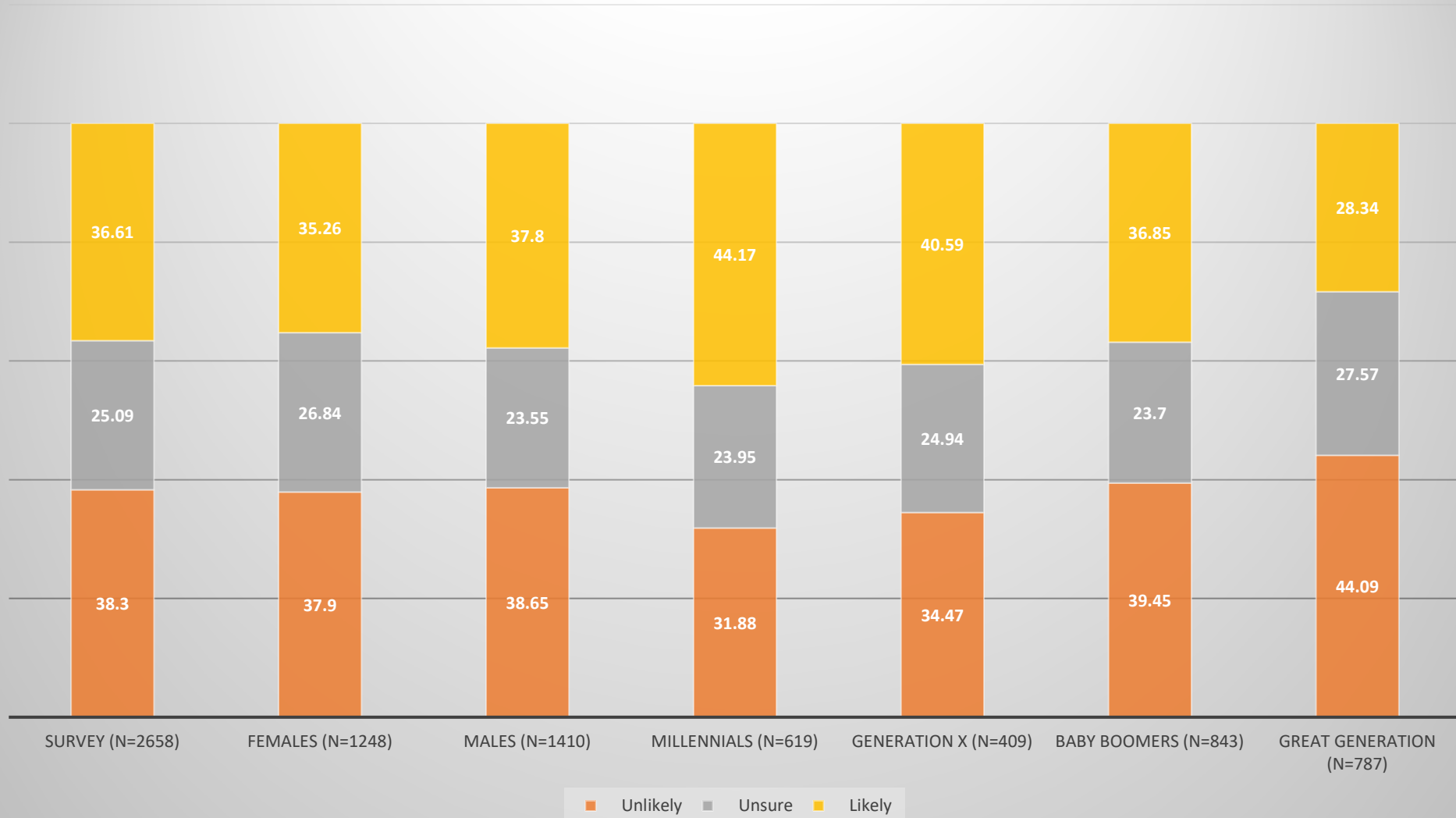
Loss in human driving skill over time



PRELIMINARY RESULTS

- One-fourth of respondents unsure about adoption

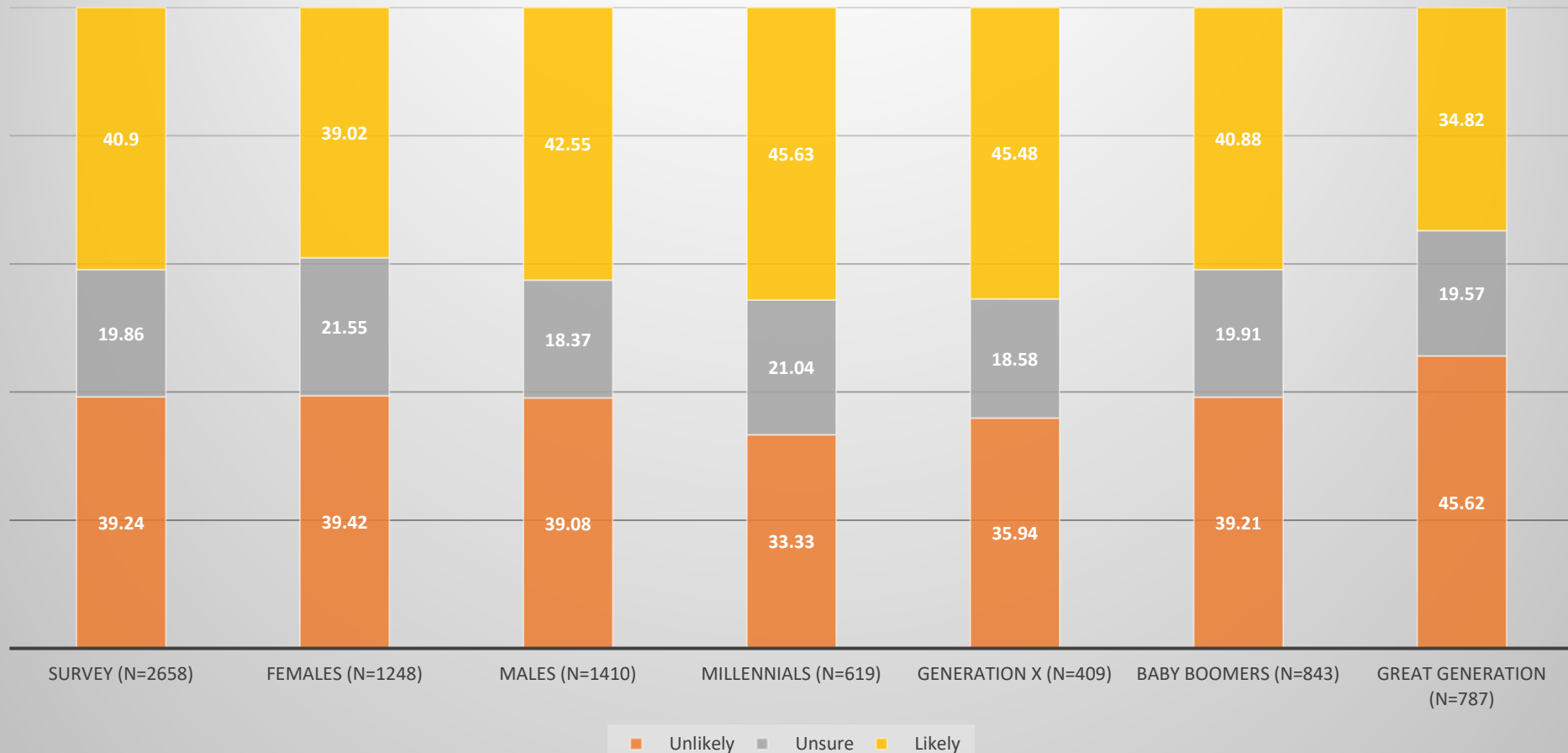
Likelihood of using AVs when they become available (before)



PRELIMINARY RESULTS

- Providing information → less uncertainty about adoption

Likelihood of using AVs when they become available (after)



METHODOLOGY

■ Two–Step Cluster Analysis

- objective: **restructure data into groups** – high degree of association with elements of each group (Tan, 2006)
- **uncover respondent subgroups** with diverse characteristics → insights into decision-making processes (Guo et al., 2015)
- **simultaneously handle** continuous & categorical variables; **flexibility** in defining **number of clusters** – preferred over hierarchical or portioning cluster analysis (Chui et al., 2001)
- used in **transportation literature** for several decades

■ Current Study – **11** perception variables (**5B+6C**)

- **4** consumer market segments obtained using **SPSS 23** (IBM Corp, 2014)
- **Benefits-Dominated** Market Segment
- **Concerns-Dominated** Market Segment
- **Uncertain** Market Segment
- **Well-Informed** Market Segment

METHODOLOGY

■ Multinomial Logit Model

- determines **characteristics** that make respondents more/less likely {one of the market segments}

$$MS_{in} = \beta_n X_{in} + \varepsilon_{in},$$

- error term → **generalized extreme value** distributed
- **extreme value Type 1** – most common EV distribution – chosen for computational convenience – similar to normal dist. (Washington et al., 2011)

$$P_n(i) = \frac{EXP[\beta_i X_{in}]}{\sum_{\forall I} EXP(\beta_I X_{In})}$$

- estimation of parameters by maximum-likelihood

■ Likelihood ratio tests

- male vs female → $X^2 = -2[LL(\beta_{total}) - LL(\beta_{male}) - LL(\beta_{female})]$ ✗
- university vs non-university → $X^2 = -2[LL(\beta_{total}) - LL(\beta_{uni}) - LL(\beta_{non-uni})]$ ✗

TWO-STEP CLUSTER ANALYSIS

Description of Autonomous Vehicles Perception Variables	Benefits-Dominated Cluster (N=513)	Uncertain Cluster (N=732)	Well-Informed Cluster (N=811)	Concerns-Dominated Cluster (N=602)
Fewer traffic crashes and increased roadway safety	4.65	3.08	4.14	2.47
Less stressful driving experience	4.62	2.89	4.21	2.27
Less traffic congestion	4.18	2.46	3.35	4.89
More productive (than driving) use of travel time	4.57	2.97	4.24	2.57
Increased fuel efficiency	4.21	3.07	3.85	2.69
Safety of the vehicle occupants and other road users such as pedestrians, bicyclists	2.35	3.43	4.26	4.43
System/equipment failure or AV system hacking	2.77	3.48	4.4	4.73
Performance in (or response to) unexpected traffic situations, poor weather conditions	2.82	3.49	4.44	4.64
Difficulty in determining who is liable in the event of a crash	2.46	3.15	3.63	4.52
Privacy risks from data tracking on my travel locations and speed	2.68	3.07	3.67	4.59
Loss in human driving skill over time	2.46	3.34	3.45	4.49
Likelihood of adopting autonomous vehicles when they become available in the market	4.24	2.54	3.39	1.74

ESTIMATION FINDINGS






Variable Description	Estimated Parameter (t statistic)	Marginal Effects by segment			
		Benefits Dominated	Uncertain	Well Informed	Concerns Dominated
Factors for the benefits-dominated market segment					
Male Respondent Indicator	0.361 (3.33)	0.0543	-0.0183	-0.0210	-0.0150
University Respondent Indicator	0.405 (3.04)	0.0610	-0.0205	-0.0236	-0.0168
Commute Distance Indicator (20+ miles one-way)	0.445 (3.28)	0.0670	-0.0225	-0.0259	-0.0185
Overall Daily Travel Time Indicator (45 minutes or less)	0.250 (2.31)	0.0377	-0.0127	-0.0146	-0.0104
Parking Time Indicator (10+ minutes)	0.223 (1.75)	0.0337	-0.0113	-0.0130	-0.0093
Factors for the uncertain market segment					
Constant	0.968 (7.41)				
Generation X Indicator	-0.336 (-2.22)	0.0170	-0.0660	0.0276	0.0213
Licensed Driver Household Indicator (3+ licensed drivers)	-0.274 (-2.32)	0.0139	-0.0537	0.0225	0.0173
Non-Commuter Indicator	0.257 (2.23)	-0.0130	0.0505	-0.0212	-0.0163
Factors for the well-informed market segment					
Constant	0.844 (6.77)				
Millennial Indicator	0.603 (5.76)	-0.0352	-0.0486	0.1253	-0.0405
Commute Time Indicator (60 + minutes)	0.339 (1.69)	-0.0198	-0.0278	0.0704	-0.0228

ESTIMATION FINDINGS




Variable Description	Estimated Parameter (t statistic)	Marginal Effects by segment			
		Benefits Dominated	Uncertain	Well Informed	Concerns Dominated
Factors for the concerns-dominated market segment					
Constant	1.147 (7.23)				
Baby Boomer Indicator	0.359 (3.31)	-0.0149	-0.0227	-0.0241	0.0617
Household Income Indicator (\$150,000 + per annum)	-0.263 (-1.77)	0.0109	0.0166	0.0177	-0.0453
Graduate Indicator	-0.239 (-2.21)	0.099	0.0151	0.0160	-0.0411
Vehicle Ownership Indicator (3+ vehicles)	0.353 (2.14)	-0.0147	-0.0223	-0.0237	0.0607
Vehicle Purchase Category Indicator (most recently purchased or leased a new vehicle)	-0.211 (-2.11)	-0.0147	-0.0223	-0.0237	0.0607
Drive Alone Commuter	-0.414 (-3.77)	0.0172	0.0262	0.0278	-0.0712
Major Injury Severity Indicator	-0.295 (-2.21)	0.0123	0.0187	0.0199	-0.0508
Number of observations	2477				
Log-likelihood at zero	-3393.299				
Log-likelihood at convergence	-3319.390				

ESTIMATION FINDINGS



BENEFITS-DOMINATED SEGMENT

Parameter	Effect
Male	
University Respondents	
Commute Distance (20+ mi one-way)	
Daily Travel Time (45 mins or less)	
Parking Time (10+ mins)	








UNCERTAIN SEGMENT

Parameter	Effect
Generation-X Respondents ^{GG}	
Licensed driver (3+ drivers)	
Non-Commuter	



WELL-INFORMED SEGMENT

Parameter	Effect
Millennial ^{GG}	
Commute time (60+ mins one-way)	

CONCERNS-DOMINATED SEGMENT

Parameter	Effect
Baby Boomer ^{GG}	
Household Income (\$150,000+)	
Graduate	
Drive Alone	
Major Injury Severity	
Vehicle Ownership (3+ vehicles)	
New Vehicle Purchase (Own/Lease)	

LEGEND

Parameter	Effect
Positive Fixed Parameter	
Negative Fixed Parameter	

MAIN FINDINGS

- Males → higher prob. – benefits-dominated
- Millennials → higher prob. – well-informed; Gen-X-ers → lower prob. – uncertain; Baby Boomers → higher prob. – concerns-dominated w.r.t. great generation
- Graduates → lower prob. – concerns-dominated
- High-Income HH → lower prob. – concerns-dominated
- Multi-vehicle HH → higher prob. – concerns-dominated
- Recently purchased new vehicle → lower prob. – concerns-dominated
- Major injury in respondent-involved crash → lower prob. – concerns-dominated

UNDERSTANDING INTENDED ADOPTION

- **Previous analysis** → better understanding on the **makeup** of consumer market segments
- **Correlations** between segment-wise perceptions and adoption helpful but does not address influencing factors



- **Ordered probit models** (with random parameters) → factors influencing consumers' **likelihood of adopting AVs**

METHODOLOGY

- **Ordered probability modeling approach** accounts for ordering of the data (from *extremely unlikely* to *extremely likely*)

$$P(y = 1) = \Phi(-\beta X)$$

$$P(y = 2) = \Phi(\mu_1 - \beta X) - \Phi(-\beta X)$$

$$P(y = 3) = \Phi(\mu_2 - \beta X) - \Phi(\mu_1 - \beta X)$$

$$P(y = 4) = \Phi(\mu_3 - \beta X) - \Phi(\mu_2 - \beta X)$$

$$P(y = 5) = 1 - \Phi(\mu_{t-1} - \beta X),$$

- $+\beta \rightarrow$ increase in X , increases the probability of *extremely likely*, decreases the probability of *extremely unlikely*; interior categories – average marginal effects
- **Unobserved heterogeneity** \rightarrow explanatory variables varying across observations \rightarrow normally distributed random parameters – simulated MLE – 500 Halton draws

METHODOLOGY

- Likelihood ratio tests

- cluster 1 vs cluster 2 vs cluster 3 vs cluster 4 $\rightarrow -2[LL(\beta_{total}) - LL(\beta_{cluster1}) - LL(\beta_{cluster2}) - LL(\beta_{cluster3}) - LL(\beta_{cluster4})]$ ✓
- university vs non-university models $\rightarrow \chi^2 = -2[LL(\beta_{total}) - LL(\beta_{uni}) - LL(\beta_{non-uni})]$ ✗
- random parameters vs fixed parameters models $\rightarrow \chi^2 = -2[LL(\beta_{total}) - LL(\beta_{random}) - LL(\beta_{fixed})]$ BD - ✓; U - ✗; WI - ✓; CD - ✗

- Benefits-dominated market segment – 7 random parameters

- millennials, baby boomers, Hispanic/black, non-commuters, short one-way commute distance, long one-way commute time, low parking time

- Well-Informed market segment – 6 random parameters

- male, whites, high income HH, two-person HH, long one-way commute time, zero vehicle HH

ESTIMATION FINDINGS

	Benefits-Dominated		Uncertain		Well-Informed		Concerns-Dominated	
Variable Description	Estimated Parameter	t statistic	Estimated Parameter	t statistic	Estimated Parameter	t statistic	Estimated Parameter	t statistic
Constant	4.537	9.95	0.510	5.11	2.758	11.08	0.426	2.58
Male Respondent Indicator*	--	--	--	--	0.271 (0.278)	3.27 (4.85)	-0.253	-2.48
Millennial Indicator*	0.154 (0.875)	0.66 (7.08)	--	--	--	--	--	--
Baby Boomer Indicator*	0.440 (1.403)	1.97 (8.91)	--	--	-0.315	-2.61	--	--
Great Generation Indicator	-0.672	-2.90	--	--	-0.640	-4.99	0.289	2.42
White Respondent Indicator*	--	--	--	--	-0.087 (0.325)	-0.81 (7.19)	-0.273	-2.03
Hispanic/Black Respondent Indicator*	0.924 (2.604)	3.18 (8.08)	--	--	--	--	--	--
Household Income Indicator (<\$50,000)	--	--	-0.316	-3.23	--	--	-0.221	-1.82
Household Income Indicator* (>\$100K)	0.420	2.70	--	--	0.147 (0.642)	1.69 (9.15)	--	--
Two-Person Household Indicator*	--	--	--	--	-0.021 (0.648)	-0.25 (10.42)	--	--

ESTIMATION FINDINGS

Non-Commuter Indicator*	0.362 (1.259)	1.79 (7.19)	--	--	--	--	--	--
Drive Alone Commuter Indicator	--	--	0.308	3.49	--	--	--	--
Commute Distance * (<5 miles)	-0.390 (1.501)	-2.20 (8.38)	-0.187	-1.65	--	--	--	--
Commute Time* (45+ mins one-way)	0.523 (1.578)	2.35 (6.70)	--	--	0.262 (0.537)	2.14 (4.78)	--	--
Daily Travel Time (< 30 mins)	--	--	0.210	2.20	--	--	--	--
Daily Travel Time (90+ mins)	--	--	--	--	--	--	-0.368	-2.21
Parking Time* (5 mins or less)	-0.008 (1.463)	-0.06 (12.42)	--	--	--	--	-0.332	-3.08
Vehicle Ownership* (Zero Vehicles)	--	--	--	--	0.575 (0.858)	3.59 (5.82)	--	--
Vehicle Ownership (> 1 vehicle)	-0.589	-3.93	--	--	--	--	--	--
Vehicle Ownership (3+ vehicles)	--	--	-0.162	-1.66	--	--	--	--
New Vehicle Purchase (Own/Lease)	0.717	4.98	--	--	0.279	3.24	--	--
Used Vehicle Purchase (Own/Lease)	--	--	--	--	--	--	-0.183	-1.80
Crash Involvement Indicator	0.261	1.73	--	--	--	--	--	--

ESTIMATION FINDINGS

Threshold, μ_1	1.282	4.19	0.671	16.65	0.948	11.60	0.732	13.86
Threshold, μ_2	2.676	8.05	1.451	28.03	1.715	18.62	1.491	18.01
Threshold, μ_3	5.360	13.91	2.600	27.35	3.366	28.68	2.159	15.63
Number of observations	468		681		761		567	
Log-likelihood at convergence	-488.478		-990.081		-1060.194		-631.104	

ESTIMATION FINDINGS

Variable Description	Marginal Effects (Benefits-Dominated Market Segment)				
	Extremely Unlikely	Unlikely	Unsure	Likely	Extremely Likely
Millennial Indicator	-0.0000002	-0.000005	-0.003	-0.055	0.059
Baby Boomer Indicator	-0.0000004	-0.00011	-0.008	-0.162	0.170
Great Generation Indicator	0.000003	0.0005	0.025	0.211	-0.236
Hispanic/Black Respondent	-0.000004	-0.00012	-0.010	-0.345	0.355
Household Income Indicator (>\$100K)	-0.0000004	-0.00012	-0.009	-0.152	0.161
Non-Commuter Indicator	-0.0000003	-0.00009	-0.007	-0.134	0.141
Commute Distance (<5 miles)	0.000001	0.00022	0.012	0.129	-0.141
Commute Time* (45+ mins one-way)	0.0000003	-0.00009	-0.008	-0.197	0.205
Parking Time (5 mins or less)	0.0	0.000002	0.0002	0.003	-0.003
Vehicle Ownership (> 1 vehicle)	-0.0000006	0.00017	0.012	0.214	-0.226
New Vehicle Purchase (Own/Lease)	-0.000001	-0.00033	-0.019	-0.246	0.266
Crash Involvement Indicator	-0.0000004	-0.00011	-0.007	-0.09	0.097

ESTIMATION FINDINGS

Variable Description	Marginal Effects (Uncertain Market Segment)				
	Extremely Unlikely	Unlikely	Unsure	Likely	Extremely Likely
Household Income Indicator (<\$50,000)	0.103	0.023	-0.035	-0.072	-0.018
Drive Alone Commuter Indicator	-0.098	-0.024	0.032	0.071	0.019
Commute Distance (<5 miles)	0.061	0.014	-0.021	-0.043	-0.011
Daily Travel Time (< 30 mins)	-0.067	-0.016	0.022	0.048	0.013
Vehicle Ownership (3+ vehicles)	0.052	0.013	-0.017	-0.037	-0.01

ESTIMATION FINDINGS













Variable Description	Marginal Effects (Well-Informed Market Segment)				
	Extremely Unlikely	Unlikely	Unsure	Likely	Extremely Likely
Male Respondent Indicator	-0.018	-0.050	-0.038	0.068	0.038
University Respondent Indicator	0.045	0.110	0.068	-0.152	-0.07
Baby Boomer Indicator	0.023	0.061	0.040	-0.085	-0.039
Great Generation Indicator	0.057	0.127	0.067	-0.180	-0.071
White Respondent Indicator	0.005	0.016	0.013	-0.021	-0.013
Household Income Indicator (>\$100K)	-0.009	-0.027	-0.021	0.036	0.021
Two-Person Household Indicator	0.001	0.004	0.003	-0.005	-0.003
Commute Time (45+ mins one-way)	-0.014	-0.046	-0.040	0.059	0.041
Vehicle Ownership (Zero Vehicles)	-0.024	-0.088	-0.094	0.097	0.110
New Vehicle Purchase (Own/Lease)	-0.018	-0.052	-0.039	0.071	0.038

ESTIMATION FINDINGS






Variable Description	Marginal Effects (Concerns-Dominated Market Segment)				
	Extremely Unlikely	Unlikely	Unsure	Likely	Extremely Likely
Male Respondent Indicator	0.100	-0.030	-0.042	-0.020	-0.007
University Respondent Indicator	-0.191	0.044	0.083	0.045	0.019
Great Generation Indicator	-0.115	0.031	0.049	0.024	0.010
White Respondent Indicator	0.108	-0.028	-0.047	-0.024	-0.01
Household Income Indicator (<\$50,000)	0.086	-0.029	-0.036	-0.016	-0.006
Daily Travel Time (90+ mins)	0.141	-0.052	-0.057	-0.023	-0.008
Parking Time* (5 mins or less)	0.131	-0.037	-0.056	-0.027	-0.011
Used Vehicle Purchase (Own/Lease)	0.072	-0.023	-0.30	-0.014	-0.005

ESTIMATION FINDINGS





BENEFITS-DOMINATED SEGMENT

Parameter	Effect
Millennials	
Baby Boomers	
Great Generation	
Hispanic/Black	
Household Income (\$100,000+)	
Non-Commuter	
Commute Distance (< 5 miles)	
Commute time (45+ minutes)	
Parking Time (< 5 minutes)	
Vehicle Ownership (> 1 vehicle)	
New Vehicle Purchase (Own/Lease)	
Crash Involvement	

UNCERTAIN SEGMENT











Parameter	Effect
Household Income (< \$50,000)	
Drive Alone	
Commute Distance (< 5 miles)	
Daily Travel Time (< 30 minutes)	
Vehicle Ownership (3+ vehicles)	

LEGEND









Parameter	Effect
Positive Random Parameter	
Positive Fixed Parameter	
Negative Random Parameter	
Negative Fixed Parameter	

ESTIMATION FINDINGS





WELL-INFORMED SEGMENT

Parameter	Effect
Male	
University Respondent	
Baby Boomers	
Great Generation	
White	
Household Income (\$100,000+)	
Two-person Household	
Commute time (45+ minutes)	
Vehicle Ownership (Zero Vehicles)	
New Vehicle Purchase (Own/Lease)	

CONCERNS-DOMINATED SEGMENT

Parameter	Effect
Male	
University Respondent	
Great Generation	
White	
Household Income (< \$50,000)	
Daily Travel Time (90+ minutes)	
Parking Time (< 5 minutes)	
Used Vehicle Purchase (Own/Lease)	

LEGEND

Parameter	Effect
Positive Random Parameter	
Positive Fixed Parameter	
Negative Random Parameter	
Negative Fixed Parameter	

MAIN FINDINGS

- **Gender** – significant but variable impact on AV adoption
 - males in **well-informed** market segments – **more likely to adopt AVs**; males in **concerns-dominated** market segments – **less likely to adopt AVs**
 - Gender insignificant in **benefits-dominated** & **uncertain** market segments
- Different **generations** behave differently on AV adoption
 - not all **millennials** & **baby boomers** behave the same way in a **benefits-dominated** market segment
 - **Great-generation less likely** to adopt AVs in a benefits-dominated & **well-informed** market segment; **more likely** in **concerns-dominated** market segment
 - Generational-level influence absent in **uncertain** market segments
- **Household Income** – significant influence in AV adoption
 - **low-income HH** – **less likely** to adopt AVs in **uncertain** & **concerns-dominated** market segments; **high-income HH** – complex in **well-informed**

MAIN FINDINGS

- **Current Vehicle Ownership** – interesting insights on AV adoption
 - multi-vehicle HH in **benefits-dominated** & **uncertain** – **less likely** to adopt AVs → possible entrenchment to the driving culture
 - not all **zero vehicle HH** in **well-informed** market segments behave same way
- **Recent vehicular purchase** – indicators for potential adoption
 - **new vehicle** purchase in **benefits-dominated** & **well-informed** – **more likely** to adopt AVs – possible presence of **safety/automation features**
 - **used vehicles** – **less likely** to adopt AVs
- Study enhanced **understanding of intended adoption** across **market segments**
 - **same influencing factor behaves differently** across different **market segments** – **targeted marketing** for adoption

THANK YOU

Speaker

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