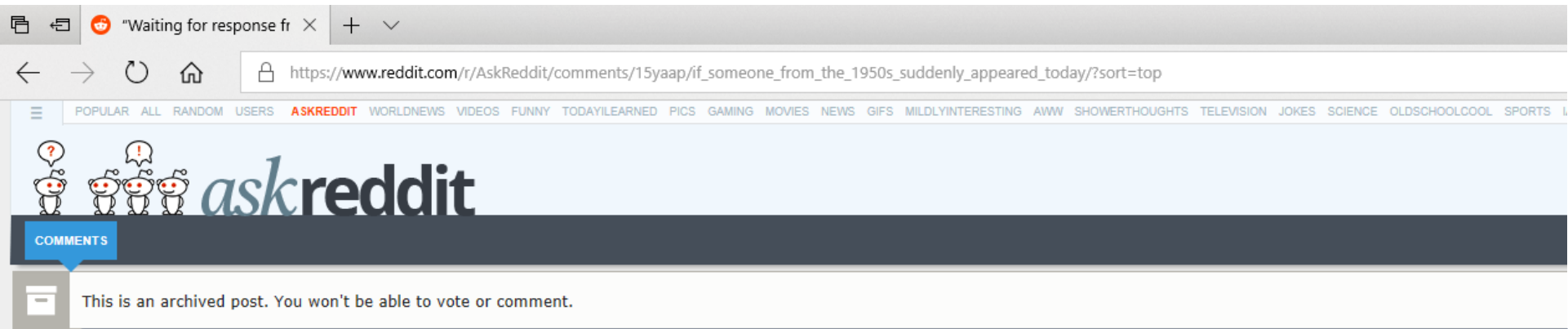


Discussing the “positive utilities”  
of autonomous vehicles:

Will travelers really  
use their time productively?

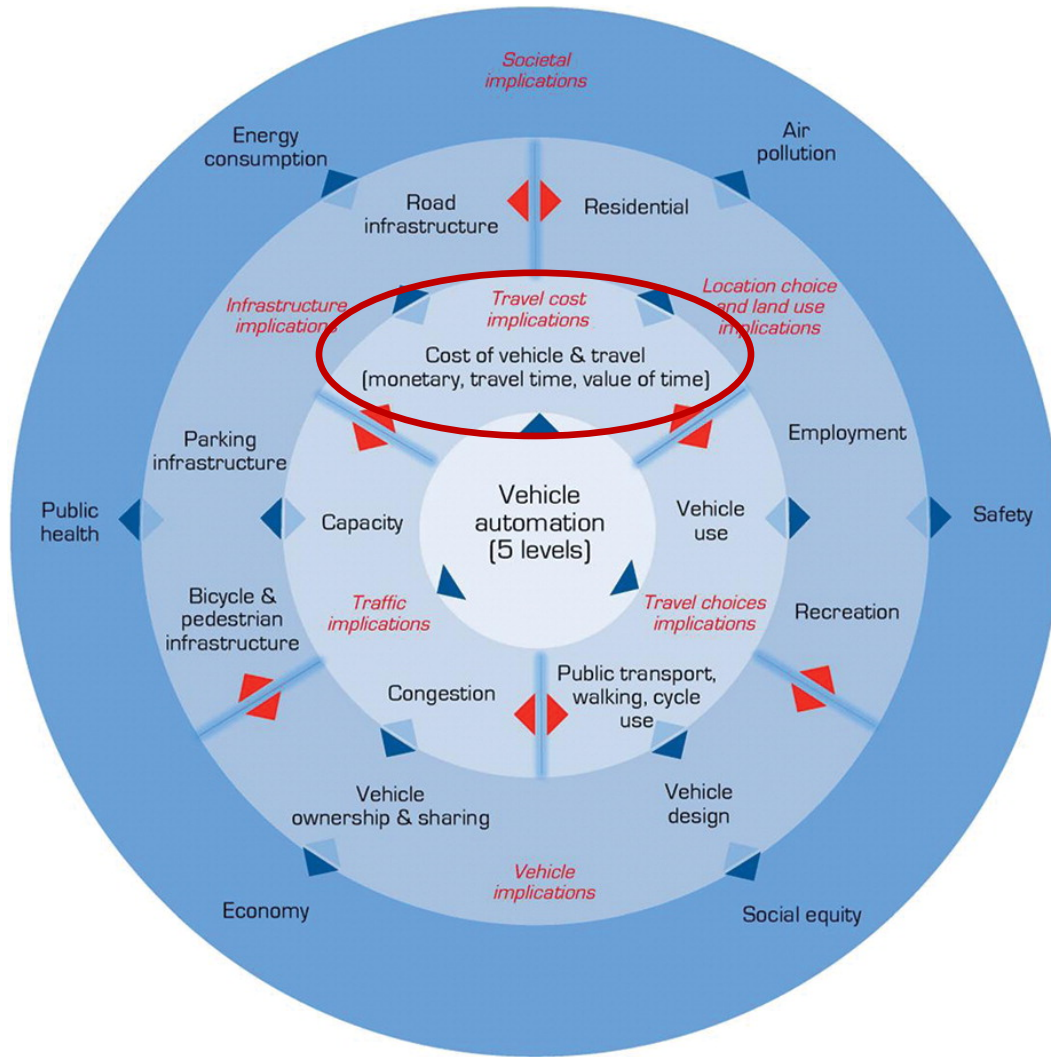
Patrick A. Singleton, Ph.D. – Utah State University  
2018 Urbanism Next Conference – 5 March 2018 – Portland, OR



**Q:** If someone from the 1950s suddenly appeared today, what would be the most difficult thing to explain to them about life today?

**A:** I possess a device [a smartphone], in my pocket, that is capable of accessing the entirety of information known to man.  
I use it to look at pictures of cats and get in arguments with strangers.

# Autonomous vehicles → Travel behavior



## ∞ Potential implications

- ∞ ↑ Highway capacity
- ∞ ↑ Intersection capacity
- ∞ ↑ Mobility
- ∞ ↑ Vehicle miles traveled

∞ ↓ Traffic crashes & injuries

∞ ↓ Vehicle ownership

∞ ↓ Parking demand

∞ ↓ Value of travel time



# AVs $\rightarrow$ $\downarrow$ Value of time (VOT) $\rightarrow$ $\uparrow$ VMT

- ⌘ Subjective value of travel time savings  $\rightarrow$  value of (travel) time (VOT)
  - ⌘ Willingness to pay for marginal reduction in travel time (\$/min or \$/hr)
- ⌘ Travel-based multitasking = engaging in other activities while traveling



# Simulation studies: some +50% ↓ VOT

Study	Area	AV VOT Assumptions
Gucwa, 2014	San Francisco Bay Area, CA	100% of high-quality rail VOT; 50% of car driver VOT; zero
Speiser et al., 2014	Singapore	30% of car driver VOT
Childress et al., 2015	Seattle, WA	65% of car driver VOT (for high-income travelers only)
Davidson & Spinoulas, 2015	Brisbane, Australia	95–75% of car driver VOT (for lower level AVs); 90–50% of car driver VOT (for higher level AVs)
Kim et al., 2015	Atlanta, GA	50% of car driver VOT
van den Berg & Verhoef, 2015	United States, the Netherlands	100–61% of car driver VOT
La Mondia et al., 2016	Michigan	75% of car driver VOT
Wadud et al., 2016	(none)	95% of car driver VOT (for lower level AVs); 50–20% of car driver VOT (for higher level AVs)
Auld et al., 2017	Chicago, IL	100%, 75%, 50%, 25% of car driver VOT
Kockelman et al., 2017	Austin, TX	100% of transit VOT; 50% of car driver VOT; zero

# What do travel behavior/modeling experts think?

★ Travel behavior/modeling “experts” are more skeptical than industry leaders.

∞ Delphi poll of 45 travel modeling experts (Willumsen & Kohli, 2016)

∞ Average 10% ↓ VOT (but wide range of estimates)

∞ Survey of 20 Netherlands transport experts (Milakis, Snelder, et al., 2017)

∞ Most aggressive AV scenario: 18% ↓ VOT (2030), 31% ↓ VOT (2050)

∞ More realistic AV scenarios: 3% ↓ VOT (2030), ~20% ↓ VOT (2050)

∞ Poll of 109 travel survey researchers/practitioners (ISCTSC, 2017)

∞ Will commuters tolerate ↑ TT in AVs? 45% certain, 39% perhaps, 16% no

## Sources:

Willumsen & Kohli (2016) <https://abstracts.aetransport.org/paper/index/id/4789/confid/21>

Milakis, Snelder, et al. (2017) <https://www.tudelft.nl/tbm/over-de-faculteit/afdelingen/engineering-systems-and-services/research/ejtir/back-issues/volume17-2017/>

# How useful is travel-based multitasking?

★ Most multitasking isn't productive/useful, except for long-distance train travel.

- ❧ Review of travel-based multitasking (Keseru & Macharis, 2017)
  - ❧ Train travelers more likely to read, write, rest, sleep, or do any other activities
- ❧ Survey of ~700 commuters in Portland, OR (Singleton, 2017, 2018)
  - ❧ Transit/auto passengers: most common activities not traditionally productive: thinking/daydreaming, viewing scenery or watching people, listening to music
  - ❧ Most activity participation was not (or negatively) associated with mode choice
  - ❧ Common travel-based multitasking may be less about productivity and more about passing the time or coping with burden/boredom of commuting.

## Sources:

Keseru & Macharis (2017) <https://doi.org/10.1080/01441647.2017.1317048>

Singleton (2017) <http://doi.org/10.15760/etd.3447>

Singleton (2018) In press at *Transportation Research Record*.





# What does the general public think?

★ General public may not perceive “productive time use” as a major AV benefit.

- ❧ Survey of 1,000 Germans (Cyganski, Fraedrich, & Lenz, 2015)
  - ❧ Biggest perceived advantages of AVs:
    - ❧ “Enjoy[ing] the trip and the landscape”
    - ❧ “Talk[ing] to companions or other passengers”
  - ❧ ~13% of respondents thought they would use an AV to “work during the trip”
- ❧ Willingness-to-pay for AV features (Bansal et al., 2016; Daziano et al., 2017)
  - ❧ ~\$3,000 for partially-automated; ~\$5,000–7,000 for fully-automated
  - ❧ Non-trivial share of respondents unwilling to pay anything for AV technologies

## Sources:

Cyganski, Fraedrich, & Lenz (2015) <https://trid.trb.org/view.aspx?id=1338518>

Bansal, Kockelman, & Singh (2016) <https://doi.org/10.1016/j.trc.2016.01.019>

Daziano, Sarrias, & Leard (2017) <https://doi.org/10.1016/j.trc.2017.03.003>



# Will AVs feel more like trains or cars?

- ★ AV experience may be closer to a car passenger, with limited multitaskability.
- ∞ Human comfort, performance, and multitasking
  - ∞ Limited ranges of acceleration/deceleration, lateral motion, and jerk
- ∞ Microsimulation study of AV operations (Le Vine, Zolfaghari, & Polak, 2015)
  - ∞ Restricting AV accelerations/decelerations to light-rail transit levels
    - decreased intersection capacity, increased intersection delay
- ∞ Carsickness (Diels & Bos, 2016; Nelson, 2017)
  - ∞  $>2/3$  of the population exhibits motion sickness while riding in a car

## Sources:

Le Vine, Zolfaghari, & Polak (2015) <https://doi.org/10.1016/j.trc.2015.01.002>

Diels & Bos (2016) <https://doi.org/10.1016/j.apergo.2015.09.009>

Nelson (2017) Presented at ACSP 2017.

# What about private vs. shared AVs?

★ Time value efficiencies of AVs may be diminished for shared vehicles/trips.

- ∞ Survey of 556 residents of Austin, TX (Zmud, Sener, & Wagner, 2016)
  - ∞ Most people would rather own an AV than use a shared AV or take a ride-share AV
- ∞ Survey of 435 Australians (Krueger, Rashidi, & Rose, 2016)
  - ∞ VOT impacts: ↓ 45% for ride-alone shared AVs; ↓ 10% for shared-ride AVs
- ∞ Stated preference experiment in Netherlands (Yap, Correia, & van Arem, 2016)
  - ∞ Egress trips from train: VOT for AV car-share > VOT for manual car-share

## Sources:

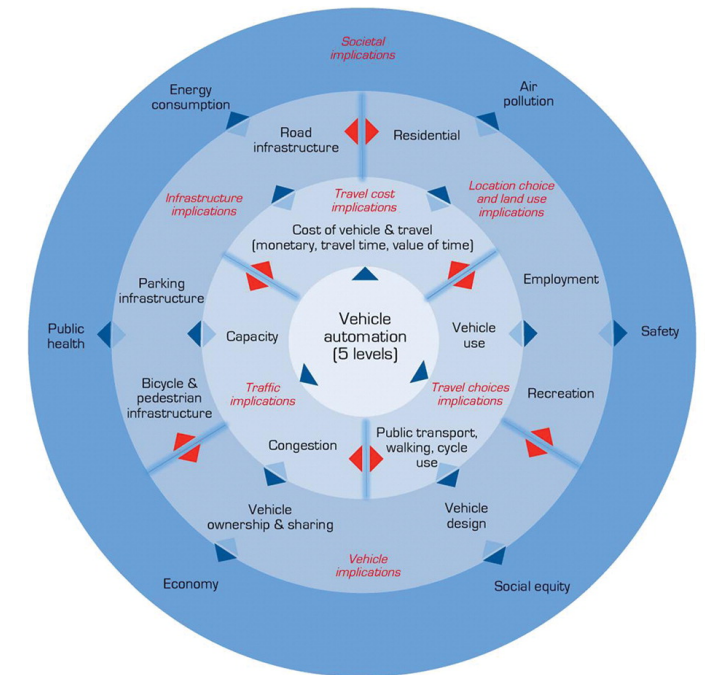
Zmud, Sener, & Wagner (2016) <https://doi.org/10.3141/2565-07>

Krueger, Rashidi, & Rose (2016) <https://doi.org/10.1016/j.trc.2016.06.015>

Yap, Correia, & van Arem (2016) <https://doi.org/10.1016/j.tra.2016.09.003>

# Summary

- Emerging evidence contrary to popular narrative
  - AVs → more productive uses of travel time (for working, reading, being entertained, sleeping, etc.) → reductions in VOT
- Importance: VOT → travel demand → VMT → ...
- Echo others with similar arguments:
  - Cyganski, Fraedrich, & Lenz, 2015
  - Milakis, van Arem, & van Wee, 2017
  - Sivak & Schoettle, 2016



## References:

- Cyganski, Fraedrich, & Lenz (2015) <https://trid.trb.org/view.aspx?id=1338518>  
Milakis, van Arem, & van Wee (2017): <https://doi.org/10.1080/15472450.2017.1291351>  
Sivak & Schoettle (2016) <https://trid.trb.org/view.aspx?id=1480404>



# Questions? Comments?



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Patrick A. Singleton

Assistant Professor  
Civil & Environmental Engineering  
Utah State University

[patrick.singleton@usu.edu](mailto:patrick.singleton@usu.edu)  
435-797-7109

