



Will autonomous cars cure congestion?



Will automated vehicles increase travel demand?



Probably.

Chauffer Experiment

- Give people a chauffer and see what happens
- **Overall:** 76% more miles traveled and longer trips
- **Retirees:** 3x increase in evening driving 2x longer trips.
- **Millennials:** $\frac{3}{4}$ of cohort increased miles.
- 20% “ghost trips” (e.g., to pick up children, friends)



Can autonomous cars improve roadway capacity?



YES.

Automated Highways

- Need cars that talk, coordinate, and drive with high speeds and small gaps
- Up to 2-3x freeway capacity increase (in ideal conditions)
- *Main idea.* Move people/goods close together at high speeds



KTH Truck platoons



[[Shladover et al. 94](#); [Johansson et al. 15](#)]

CARPOOL. Another way to move people together
at high speeds



[The Late Late Show With James Corden] 4

CARPOOL. Another way to move people together
at high speeds



[The Late Late Show With James Corden] 5

Taking the argument further...



**72 people
(bike)**



**72 people
(car)**



**72 people
(bus)**

Taking the argument further...



**72 people
(bike)**



**72 people
(autonomous car)**



**72 people
(bus)**

What to expect from a small number of autonomous vehicles (AVs)



- A few AVs will not eliminate traffic congestion
 - As long as demand exceeds supply...



What to expect from a small number of autonomous vehicles (AVs)



- AVs might not eliminate traffic congestion
 - As long as demand exceeds supply...
- **CLAIM:** A small number of automated vehicles can prevent “phantom jams” →

The screenshot shows the Science magazine website interface. At the top, the word "Science" is prominently displayed in white on a black background, with "AAAS" in smaller letters to its right. Below this is a red navigation bar with white text for "Home", "News", "Journals", "Topics", and "Careers". Underneath the red bar is a black bar with white text for "Latest News", "ScienceInsider", "ScienceShots", "Sifter", "From the Magazine", "About News", and "Quizzes".

The main content area features a video player with a dark background and white text. The title "Traffic Jam without Bottleneck" is at the top in a large, bold font. Below it, the subtitle reads "Experimental evidence for the physical mechanism of forming a jam". The authors' names are listed: "Yuki Sugiyama, Minoru Fukui, Macoto Kikuchi, Katsuya Hasebe, Akihiro Nakayama, Katsuhiro Nishinari, Shin-ichi Tadaki and Satoshi Yukawa". At the bottom of the video player, it says "Movie 1".

To the left of the video player is a "SHARE" section with social media icons for Facebook (with a "3" below it), Twitter, and LinkedIn (with a "32" below it). Below the video player, there is a "Roundabout." section with the text "Too many cars equals a traffic jam, even without an external cause." and the "Mathematical Society of Traffic Flow" logo. Below that is the article title "Traffic Jams Happen, Get Used to It" and the byline "By Dennis Normile | Mar. 28, 2008, 12:00 AM".

[Sugiyama et al. 2008]

Phantom jams occur on real roads too



[Joe Miroe (Youtube), 2017]

Dissipation of stop-and-go traffic waves via control of a single autonomous vehicle



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[Stern, Cui, Delle Monache, Bhadani, Bunting, Churchill, Hamilton, Haulcy, Pohlmann, Wu, Piccoli, Seibold, Sprinkle, & Work, 2017]



Take home messages

- Self driving cars won't solve all of our mobility problems
- But CAVs at moderate penetration rates can help smooth flow – experimentally demonstrated.
- Current autonomous vehicle systems have widely varying qualities, from a traffic perspective.