

Mobile Technology

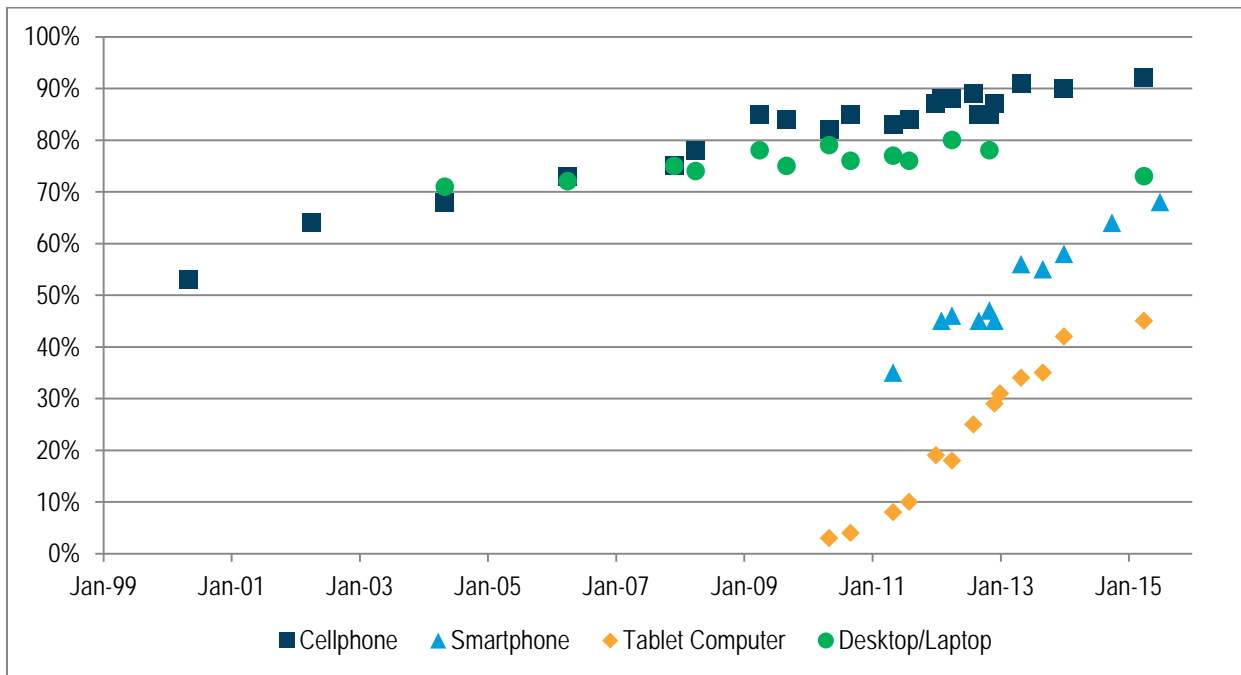
This paper is based on work completed as part of The University of Minnesota's Transportation Futures Project. More information about The Transportation Futures Project can be found on the [project homepage](#).

Development of mobile technologies has occurred at a rapid pace in the United States since the early 2000s. The ways in which people send and receive information and data have changed nearly all facets of day-to-day life for many Americans. This is reflected in many of the other Trend Analysis papers on shifting transportation behavior, changes in shopping and commuting habits, and more. The proliferation of devices that allow people to access the internet has changed how people spend their time while traveling or waiting for transportation, and has the potential to change which modes people prefer all-together.

SMARTPHONES & MOBILE DATA

The development of cellular phone technology and eventually the smartphone has provided a large portion of the population nearly instant access to a wealth of information from any place that they can find Wi-Fi or cellular service. Figure 1 shows the percentage of adults in the United States who own a cell phone, smartphone, tablet, or desktop/laptop computer. Smartphones seem to be providing a more accessible avenue to accessing the internet for low-income residents of the United States than traditional contract broadband service. About 13% of Americans with annual household incomes of below \$30,000 per year are classified by the Pew Research Center as smartphone-dependent for internet access.¹

Figure 1: Percentage of adults in the United States with selected technological devices²



Having access to wireless internet-enabled devices allows people to work, play, shop, read, and more all while on the go, potentially increasing their ability to utilize time spent traveling from one destination to another. The following sections investigate just how people are using travel time to multitask, and what kinds of technological advances are making it possible for people to be more productive while going from point A to point B.

¹ [Smith, 2015](#): Smartphone-dependent users are classified as those who do not have broadband access at home and have relatively few options for accessing the internet than their smartphone.

² [Pew Research Center, 2015](#)

MULTITASKING & TRANSPORTATION

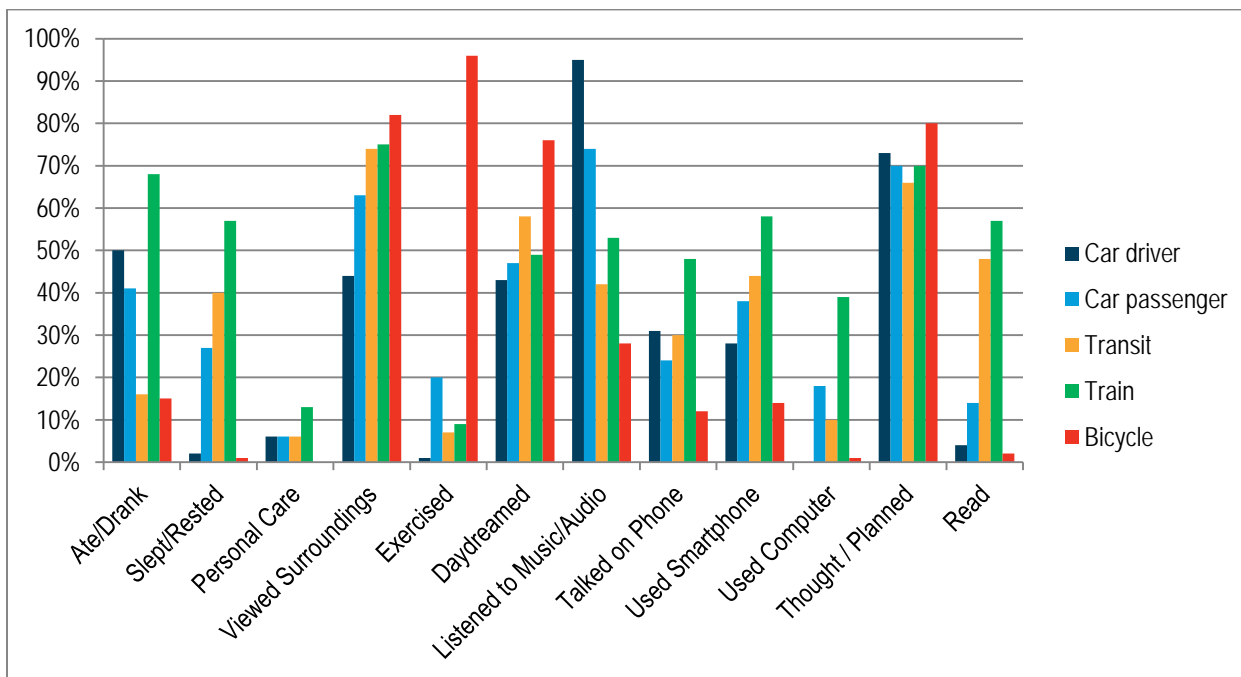
People engage in a wide variety of different activities while traveling. When time spent waiting for a bus, plane, train, or ride to arrive can be utilized with a connected device, the potential for multitasking as part of travel expands dramatically. Combined with the rapidly increasing proliferation of smartphones, tablets, and other portable devices that can access the internet, the possibilities for engaging in connected activities while on the go are seemingly endless.

Multitasking In-Motion

Travelers have always engaged in a variety of activities while traveling, but the scope and style of activities available to people has changed significantly in the last 15 years. Shaving, applying make-up, brushing one's teeth – many people can easily recall even drivers engaging in seemingly bizarre actions while traveling in cars. One might even remember an instance where their grandmother or grandfather proudly described their ability to steer with one knee while eating and breaking up two quarreling kids in the back seat while on the road. When people are not required to pilot the vehicle, whether riding as a passenger in a car or traveling on a bus, train, or airplane they are free to engage in non-piloting activities without the dangers that accompany distracted driving.

The most common activities that people engage in regardless of mode are listening to music or other audio and planning for / reflecting on the current day. Other insights into what people do while traveling can be found in Figure 2.

Figure 2: Percentage of survey respondents who participated in activities while commuting³



A few general themes related to how people utilize their travel time emerged from a review of the literature conducted by researchers at the University of Minnesota.⁴ Trip purpose and direction of travel (to or from home) has an influence, particularly in terms of commutes to work. Travelers are more likely to engage in work activities during their morning commute to work than their commute home from work. The length of time that a person spends traveling has an influence on whether or not a person will choose to engage in an activity as opposed to spending a short trip

³ [Circella et. al., 2015](#): Survey of 2586 commuters in Northern California carried out in 2011 & 2012.

⁴ [Levinson et. al., 2015](#)

“watching the world go by.” To an extent, it is possible that people choose between different modes of transportation available to them based on what kinds of activities they are able to complete during their journey.

Distracted Driving

The emergence of mobile technologies has impacted driver safety in unfortunate ways. Drivers are easily distracted by mobile devices while operating a vehicle. The seemingly quick-and-easy nature of many activities possible with mobile technology (calls, texts, email, etc.) can lead drivers to feel that they can look away from the road for a brief instant and still be okay. Each year in Minnesota distracted or inattentive driving is a factor in one in four crashes, resulting in at least 70 deaths and 350 injuries.⁵ State law places restrictions on the use of mobile devices while driving, but those restrictions are difficult to enforce. Drivers are prohibited from reading, composing, or sending text messages and emails, or accessing the Internet using a wireless device at any time when a vehicle is part of traffic, including when stopped at a red light.⁶ Additionally, school bus drivers and drivers under the age of 18 are prohibited from using a cell phone while part of traffic in any capacity.⁷

Multi-tasking While Waiting

Time spent waiting and transferring from one leg of a trip to another is often perceived as taking much longer than time spent riding on a vehicle during the trip.⁸ Improved connectivity to technology offers the potential of reducing the perceived burden of wait time as people can work, shop, talk to friends and family, play games, and more. This has practical applications in many locations including airports, train stations, transit stops, on transit vehicles, and beyond.

IN-VEHICLE TECHNOLOGY

Currently Available

Much as personal technology has evolved rapidly in the last decade, technology in vehicles offers travelers new ways to connect to the world around them. Automobiles increasingly offer connectivity to existing mobile data providers and some offer Wi-Fi hotspot capabilities to connect personal devices within the vehicle.⁹ This technology, along with other innovations like video screens for passengers and heads-up displays will make it easier for drivers and passengers alike to access content from the web.

Other modes of transportation increasingly offer technological connections to passengers as well. Many airlines offer in-flight Wi-Fi to passengers, and an increasing number of transit vehicles, trains, and long-distance buses also offer on-board wireless internet.¹⁰ Beyond activities that require internet connections, Figure 2 suggests that passengers on transit vehicles or trains are even more likely to read or sleep than their passenger counterparts in automobiles.

Future / Concept Technologies

Advancement in autonomous vehicle technologies and mobile connections stand to significantly alter how people use their travel time. Volvo is working with Ericsson (a Swedish technology company) to develop a media-streaming system for vehicles that would anticipate drop-offs in data coverage to allow for seamless streaming in autonomous vehicles around the country, regardless of data coverage.¹¹ Toyota is looking to move beyond internet connections delivered through the cellular network and unveiled a concept car at the Detroit Auto Show in 2016 that features a

⁵ [MN Department of Public Safety, 2016](#); this statistic is likely underreported, as it can be difficult to tell if distractions were a cause in crashes.

⁶ Ibid.

⁷ Ibid.

⁸ [Litman, 2015](#)

⁹ [Chevrolet, 2016](#)

¹⁰ [Airline Wi-Fi](#); [Northstar Commuter Rail](#); [Megabus](#);

¹¹ [Golson, 2016](#)

satellite antenna for connection to satellite-based data services.¹² New configurations in autonomous vehicles may allow for living-room style seating arrangements that would allow families and friends to treat travel time as an opportunity to converse, eat, play games, observe religious practice, and more. Ford recently patented an autonomous vehicle design that allows passengers in the front seat to reconfigure their row of seating to face those in the back seat of the vehicle.¹³

IMPACTS ON TRANSPORTATION

The impacts of improved connectivity on how Minnesotans travel are still largely unknown. Given the rapid advancement of mobile technologies in the last decade, developing a comprehensive understanding of how these technologies are affecting people's travel choices has proven to be challenging. A few key themes merit special study going forward.

Mode Choice

The availability of mobile connections allows non-drivers to safely utilize their travel time for work, play, shopping, and more. Despite these benefits, there seems to be little evidence that people give much weight to the impact that mobile devices could have on their commute when deciding between alternate modes of transportation as a means of on-board entertainment. Much more weight is given to the quality, reliability, and general performance of automobile alternatives in comparison to the ability to use technology while traveling.¹⁴

Mobile technology does stand to have an impact in making the use of different modes more appealing to travelers. Research conducted by the City College of New York found that transit riders who used real-time transit tracking apps experienced shorter wait times and higher trip satisfaction, and widespread deployment of these apps showed that they may in-fact increase overall transit ridership.¹⁵ Ride-, bike-, and car-sharing services also often have accompanying apps that provide key information for users of each system, helping to ease potential nervousness about cars or bikes being claimed before a person can arrive at the checkout point or long wait times. The integration of transit, walking, and biking directions into many navigational apps also has the potential to encourage the use of non-automobile travel alternatives.

Vehicle Size

Prototype and concept versions of autonomous vehicles seem to fall on the extreme ends of the vehicle size continuum. The autonomous vehicle developed by Google is on the small side of the scale, while larger concepts like the example from Ford referenced above envision a future where people may look to "spread out" while traveling in autonomous vehicles. More information about vehicle size can be found in the Autonomous Vehicles trend analysis paper.

Longer Trips

The ability to stay connected, whether for productivity or entertainment, may reduce the total burden that people feel in regard to time spent traveling. As the variety of activities that people can engage in while traveling expands, it is likely that people will see spending time traveling as less of a burden, and in fact may even come to enjoy it. This may result in people becoming more likely to take longer trips and live farther from their place of work in pursuit of other amenities.¹⁶

¹² [Davies, 2016](#)

¹³ [Perkins, 2015](#)

¹⁴ Levinson et. al., 2015

¹⁵ [Jaffe, 2014](#)

¹⁶ Ibid.