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Beating long trips with a smartphone? A case study of Beijing residents

Jiangping Zhou[a,*], Linchuan Yang[a], Jixiang Liu[a], Chun Zhang[b]

[a] Faculty of Architecture, The University of Hong Kong, Hong Kong, China
[b] School of Architecture and Design, Beijing Jiaotong University, Beijing, China

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ABSTRACT

Smartphone has become a desired product and even a necessity for more and more workers. This manuscript first proposes a framework for the effects of smartphone use on travel based on existing studies and anecdotal evidence. It then hypothesizes that usage of smartphone can increase the tolerance (or in other words, increase perceived benefits or positive utility of travel time) of a long trip (one type of "productivity effect" as per the above framework). It undertakes a survey of local residents in Beijing (valid sample $n = 271$) to validate the above hypothesis. Based on an ordered probit model, it examines whether and how the tolerance varies by factors such as socio-demographic characteristics, personal preference, and smartphone usage pattern. Its main findings are that: (a) smartphone usage significantly increases the tolerance of travel time; (b) the above tolerance varies across residents of different ages, preference, and employment statuses; (c) the tolerance is correlated to whether residents value the jobs-housing proximity; (d) younger, unemployed, or low-income smartphone users bear on average longer travel time than other users; (e) railway transit riders tend to see fewer productivity effects as compared to riders of other transit modes (e.g., regular bus). The findings indicate that the emergence of smartphone has some potential to ameliorate the situations of increased travel time, traffic congestion, and jobs-housing separation and to increase perceived benefits of travel time among some residents. This potential, nevertheless, is moderated by other factors such as preference, age, mode of travel, and employment status. Policy analysts and scholars need to probe further into the above tolerance and its influencing factors so as to take fuller advantage of the productivity effect of smart phones.

1. Introduction

In both developed countries and developing countries, jobs-housing separation and associated longer average commuting distance and/or time are a norm rather than an exception nowadays in many cities (e.g., ABC7 News, 2015; Jarosz & Cortes, 2016; Yang, 2006; Wang & Chai, 2009). Partially because of this, a variety of undesirable phenomena and consequences arose, for instance, dependence on private cars, increased traffic congestion, pipeline air pollution, lost productivity, and commuter pain (IBM, 2011). In the same time, smartphone has become a desired product and even a necessity for more and more people (Brunwasser, 2015; Ryzik, 2014). In the US, nearly two-thirds of people own a smartphone (Pew Research Center, 2015). In China, 81% of mobile-phone users own a smartphone (Deloitte China, 2014). Unlike their earlier analogues such as Windows-based desktops, tablets, and laptops that are connected to, or even capsulate Information and Communication Technologies (ICT), smartphones not only can fulfil most of the latter's functions but also are extremely portable and can effectively produce more "user values" to owners (Park & Han, 2013). ICT could have four possible effects on travel: substitution, modification, enhancement, and neutrality (Salomon, 1986). Being something that has all the distinctive features of ICT and that has probably more features such as portability and abundant free apps, what effects do smartphones have on travel? This paper assumes that in addition to the four ICT effects, smartphone has an extra effect on travel: "productivity", which means new intrinsic values trip makers gain because of smartphone usage. This effect has been discretely mentioned in scholarly works and mass media, as detailed below. But it has rarely been quantified and its determinants and their respective magnitudes of impact remain unclear hitherto. These questions are what we attempt to probe into in this study, using information collected from residents/workers in Beijing.

We hope to achieve three purposes in the study. First, to (re)define the effects of smartphones on travel by expanding what we have known from both scholarly studies and mass media. Second, to offer an empirical study, validating one specific effect ("productivity") identified from the above sources and exploring whether and to what degree this effect is influenced by factors such as workers' socio-demographics and

* Corresponding author.
E-mail addresses: zhoujp@hku.hk (J. Zhou), u3003593@connect.hku.hk (L. Yang), u3004679@hku.hk (J. Liu), zhangc@bjtu.edu.cn (C. Zhang).

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housing choices. Third, based on the secondary information and an empirical study, to outline and discuss the opportunities and challenges faced by transportation planners and decision-makers who have to work in the context where smartphones have been, and would become more popular among workers.

The remainder of the paper is organized as follows. The ensuing section (Section 2) synthesizes related work in scholarly studies and mass media. Based on that, we propose five smartphones' effects on travel. Section 3 presents a case study. It begins with a description of data collection, followed by a descriptive analysis of the survey responses. It ends with a short introduction to the ordered probit model (OPM) and an analysis of the survey responses based on an OPM. Section 5 summarizes the findings and discusses future research directions.

2. Smartphones and travel

2.1. Scholars' views

Transportation scientists and planners often categorize travel by purpose, by distance and/or by mode (Meyer & Miller, 2001; Szeto, Yang, Wong, Li, & Wong, 2017). For instance, commuting is a worker's travel between his/her residence and workplace and the purpose of travel is going to work. An intra-city travel means that the travel occurs within the boundary of a city. Otherwise, it would be called an intercity travel. Automobile travel is a trip that occurs in a car. There have been a few scholarly studies specifically on smartphones and travel based on Web of Science, one of the most popular online search engines for scholarly literature. About half of these studies, however, focus on travel or experience of tourists and are synthesized and reviewed as follows. In addition, smartphones' impacts on travel have often been treated as part of those of ICT. This may be not too surprising as smartphone usage is simply a very recent phenomenon. The first iPhone, for instance, was only launched in 2007.

Prior to the emergence and popularity of smartphones, ICT scholars have already pointed out the positive impacts of ICT on travel time. Given the strong connections between ICT and smartphones, those impacts of ICT often apply to smartphones as well. Above all, how travel time can provide utility to ICT or smartphone users. Traditionally, travel time has been considered as disutility (Banister, 2008; Guo, Derian, & Zhao, 2015; Wardman & Lyons, 2016). In the information age, when new ICT technologies and tools are rather abundant and pervasive, “travel time can be, and is, being used productively as activity time” (Lyons & Urry, 2005, p. 257). Furthermore, ICT has brought about “virtual mobility” and could potentially alleviate problems such as traffic congestion and environmental damage (Kenyon & Lyons, 2007, p. 161). For smartphone users, thus, there arises “equipped time”, which is the time they could gain utility (i.e., is a gift rather than a burden) from mobile devices (Jain & Lyons, 2008, p. 81).

In the era of smartphone, Wang, Xiang, and Fesenmaier (2014) propose a framework that integrates factors shaping the adoption, use and impacts of smartphones among tourists. They argue that smartphone has been “naturally embedded in everyday life” (p. 12). Thus, smartphone is connected to various activities in life, including travel. Their studies of a number of the US smartphone users confirm that smartphone use is shaped by contextual factors, cognitive beliefs, previous experiences, and everyday use. Looking into the future, smartphones would change tourists' experiences to a greater degree than nowadays. Essentially, smartphones could help users fulfil four types of functions en route: communication, entertainment, facilitation, and information search. In addition to Wang et al. (2014), other scholars have examined how frequently ICT, smartphones in particular, are being used by travellers during their trips especially short ones (Gamberini et al., 2013), and how and why smartphone can serve as a real-time communication tool and information source, especially in tourism (e.g., Eriksson & Strandvik, 2008; Kim, Park, & Morrison, 2008; Jansson, 2007; Wang, Park, & Fesenmaier, 2012), and how usage of smartphone improve tourists' experiences (e.g., Kramer, Modsching, Hagen, & Gretzel, 2007; Tussyadiah & Zach, 2012; Wang, Xiang, & Fesenmaier, 2016). According to the above studies, smartphones influence tourists' activities, sensations, emotions, and understanding of their environment. Also, ICT, especially smartphones, which are so portable, have increased travellers' ability to work and provide enhancements to time use while travelling, increasing utility of the used-to-be “dead time” (Gripsrud & Hjorthol, 2012). As smartphones have become increasingly popular and functionally powerful, it is hard to separate their impacts on life and travel (Wang et al., 2016). In some extreme cases, portable devices such as a smartphone can even ameliorate a negative journey experience through listening to radio/music (Mokhtarian, Papon, Goulard, & Diana, 2015).

As a whole, utility provided by smartphone usage has been frequently mentioned but rarely been linked to workers' travel, commuting in particular. Westman, Olsson, Gärling, and Friman (2015) suggest some kind of positive impact (utility) of smartphone usage on children during their long commuting: these children performed better in the subsequent word-fluency test significantly. Wang et al. (2012) have pointed out that smartphone use can have utility such as problem solving, real-time information supply, flexibility in travel plans, experience sharing and storing memories. Moores (2003) argue that mobile technologies can enable tourists to keep constant interactions with their families and friends. Based on all the above, the smartphone's utility can be seen as the expansion and enhancement of those by traditional mobile phones and ICT. Whether smartphone usage can help ameliorate the situations of increased travel time, separation of jobs-housing and traffic congestion in large cities and increase utility of travel time among workers regardless of locations has rarely been addressed in scholarly works. But mobile real-time information via website, telephone, text-messaging, and smartphone reduces not only travellers' perceived wait time, but also their actual wait time (Frei & Mahmassani, 2011; Watkins, Ferris, Borning, Rutherford, & Layton, 2011). Similar positive effects exist with or without smartphones but the latter could enhance the former (Ferris, Watkins, & Borning, 2009; Mokhtarian & Salomon, 2001). Despite the high ownership of smart devices, the usage of them on transit is not as high as expected, especially among university students. But the usage, if observed, does increase utility via the mechanism of multitasking (e.g., Guo et al., 2015). Last but not least, increased crowding tends to influence riders' perception of positive travel time despite higher penetration of smartphones (Lyons, Jain, & Weir, 2016).

2.2. Mass media

Given that smartphones and their popularity are very recent phenomena, we decided to use mass media besides scholar works to collect anecdotal evidence about their impacts on travel. But which source can be the best representative of mass media? We looked around and decided to focus on *The New York Times*, *New York Daily News*, *USA Today*, *Forbes*, *Time*, *BBC*, and *ABC* for four primary reasons: First, they are all international media. In many countries and regions, some of them even have localized editions (e.g., *The New York Times* and *BBC* in Chinese). Second, each of them maintains and keeps updating an exhaustive and searchable on-line database for its published or broadcasted items. Third, they are all equipped with multi-channel propagation modes, not only having websites but also being nationally and even globally circulated in hard-copy format. Fourth, over time, the quality or contents of publications, coverages or articles of them are generally considered timely and/or fine.

As a whole, the publications we identified from the aforementioned sources have identified the intrinsic value produced or enhanced by smartphone usage, which can help ameliorate the situations of increased travel time, jobs-housing separation and traffic congestion in