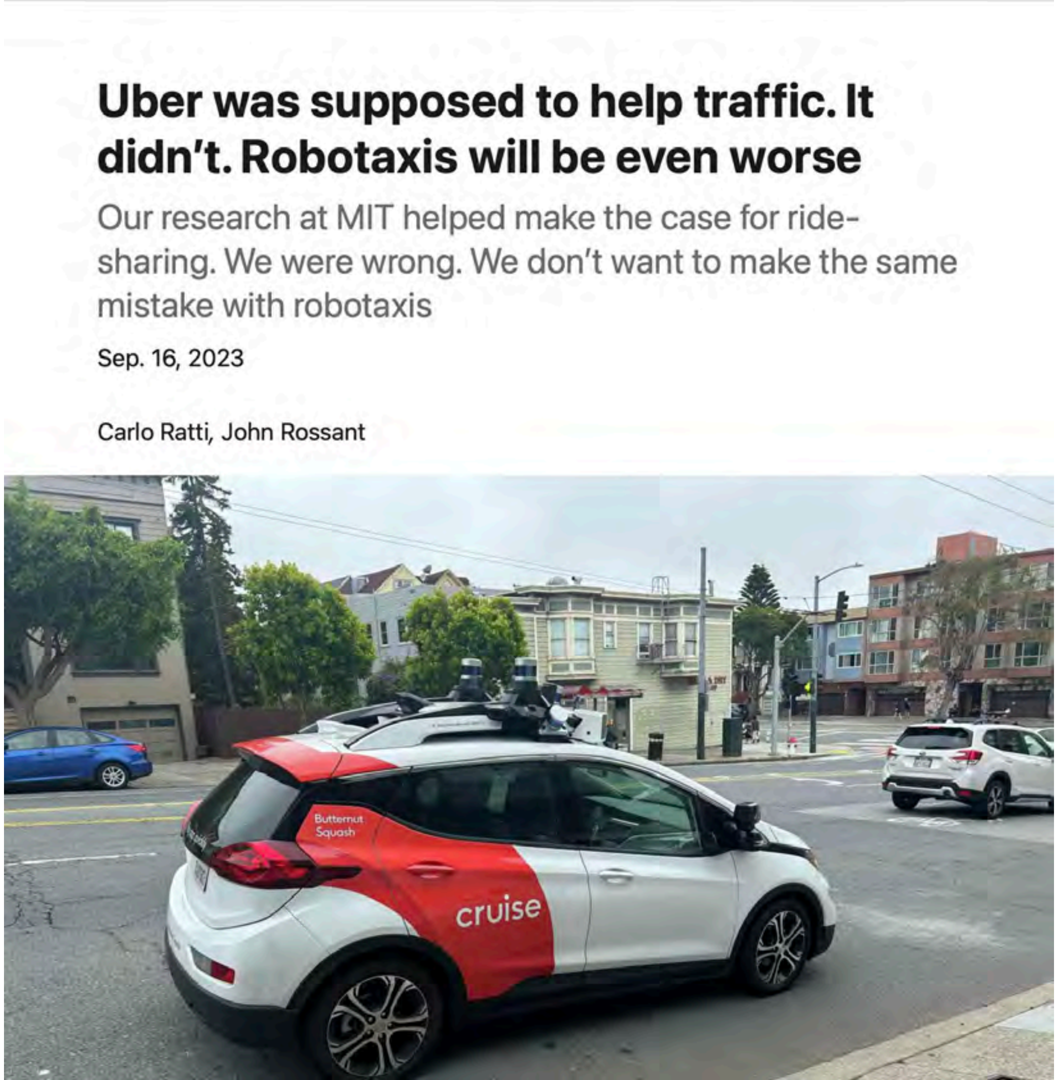
Conferenza sharing mobility 2023

SENSEABLE CITIES

… and Sharing Risks…

Carlo Ratti
MIT Senseable City Lab & CRA Carlo Ratti Associati



Uber was supposed to help traffic. It didn’t. Robotaxis will be even worse

Our research at MIT helped make the case for ride-sharing. We were wrong. We don’t want to make the same mistake with robotaxis

Sep. 16, 2023

Carlo Ratti, John Rossant

HubCab is an interactive visualization that invites you to explore the ways in which over 150 million taxi trips connect the City of New York in a given year. Show me how it works.

Learn more about the project ↓

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Sharing benefits

3,160,172 $

1,052,627 mi

445,261 kg

hubcab

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Taxi Pickup Reset

West 15th Street

Total Pickups: **1069**

Average duration: **12.4 min**

Average distance: **3 mi**

Taxi Dropoff Reset

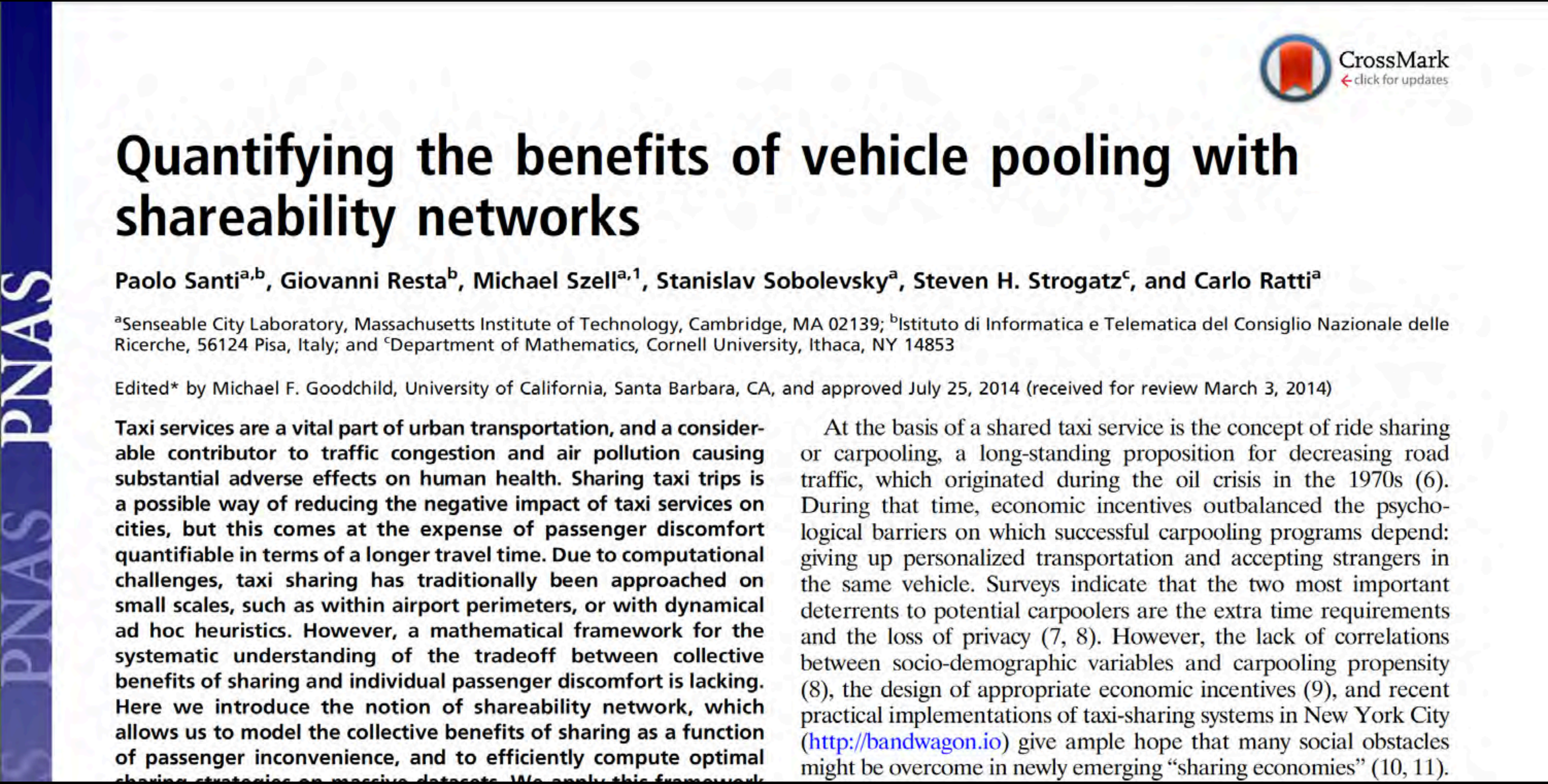
East 54th Street

Total Dropoffs: **1053**

Average duration: **10.2 min**

Average distance: **2.38 mi**

Learn more about the project ↓



Quantifying the benefits of vehicle pooling with shareability networks

Paolo Santi[a,b], Giovanni Resta[b], Michael Szell[a,1], Stanislav Sobolevsky[a], Steven H. Strogatz[c], and Carlo Ratti[a]

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Edited* by Michael F. Goodchild, University of California, Santa Barbara, CA, and approved July 25, 2014 (received for review March 3, 2014)

Taxi services are a vital part of urban transportation, and a considerable contributor to traffic congestion and air pollution causing substantial adverse effects on human health. Sharing taxi trips is a possible way of reducing the negative impact of taxi services on cities, but this comes at the expense of passenger discomfort quantifiable in terms of a longer travel time. Due to computational challenges, taxi sharing has traditionally been approached on small scales, such as within airport perimeters, or with dynamical ad hoc heuristics. However, a mathematical framework for the systematic understanding of the tradeoff between collective benefits of sharing and individual passenger discomfort is lacking. Here we introduce the notion of shareability network, which allows us to model the collective benefits of sharing as a function of passenger inconvenience, and to efficiently compute optimal sharing strategies on massive datasets. We apply this framework

At the basis of a shared taxi service is the concept of ride sharing or carpooling, a long-standing proposition for decreasing road traffic, which originated during the oil crisis in the 1970s (6). During that time, economic incentives outbalanced the psychological barriers on which successful carpooling programs depend: giving up personalized transportation and accepting strangers in the same vehicle. Surveys indicate that the two most important deterrents to potential carpoolers are the extra time requirements and the loss of privacy (7, 8). However, the lack of correlations between socio-demographic variables and carpooling propensity (8), the design of appropriate economic incentives (9), and recent practical implementations of taxi-sharing systems in New York City (http://bandwagon.io) give ample hope that many social obstacles might be overcome in newly emerging "sharing economies" (10, 11).

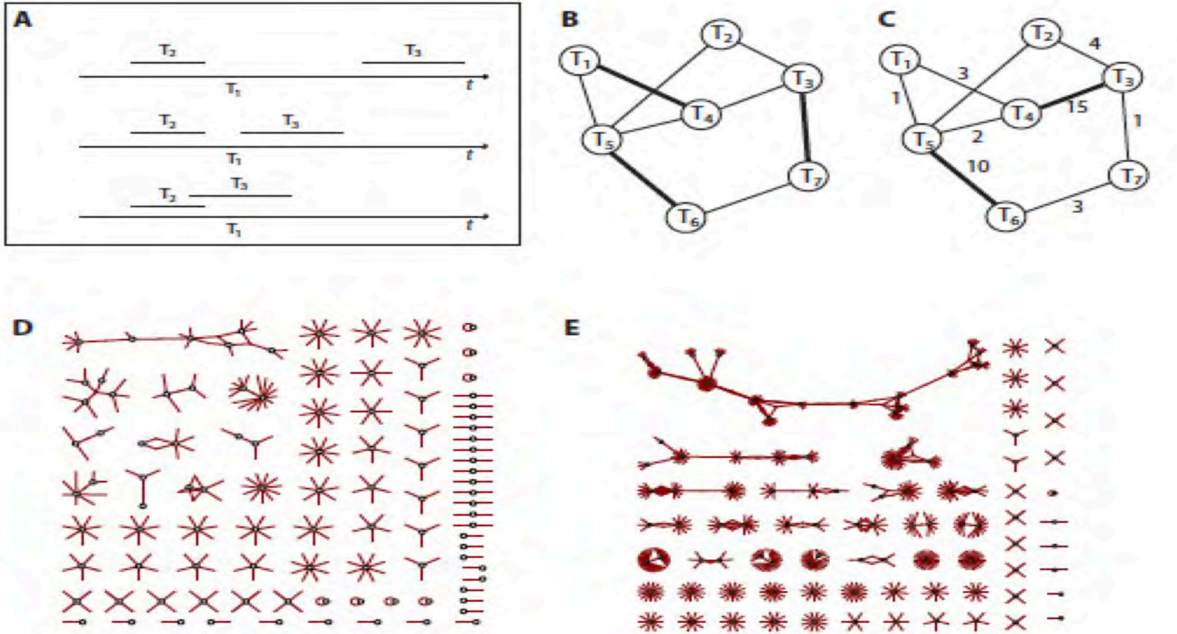
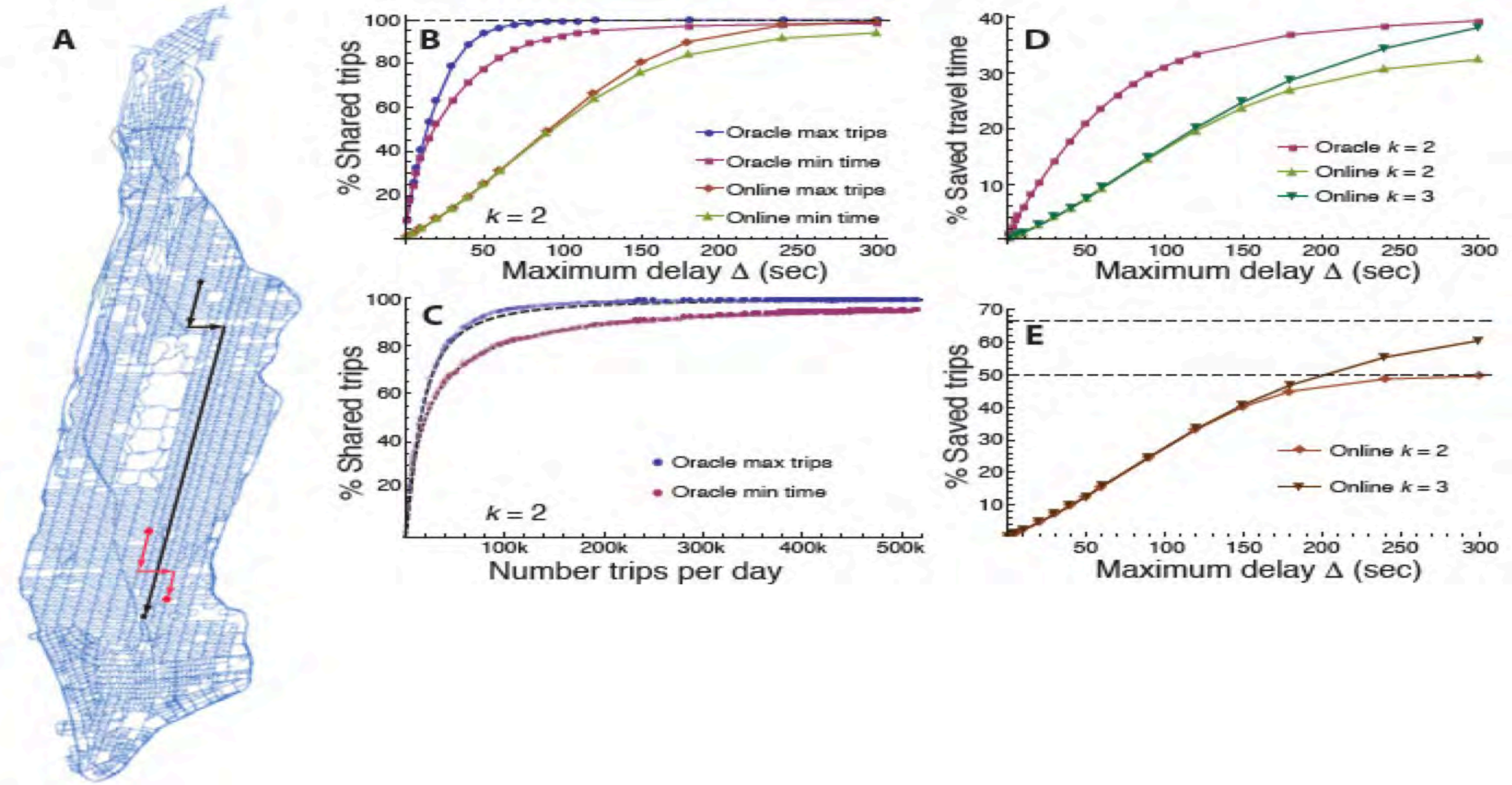


Figure 1: **Shareability networks.** **(A)** Trip sharing model and taxi capacity. Each of the three cases involves three trips T_1, T_2, and T_3 to be shared, but ordered differently in time t. The top case corresponds to a feasible sharing according to our model with $k = 2$, and the trips can be accommodated in a taxi with capacity ≥ 2. The middle case corresponds to a model with $k = 3$ since three trips are combined; notice that the three trips can be combined in a taxi with capacity two since two of the combined trips are non-overlapping. The bottom case corresponds to $k = 3$, but here a taxi capacity ≥ 3 is needed to accommodate the combined trips. **(B)** Example of maximum matching (*4*) in a simple shareability network. The links belonging to the maximum matching are displayed in bold. **(C)** Example of maximum weighted matching (*4*). **(D)** Exemplary subset of the shareability network corresponding to 100 consecutive trips for values of $\Delta = 30\,\mathrm{sec}$ and **(E)** $\Delta = 60\,\mathrm{sec}$, showing network densification effects and thus an increase of sharing opportunities with longer time-aggregation. Open links point to trips outside the considered set of trips. Isolated nodes are represented as self-loops. Node positions are not preserved across the networks.


A
B
% Shared trips
100
80
60
40
20
k = 2
Oracle max trips
Oracle min time
Online max trips
Online min time
50
100
150
200
250
300
Maximum delay Δ (sec)
C
% Shared trips
100
80
60
40
20
k = 2
Oracle max trips
Oracle min time
100k
200k
300k
400k
500k
Number trips per day
D
% Saved travel time
40
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Oracle k = 2
Online k = 2
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Maximum delay Δ (sec)
E
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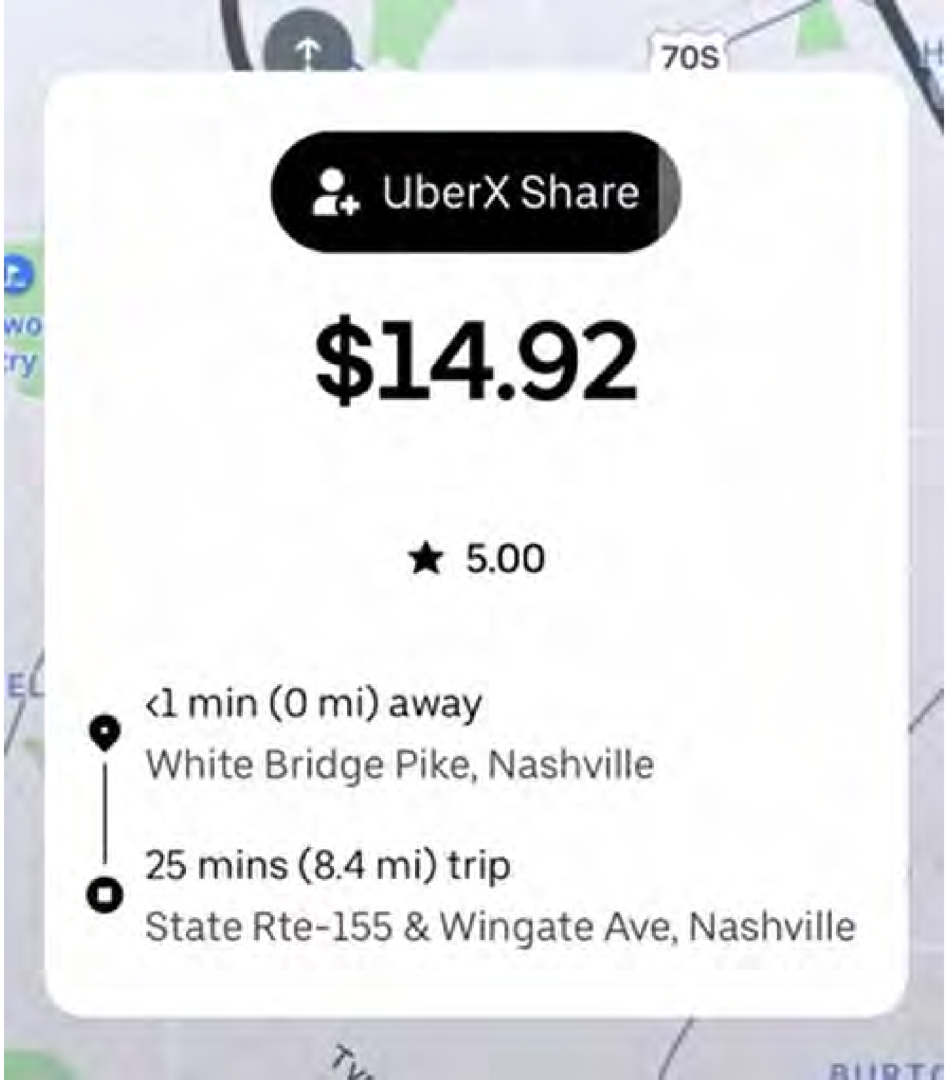


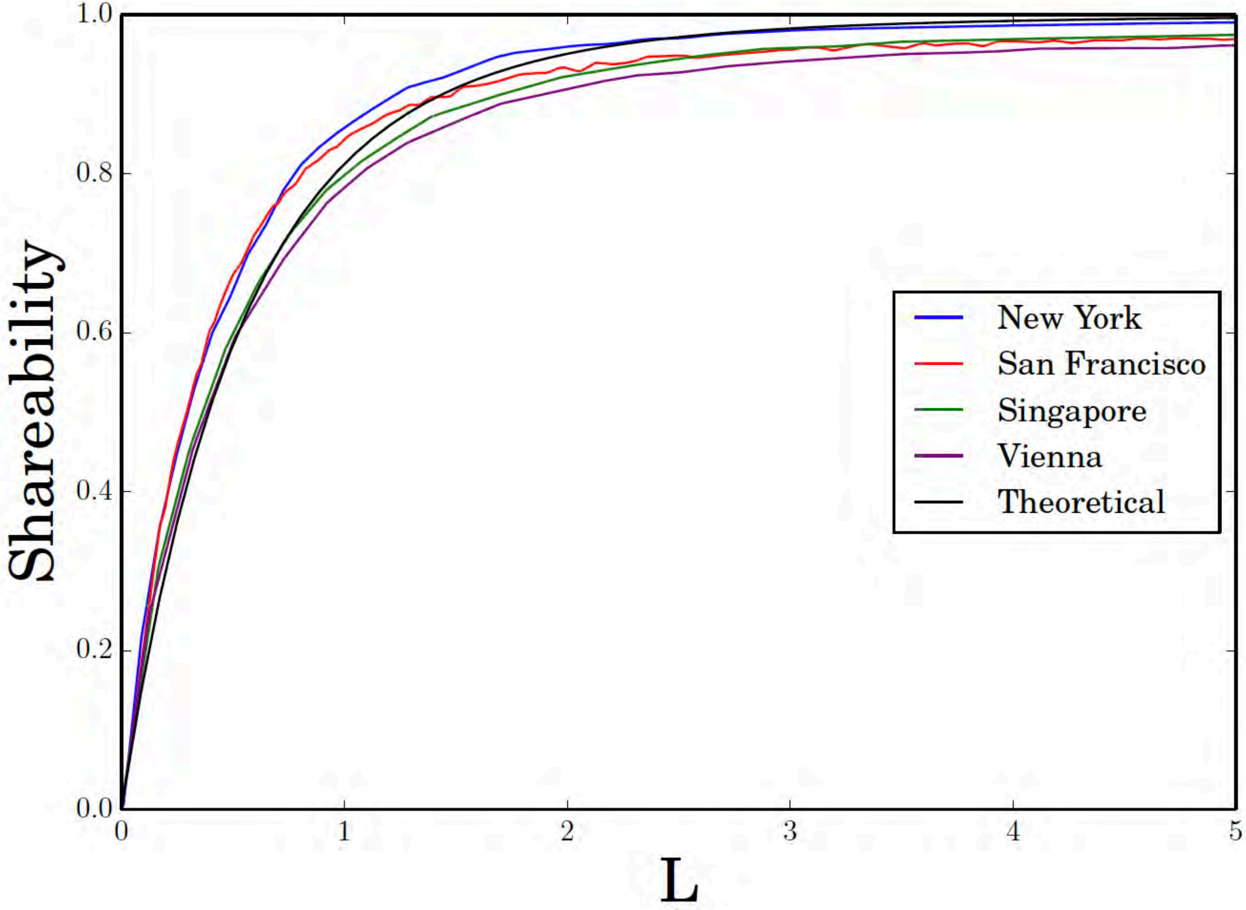
UberX Share

$14.92

★ 5.00

<1 min (0 mi) away
White Bridge Pike, Nashville

25 mins (8.4 mi) trip
State Rte-155 & Wingate Ave, Nashville


Shareability
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New York
San Francisco
Singapore
Vienna
Theoretical

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Scaling Law of Urban Ride Sharing

R. Tachet[1], O. Sagarra[1,2,3], P. Santi[1,4], G. Resta[4], M. Szell[1,5], S. H. Strogatz[6] & C. Ratti[1]

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Sharing rides could drastically improve the efficiency of car and taxi transportation. Unleashing such potential, however, requires understanding how urban parameters affect the fraction of individual trips that can be shared, a quantity that we call *shareability*. Using data on millions of taxi trips in New York City, San Francisco, Singapore, and Vienna, we compute the shareability curves for each city, and find that a natural rescaling collapses them onto a single, universal curve. We explain this scaling law theoretically with a simple model that predicts the potential for ride sharing in any city, using a few basic urban quantities and no adjustable parameters. Accurate extrapolations of this type will help planners, transportation companies, and society at large to shape a sustainable path for urban growth.

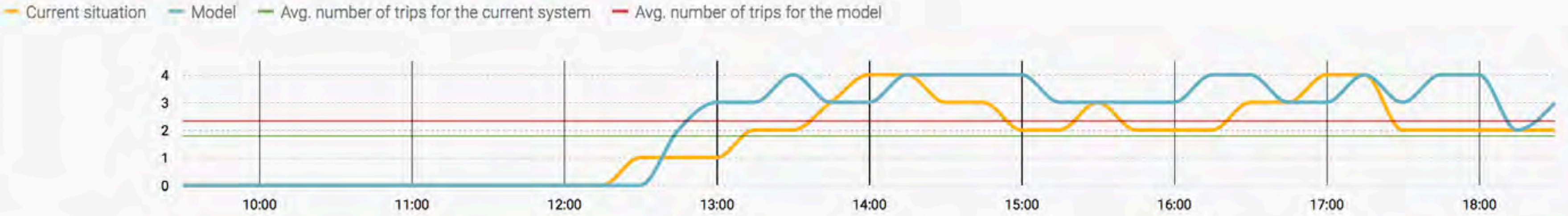
Working hour optimization

MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY

TYPES OF CAR MODES

Cumulated time with and without passenger in a typical working day

TRIPS SERVED BY HOUR AND CAR (CUMULATIVE FOR 1 HOUR)



The displayed cars represent the median number of trips for both the system and model.

nature

THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE

Network analysis of journeys reveals optimum size for New York taxi fleet PAGE 534

DRIVING FORCE

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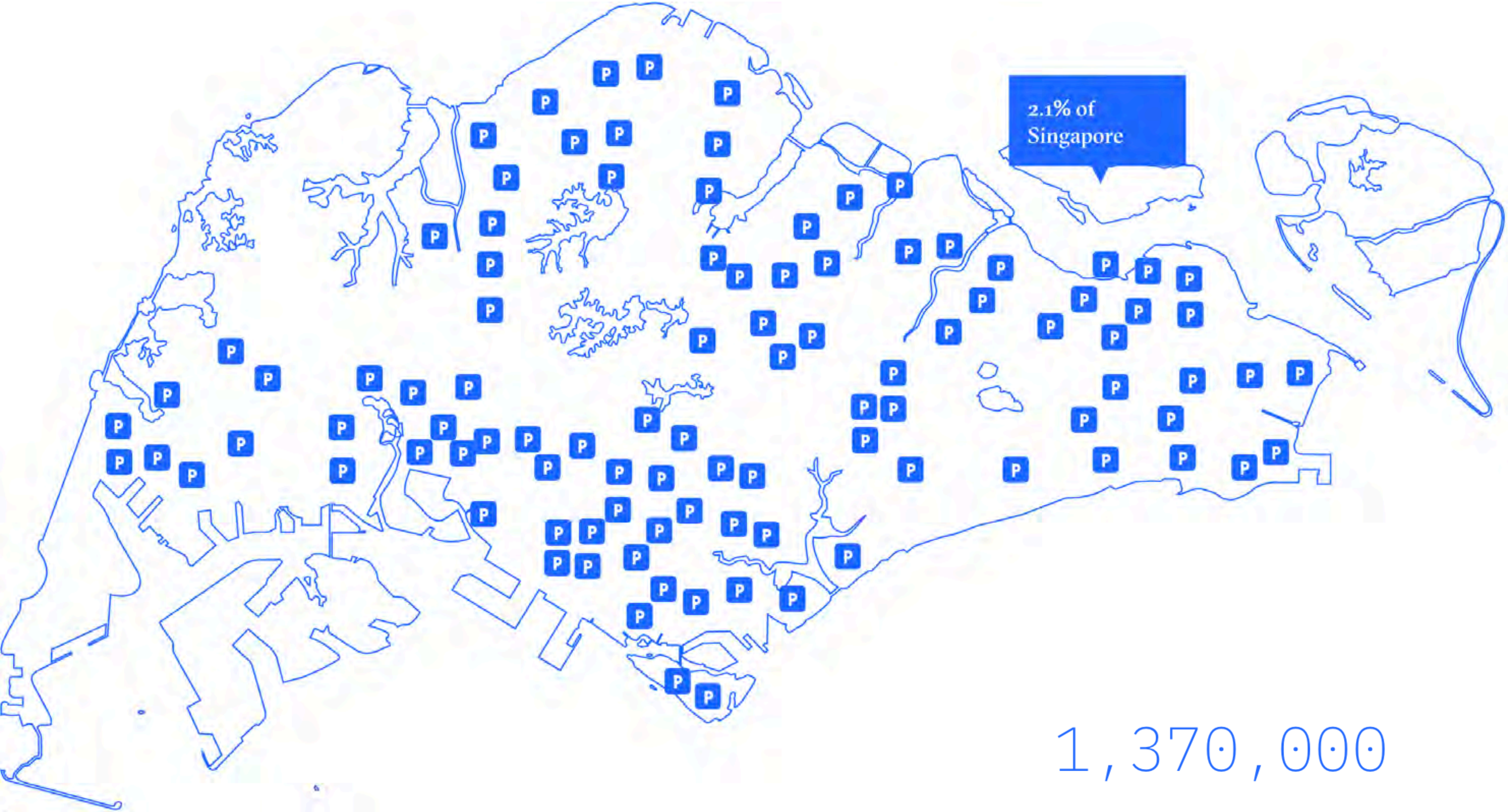
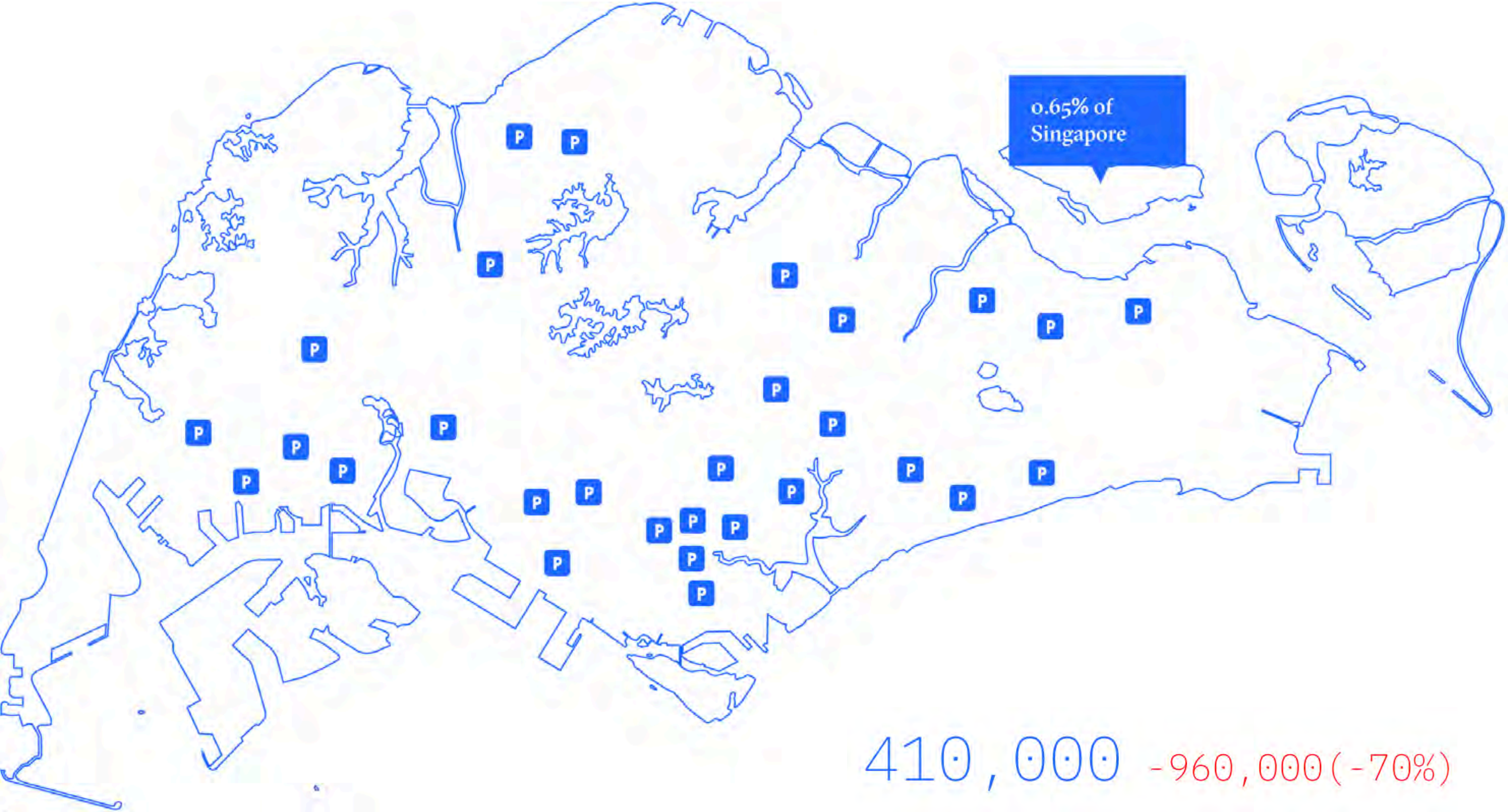
95%

Manheim, Pennsylvania (© Nearmap)



2.1% of Singapore

1,370,000



0.65% of Singapore

410,000 -960,000(-70%)

Article | Open Access | Published: 08 October 2020

Addressing the “minimum parking” problem for on-demand mobility

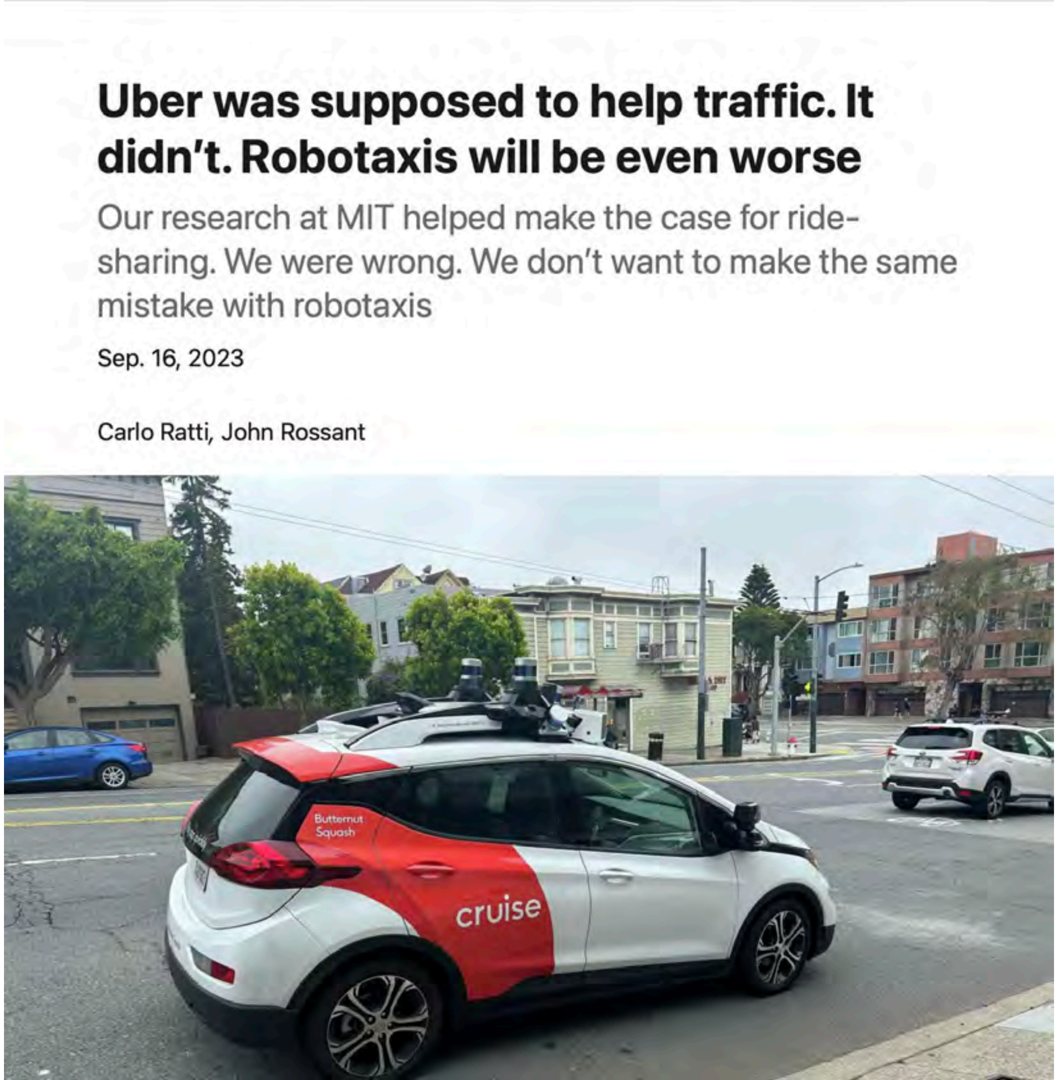
Dániel Kondor, Paolo Santi, Diem-Trinh Le, Xiaohu Zhang, Adam Millard-Ball & Carlo Ratti

Scientific Reports **10**, Article number: 15885 (2020) | Cite this article

808 Accesses | **5** Altmetric | Metrics

Abstract

Parking infrastructure is pervasive and occupies large swaths of land in cities. However, on-demand (OD) mobility has started reducing parking needs in urban areas around the world. This trend is expected to grow significantly with the advent of autonomous driving, which might render on-demand mobility predominant. Recent studies have started looking at expected parking reductions with on-demand mobility, but a systematic framework is still lacking. In this paper, we apply a data-driven methodology based on shareability networks to address what we call the “minimum parking” problem: what is the minimum parking infrastructure needed in a city for given on-demand mobility needs? While solving the problem, we also identify a critical tradeoff between two public policy goals: less parking means increased vehicle travel from deadheading between trips. By applying our methodology to the city of Singapore we discover that parking infrastructure reduction of up to 86% is possible, but at the expense of a 24% increase in traffic measured as vehicle



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