Mass Effects and Mobility Decisions

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Maya Abou-Zeid (American University of Beirut)
Jan-Dirk Schmöcker (Kyoto University)
Prawira Fajarindra Belgiawan (Kyoto University)
Satoshi Fujii (Kyoto University)

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Outline

- Introduction
- Empirical evidence of mass effects
  - Outside transportation
  - Transportation and land use
- Data and modeling methodologies
- Summary and implications
- Ongoing research

Introduction

- Mobility decisions are often made within social contexts
  - Tight social networks: households, close friends
  - Loose social networks: friends, colleagues, online networks, neighborhoods

- Social interaction leads to the formation of norms which may affect mobility decisions

Norms

- Descriptive
  - Mass effects, i.e. majority decisions or “culture”
- Injunctive
  - Expectations of others
- Some norms are desirable (e.g. cities with “bicycle culture”), while others are not (e.g. jaywalking, illegal parking)

Objective

- Can policies be designed to direct social norms towards more sustainable transportation?
- Focus here is on descriptive norms, i.e. mass effects, and their effect on behavior
  - Empirical evidence
  - Data and modeling methodologies
  - Implications for changing norms

Psychological Foundations: Why Do People Conform?

- Motivation
  - Reduce cognitive effort involved in decision making
  - Maintain social approval
- Psychological theories
  - Theory of social comparisons (Festinger, 1954)
  - Spiral of silence theory (Noelle-Neumann, 1974)
  - Theory of planned behavior (Ajzen, 1985)

Empirical Evidence: Outside Transportation (1)

- Bass model (1969): spread of products
  - Innovators vs. imitators
  - Likelihood to purchase:
    - $f(\tau)/ (1-F(\tau)) = p + qF(\tau)$
  - **Implications:** identifying key "influencing" persons in society could trigger sustainable transportation change

Empirical Evidence: Outside Transportation (2)

- Tourism and product sales: word of mouth, online reviews
  - Popular products/services are bought more often

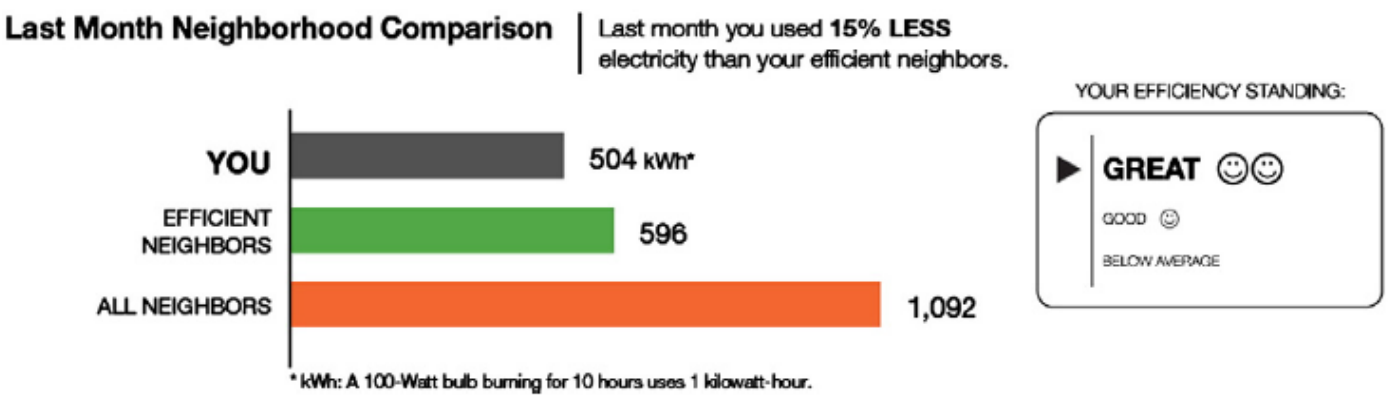
  - **Implications:** provide targeted personalized travel information instead of global expert information

Empirical Evidence: Outside Transportation (3)

- Health: misperceptions
  - College student drinking misperceptions
  - **Implications:** utilize social norms marketing campaigns to shift norms

Empirical Evidence: Outside Transportation (4)

- Pro-environmental behavior: information about similar others
  - Energy consumption



Source: Allcott, 2011

  - **Implications:** provide information about similar others' transportation behavior

Empirical Evidence: Transportation and Land Use (1)

- Long/medium term
  - Residential location
  - Vehicle ownership and type
  - Mode choice and telecommuting
- Short term
  - Parking location choice
  - Driving behavior
  - Pedestrian crossing behavior

Empirical Evidence: Transportation and Land Use (2) -- Residential Location Choice

- Páez et al. (2008): field effects in a 2-period simulation
  - In period 2, utility of location choice is a function of market share of that location in period 1 among members of the individual's social network
  - Found significant social influence on individuals' distribution across locations and sensitivity to network structure

Empirical Evidence: Transportation and Land Use (3) -- Vehicle Ownership

- Goetzke and Weinberger (2011): endogenous vs. contextual effects

  For a given household:

Endogenous Effect	Contextual Effect
% of zero-car households in the household's zone	Distribution of households in the household's zone by education, income, and size

  - Found that endogenous (peer) effect is highly significant and contextual effects are consistently estimated only when endogenous effects are accounted for

Empirical Evidence: Transportation and Land Use (4) -- Vehicle Type Choice

- Rasouli and Timmermans (2013): estimating the influence of mass effects through experimental design

Attribute	Attribute level
Reviews	Only positive reviews
	Mainly positive reviews but also some criticism
	Mainly negative criticism, but some positive
	Only negative reviews
Share of electric car among friends and acquaintances	0 %
	25 %
	50%
	75%

- Found positive impact of reviews on the utility of the intention to buy an electric car but generally non-significant effect of descriptive norms

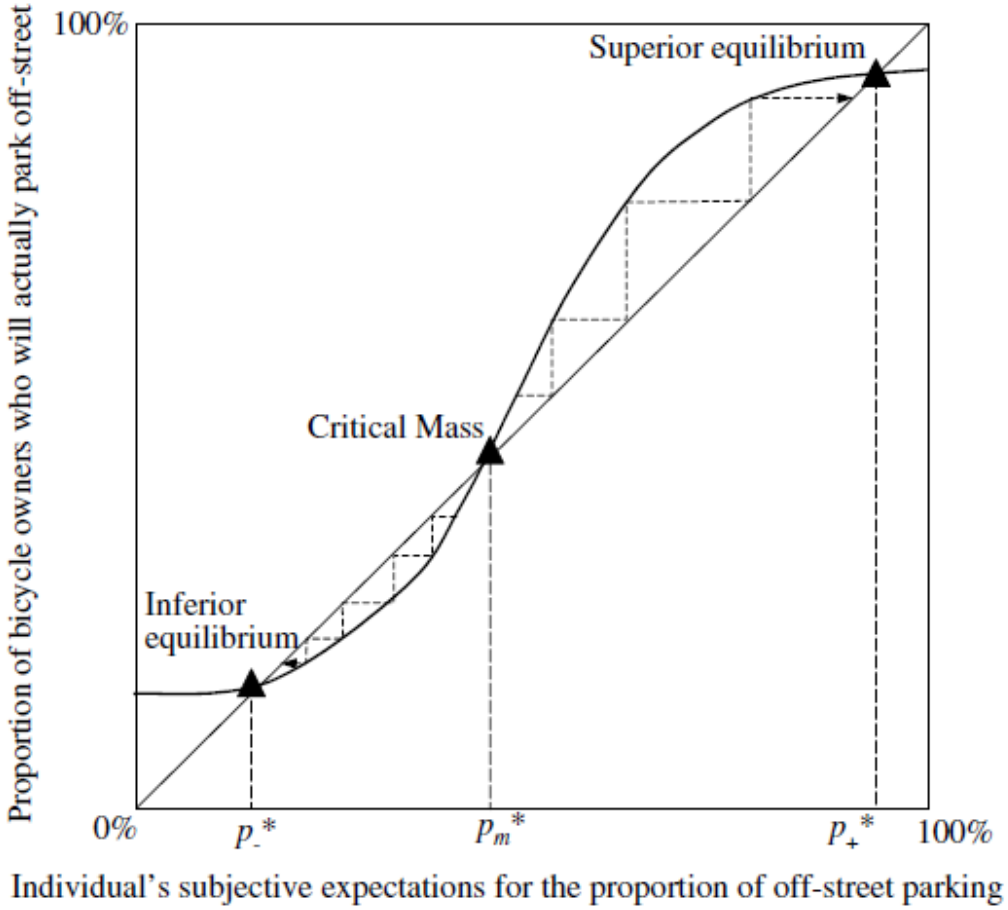
Empirical Evidence: Transportation and Land Use (5) -- Mode Choice

- Evidence for field effects in mode choice decisions
- Methodological issues:
  - Accounting for endogeneity of field effects (Walker at al., 2011)
  - Separating supply effects from field effects (Goetzke, 2008)

Empirical Evidence: Transportation and Land Use (6) -- Bicycle Parking Behavior

- Fukuda and Morichi (2007): existence of multiple equilibrium solutions (inferior, superior, and critical mass)
  - Application: choice between legal off-street bicycle parking and illegal on-street parking near train stations in Tokyo

Empirical Evidence: Transportation and Land Use (7) -- Bicycle Parking Behavior



- Policy implication: increase in frequency of police patrols to shift from inferior to superior equilibrium

Data and Modeling Methodologies (1)

- Egocentric approach
- Psychological causal models
- Random utility choice models with field effect
- Stochastic process models
- Simulation

Data and Modeling Methodologies (2)

- Egocentric approach
  - Data requirements: knowledge of ties and characteristics of people in a person's social network
  - Advantages: no assumptions about the social network
  - Limitations: limited insights regarding mass effects

Data and Modeling Methodologies (3)

- Psychological causal models
  - Data requirements: measurement of attitudes, norms, intentions, etc. but not social networks per se
  - Advantages: can estimate associations between different constructs
  - Limitations:
    - Does not consider dynamics
    - Difficult to validate (cross-sectional data)
    - Stated intentions may differ from actual behavior

Data and Modeling Methodologies (4)

- Random utility choice models with field effect
  - Data requirements: large datasets about revealed behavior to define different reference groups and compute average shares of different alternatives
  - Advantages: can explain society wide distribution of choices
  - Limitations:
    - Does not consider dynamics
    - Does not measure attitudinal/normative indicators
    - Choice of reference group may be arbitrary

Data and Modeling Methodologies (5)

- Stochastic process models -- probability expressions for the state of a system and their transition dynamics
  - Data requirements: observation of system states over time
  - Advantages:
    - Can investigate a large number of scenarios
    - Can model dynamics and forecast influence of mass effects
  - Limitations:
    - May not fully account for attitudinal changes
    - Requires time series data for model calibration

Data and Modeling Methodologies (6)

- Simulation
  - Data requirements: no specific data requirements
  - Advantages:
    - Can test a rich set of agent strategies
    - Can model the interaction between social network structure itself and mass effects
    - Can model dynamics and is hence useful for policy forecasting
  - Limitations:
    - Need to conduct long term / repeated simulations to check for steady state solution

Summary

- Evidence for influence of mass effects on decisions outside and within transportation
- If mass effects are not accounted for, can lead to significant biases in models
- Policies may be designed to weaken unwanted norms and support desired norms, e.g. to encourage more sustainable travel

Utilizing Norms to Influence Behavior

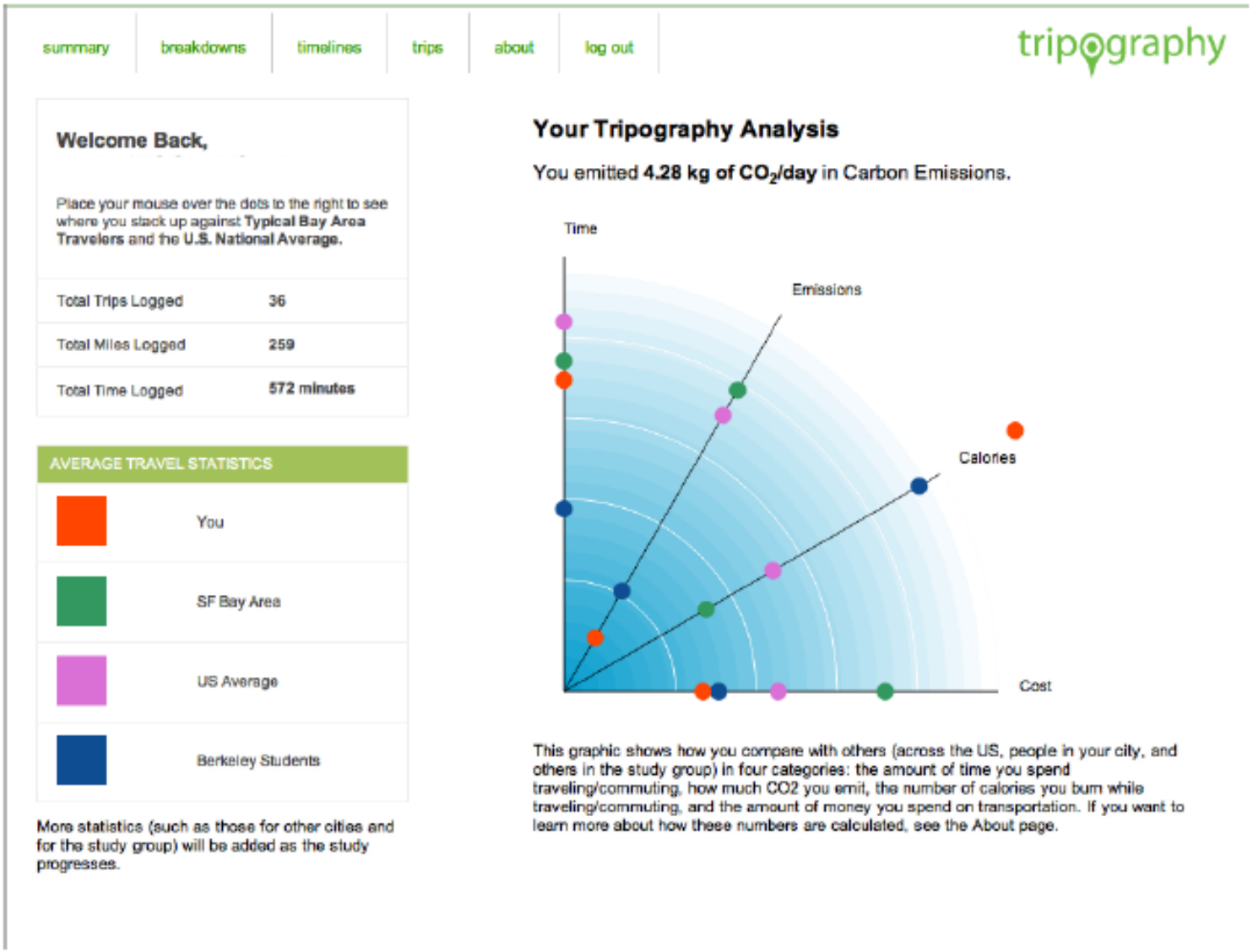
- React early to unwanted trends before tipping points are reached (e.g. rising car ownership in developing countries)
- Identify key players in a society (innovators vs. imitators) and key influentiable persons (e.g. pro-socials vs. pro-selfs)
- Create a “culture of change”: appeal to individuals as well as groups to influence community normative values
- Appeal to injunctive norms directly (e.g. travel feedback programs) but difficult to show long term / system wide influences
- Utilize normative messages

Normative Messages

- Correct misperceptions about prevalence of certain behaviors
- Explain the risks of compliance (e.g. risk of jaywalking with others)
- Present customized “local” information about similar others

Normative Messages (cont.)

Customized Local Information



Source: Jariyasunant et al., 2012

Issues for Future Work

- Methodological:
  - More empirical work to show evidence for mass effects within the transportation field
  - Scalable measurement of social networks
  - Panel data to model changes in social networks and causality with travel behavior
  - Linking egocentric approaches to mass effects
- Policy:
  - Role of mass effects vs. injunctive norms in changing behavior
  - Boomerang effect (reverting to the average)
  - Long-term effectiveness of normative policies

Ongoing Research

- Cross-cultural study of car ownership intentions of university students
  - Car ownership levels increasing rapidly in developing countries, peaked in developed countries
  - Aim is to identify the role of descriptive and injunctive norms on these decisions
- Case studies and collaborators from: Indonesia, Japan, Shanghai, Taiwan, Beirut, Berkeley, Utrecht