URBAN AGE
ELECTRIC CITY CONFERENCE

DECEMBER 2012

Frauke Behrendt

University of Brighton

Smart e-bikes

www.lsecities.net

Electric Bikes - Smart, Networked, Sustainable?

Dr Frauke Behrendt
Smart e-bikes Research Project
www.smart-ebikes.co.uk

University of Brighton
f.behrendt@brighton.ac.uk
www.fraukebehrendt.com

E-Bike Types

Common
Bike
Motor
Battery

Variation
Speed
Range
Style
Cost




Always

Assistance

optional

Pedal-assisted,
Electrically-assisted
(Pedelec)

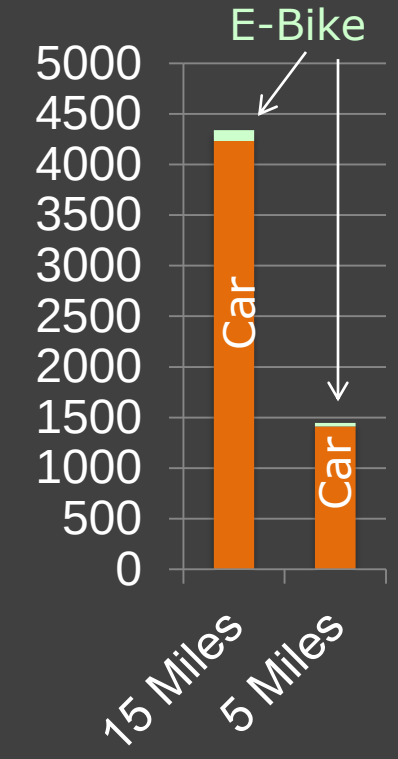
Throttle-controlled
(Twist-and-go)

Electric Scooter/Moped

Pedaling

Always optional Never

Sustainable?



CO2 (lbs/year)

Trips 200 days/year

- "E-bikes emit substantially less pollution per kilometer than cars based on life-cycle emissions analysis" (Shao Z et al 2012)
- Depends on type of battery, how electricity is produced, etc.

Table 5. Fuel Cost and CO_2 Emissions for Daily Round Trips, e-Bike vs. Car

Distance	Round Trip per Day		200 Days per Year		300 Days per Year	
	by Car	By e-Bike	By Car	By e-Bike	By Car	By e-Bike
15 Miles	$4.08	$0.12	$816	$25	$1,224	$37
5 Miles	$1.36	$0.04	$272	$8	$408	$12
CO2, lbs per Year						
15 Miles	21	0.53	4233	106	6349	159
5 Miles	7	0.18	1411	35	2116	53

Global e-bike market

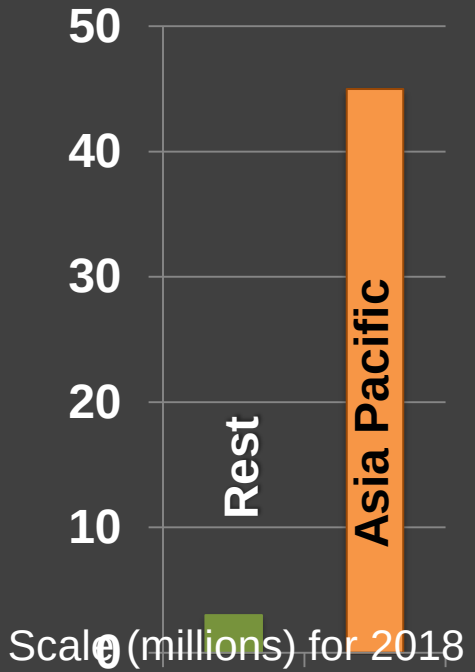
2012 projected global sales: 30 million

Chinese market is largest – estimated 83% to 92% of overall market

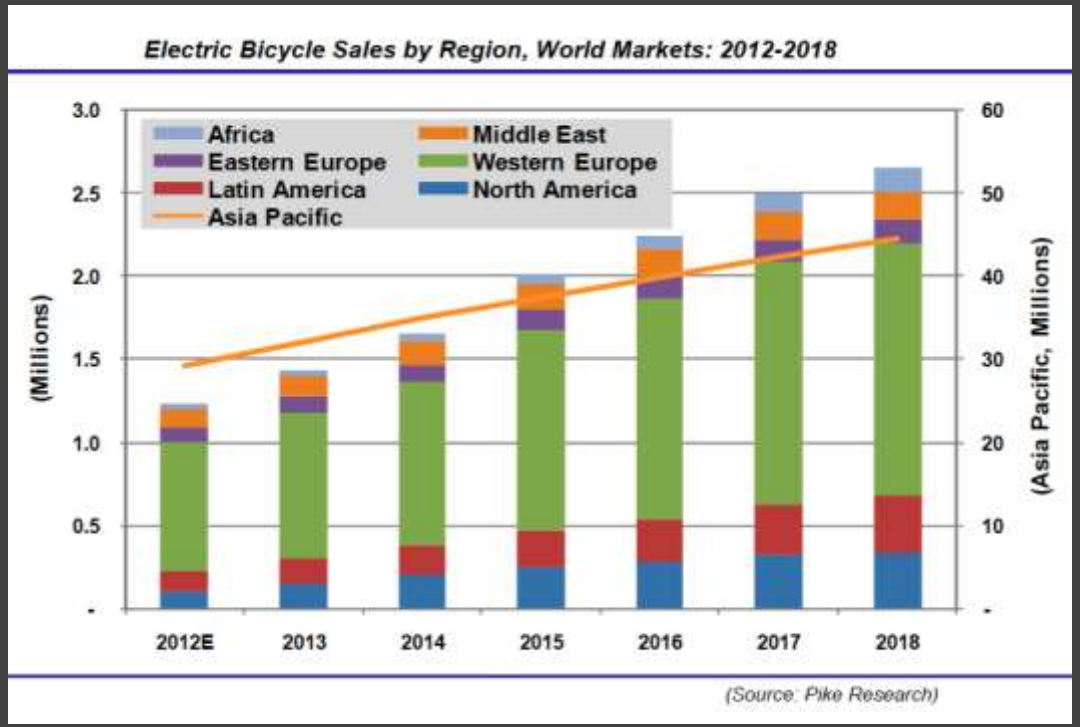
1 million units sold in Western Europe in 2010, 105,682 in U.S.

In China “e-bikes are relatively inexpensive and make up a significant portion of transportation mode share, especially in cities” (Shao Z et al 2012)

Projected E-bike Sales

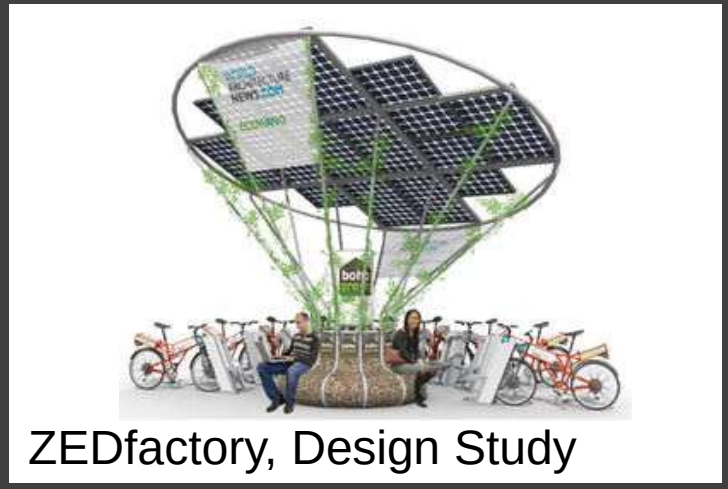


Scale (millions) for 2018



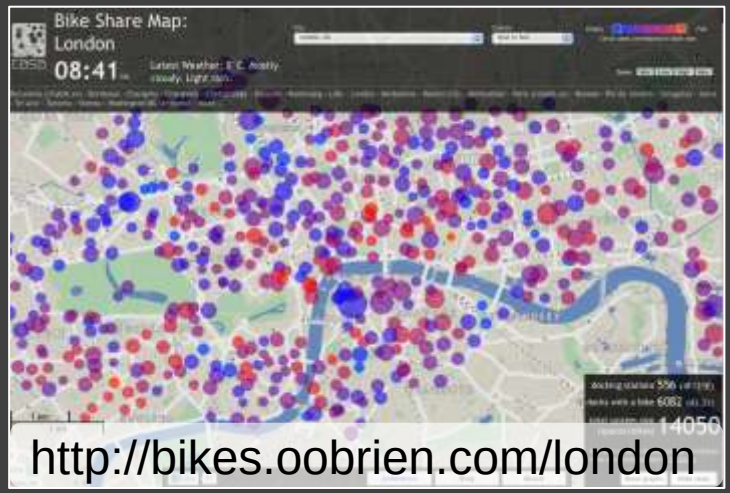
E-bike Sharing

DB, Germany



ZEDfactory, Design Study

University of Tennessee (US)



http://bikes.oobrien.com/london

www.smart-ebikes.co.uk

- How do people engage with (smart) e-cycling?
- Policy, design & research?
- Key user groups:
  (1) commuters
  (2) ageing population
- Mobile media for monitoring & feedback
- Potentially reduce carbon emissions

Developing fleet of 35 smart e-bikes

Server

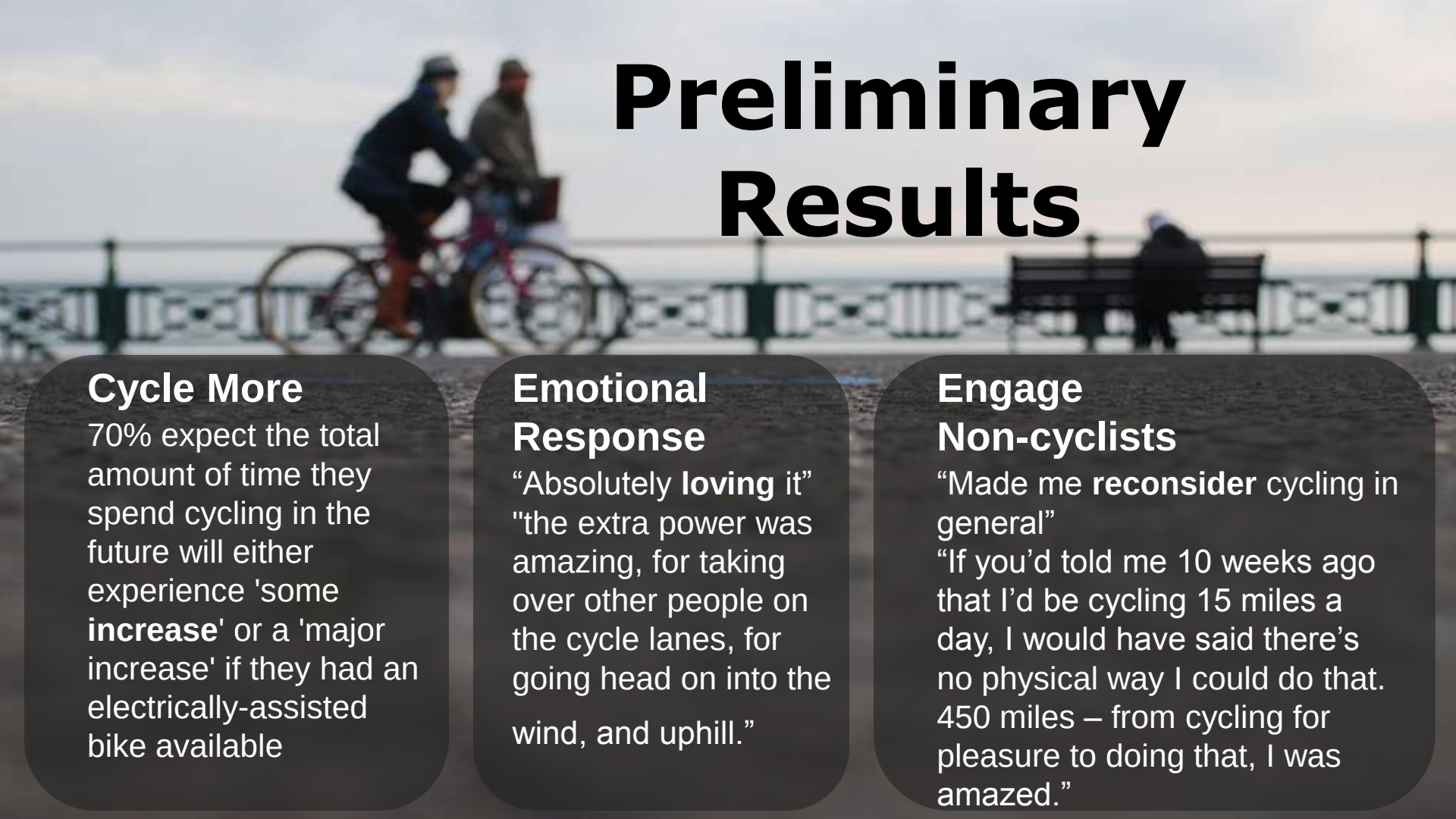
Phone/website to display and share ride data

Modular Monitoring System
realtime data:
GPS + bike motor usage + sensors (open source)

Data analysis by researchers

Motor

Battery



Preliminary Results

Cycle More

70% expect the total amount of time they spend cycling in the future will either experience 'some **increase**' or a 'major increase' if they had an electrically-assisted bike available

Emotional Response

“Absolutely **loving** it”

"the extra power was amazing, for taking over other people on the cycle lanes, for going head on into the wind, and uphill.”

Engage Non-cyclists

“Made me **reconsider** cycling in general”

“If you’d told me 10 weeks ago that I’d be cycling 15 miles a day, I would have said there’s no physical way I could do that. 450 miles – from cycling for pleasure to doing that, I was amazed.”

Preliminary Results

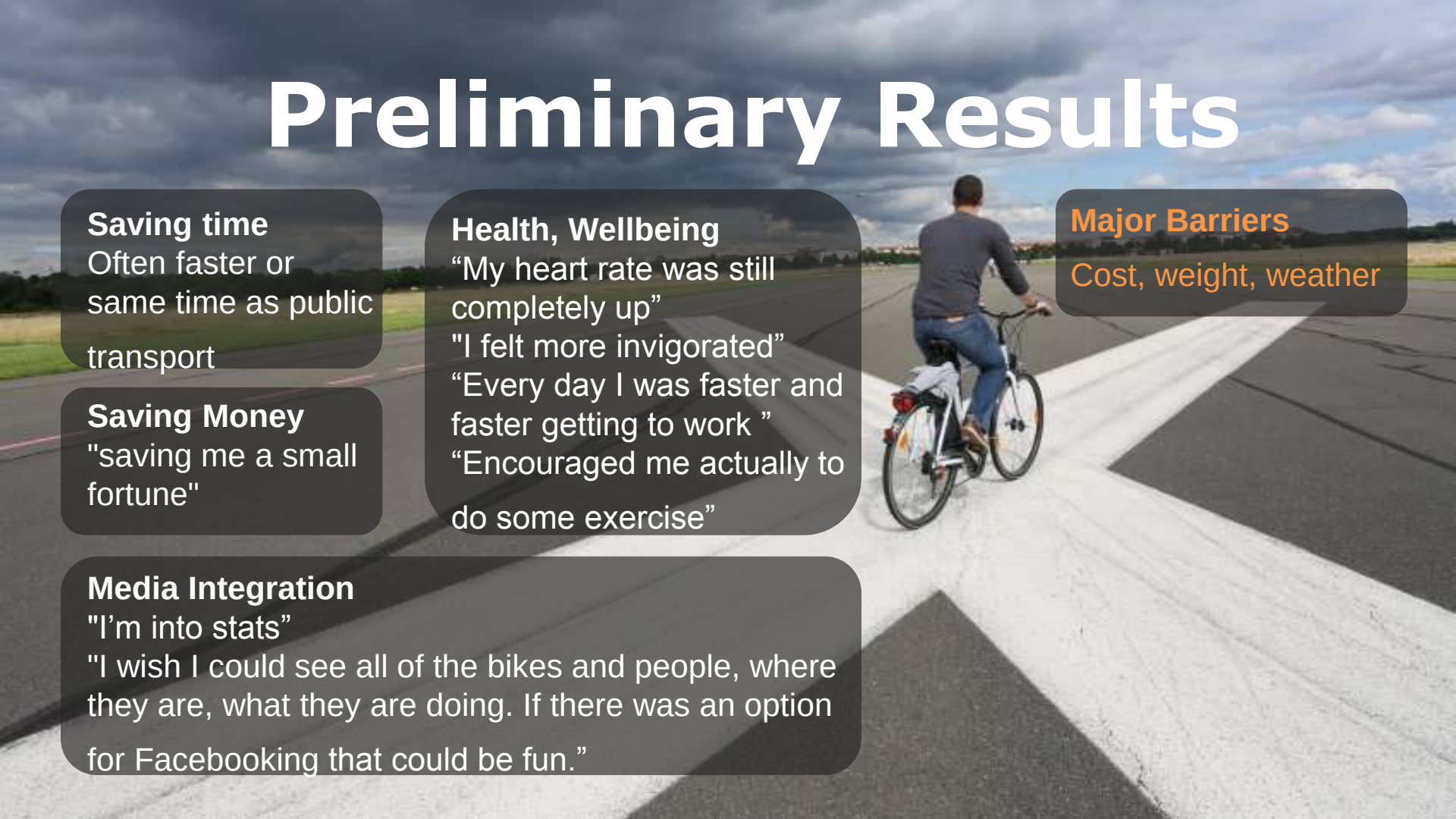
Saving time
Often faster or same time as public transport

Saving Money
"saving me a small fortune"

Health, Wellbeing
“My heart rate was still completely up”
"I felt more invigorated”
“Every day I was faster and faster getting to work ”
“Encouraged me actually to do some exercise”

Major Barriers
Cost, weight, weather

Media Integration
"I’m into stats”
"I wish I could see all of the bikes and people, where they are, what they are doing. If there was an option for Facebooking that could be fun.”



Electric Bikes - Smart, Networked, Sustainable?

Internet of Things – Mobile Media – Networked - Sensors – Sustainable Transport – Silent – Individual – Wellbeing – Sharing - Crowdsourcing

Dr Frauke Behrendt
Smart e-bikes Research Project
www.smart-ebikes.co.uk

University of Brighton
f.behrendt@brighton.ac.uk
www.fraukebehrendt.com

Sponsors

University of Brighton

EPSRC
Engineering and Physical Sciences Research Council

UCL

University of ULSTER

Research Councils UK Energy For a Low Carbon Future

Local Sustainable Transport Fund (LSTF)

BupaFoundation
The Medical Research Charity

Brighton & Hove

Bupa

RALEIGH BIKES

References

Behrendt, F., Cairns, S., Raffo, D., Kiefer, C. (2012) Smart e-bikes. Available at: www.smart-ebikes.co.uk

Cherry, Christopher R., Jonathan X. Weinert, Yang Xinmiao. (2009) Comparative Environmental Impacts of E-bikes in China. Transportation Research Part D 14, 281-290

Hurst, D. & Gartner, J., 2012. Executive Summary: Electric Bicycles. Available at: http://www.pikeresearch.com/research/electric-bicycles.

Shao, Z. et al., 2012. Can Electric 2-Wheelers Play a Substantial Role in Reducing CO 2 Emissions?, University of California, Davis. Available at: http://pubs.its.ucdavis.edu/publication_detail.php?id=1610.

Weinert, Jonathan X., Chaktan Ma, Xinmiao Yang, Christopher R. Cherry (2008) Electric Two-Wheelers in China: Effect on Travel Behavior, Mode Shift, and User Safety Perceptions in a Medium-Sized City.

Transportation Research Record 2038, 62 – 68