Using Street View to Audit the Built Environment

Is it Reliable?

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Measuring the Built Environment

Brownson et. al (2009) identified 3 general approaches:

1. Perceived measures obtained from surveys of participants — Subjective / Self-report
2. Obtaining measures from existing data sets (e.g., using GIS)
3. Systematic observational audits by trained observers

} Objective

Brownson RC, Hoehner CM, Day K, Forsyth A, Sallis JF. 2009. Measuring the Built Environment for Physical Activity: State of the Science. *American Journal of Preventive Medicine,* 36(4): S99-S123.

Background

- Field Audits
  - Trained observers walk or drive through the study area and identify the presence/absence of built environment characteristics and their condition
  - e.g., are sidewalks present?, are they in good shape? recreational facilities? levels of physical disorder? etc.
  - Provides a human perspective that is not captured in most "top-down" GIS data

Background

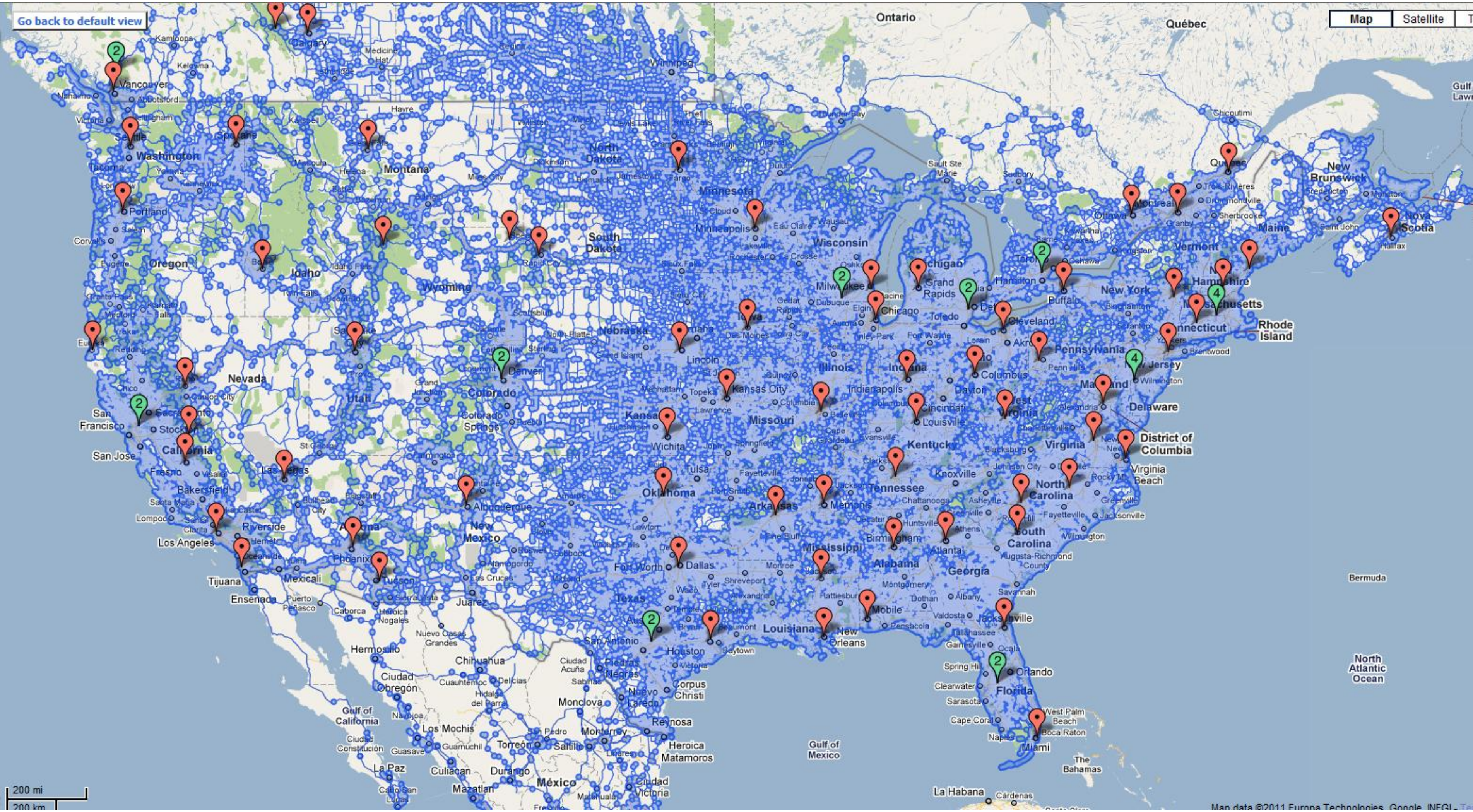
- Limitations of Field Audits include…
  - Time and expense if data are needed for large or geographically dispersed areas
  - May need to train large groups of people to collect data
  - It's not possible to go back in time to evaluate environmental conditions as they existed in the past (e.g., to support retrospective longitudinal studies)

New Methods to Measure Built Environment

- Omnidirectional Imagery
  - Simultaneous collection of images in multiple directions from a single location producing a panoramic view
  - Allows the viewer to virtually walk or drive through a community to observe characteristics
  - Imagery provides a visual record of built environment characteristics (potential for retrospective studies)

What's Omnidirectional Imagery?

- Example of an omnidirectional imaging system



Go back to default view
Map
Satellite
Ontario
Québec
Vancouver
Seattle
Washington
Spokane
Portland
Oregon
Idaho
Montana
Wyoming
North Dakota
South Dakota
Minnesota
Minneapolis
Wisconsin
Michigan
Grand Rapids
Chicago
Toledo
Cleveland
Buffalo
Montréal
Ottawa
Québec
New Brunswick
Nova Scotia
Maine
Vermont
New Hampshire
Massachusetts
Rhode Island
Connecticut
New York
Pennsylvania
New Jersey
Maryland
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Virginia
Virginia Beach
West Virginia
Ohio
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Indiana
Indianapolis
Illinois
Iowa
Nebraska
Lincoln
Kansas City
Kansas
Wichita
Missouri
Louisville
Cincinnati
Kentucky
Tennessee
Knoxville
Memphis
North Carolina
South Carolina
Georgia
Atlanta
Alabama
Birmingham
Mississippi
Louisiana
New Orleans
Arkansas
Oklahoma
Tulsa
Texas
Dallas
Fort Worth
Houston
San Antonio
Austin
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Orlando
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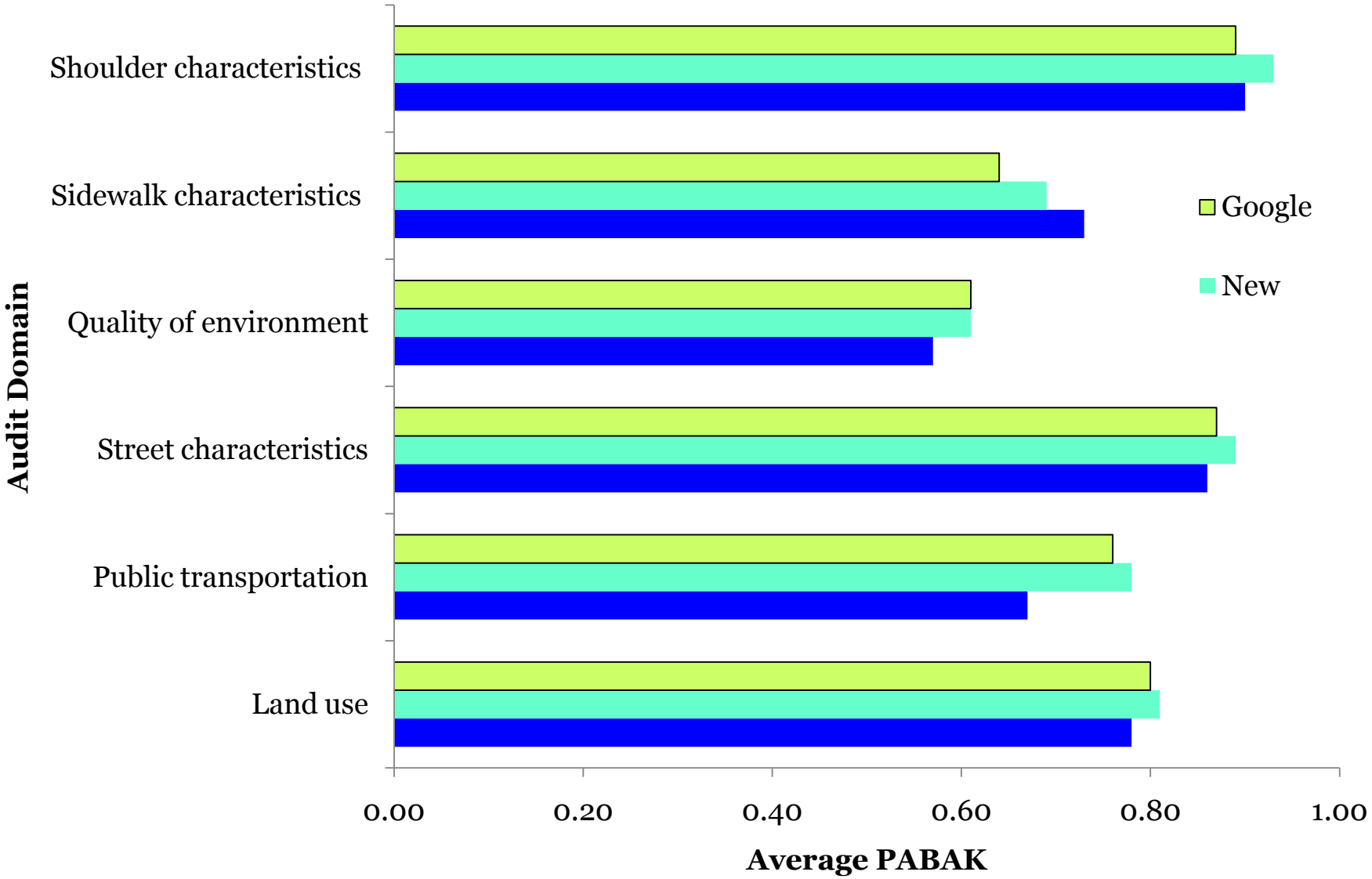
Colorado
Denver
Colorado Springs
New Mexico
Albuquerque
Arizona
Phoenix
Tucson
Las Vegas
California
San Francisco
San Jose
Sacramento
Stockton
Fresno
Bakersfield
Los Angeles
Riverside
Tijuana
Mexicali
Ensenada
Hermosillo
Chihuahua
Monclova
Monterrey
Reynosa
Heroica Matamoros
México
Gulf of California
Gulf of Mexico
Bermuda
North Atlantic Ocean
The Bahamas
La Habana
Map data ©2011 Europa Technologies, Google, INEGI
200 mi
200 km

New Methods to Measure Built Environment

- Omnidirectional Imagery
  - How useful is this type of imagery for replacing or supplementing field audits?
  - Is it reliable method for assessing the built environment?

Comparing 3 Sources of Imagery



Objective

Assess inter-rater reliability
of using Google Street View
as a method for auditing the built environment

SAMPLING TABLE

	Residential Land Use Area Above Median		Residential Land Use Area Below Median	
	>/= 20% Poverty	< 20% Poverty	>/= 20% Poverty	< 20% Poverty
>50% African American	31	36	38	40
>50% White	34	39	32	38

n = 288

Measurement

- Active Neighborhood Checklist
  - Land Use Characteristics
  - Sidewalks
  - Shoulders & Bike Lanes
  - Street Characteristics
  - Quality of the Environment

Analysis

- Reliability between two independent raters viewing the same street
  - Cohen's Kappa (K) & PABAK (adjusts for lack of variability)
  - All variables were dichotomized
    - Ex. Sidewalk present or not present (captured as not present, present one side or present on both sides)

Table 1. Inter-rater Reliability using PABAK and % Agreement

	PABAK	% Agreement	Interpretation
Land Use			
Types of land use	0.76	76	Substantial
Predominant uses	0.85	84	Nearly Perfect
Residential uses	0.89	88	Nearly Perfect
Parking facilities	0.60	59	Substantial
Recreational uses	0.97	96	Nearly Perfect
Non-residential uses	0.93	91	Nearly Perfect

Table 2. Inter-rater Reliability using PABAK and % Agreement

	PABAK	% Agreement	Interpretation
Public Transportation	0.90	89	Nearly Perfect
Street Characteristics	0.91	89	Nearly Perfect
Quality of Environment	0.73	72	Substantial

Table 3. Inter-rater Reliability using PABAK and % Agreement			
	PABAK	% Agreement	Interpretation
Sidewalk Characteristics			
Sidewalk present	0.90	88	Nearly Perfect
Sidewalk continuity	0.83	82	Nearly Perfect
Sidewalk width	0.70	71	Substantial
Curb cuts	0.63	62	Substantial
Buffer	0.82	81	Nearly Perfect
Alignment/Obstructions	0.73	61	Substantial

Table 4. Inter-rater Reliability using PABAK and % Agreement

	PABAK	% Agreement	Interpretation
Shoulder Characteristics			
Bike route or signage	0.97	95	Nearly Perfect
Shoulder present	0.85	84	Nearly Perfect
Shoulder width	0.93	92	Nearly Perfect
Shoulder continuity	1.00	99	Nearly Perfect
Shoulder obstructions	1.00	99	Nearly Perfect

Implications

Street View is a reliable alternative to field audits

- Strong inter-rater reliability
- Strong agreement with field audits

Items less reliable:

- Quality (e.g, trash, sidewalk alignment)
- Parking facilities (e.g., on street parking)
- Curb cuts

Next Steps

Assess the relationship between physical activity behavior (as measured through direct observation) and the built environment (as measured through imagery and in-person field audits)

- Do more walkable/bikable streets have more pedestrian activity?

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