Utilitarian and Recreational Walking Differ in Their Associations with the Built Environment

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Opportunities for Accelerating
the Assessment of Health Impacts, Washington DC

Session: Determinants of Active Travel

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Introduction

- Many health benefits of walking
- {barriers, facilitators} $\rightarrow$ Walking
- Mixed results

Introduction

- Many health benefits of walking
- {barriers, facilitators} → Walking
- Mixed results
- Walking = multi-dimensional behavior

Purpose/type	Utilitarian/transportation	Recreational/leisure
Location	Home neighborhood	Worksite
Time	Weekday	Weekend
…	…	…

Difficult to Classify...

- Walking dog?
  - Utilitarian (Agrawal 2007)
  - Recreational (Cutt 2008)
  - Neither (Yang 2012)
- Walking to gym?
  - Purpose of walking : Purpose of destination activity

- We need robust classification definitions.

Utilitarian vs. Recreational

	Utilitarian	Recreational	Data
Duration	<		NHTS, NHIS
Prevalence	>		ATU, NHIS
Built environment	Strong	Weak	Saelens 2008
Destination	Strong	Weak	Sugiyama 2012

Utilitarian vs. Recreational

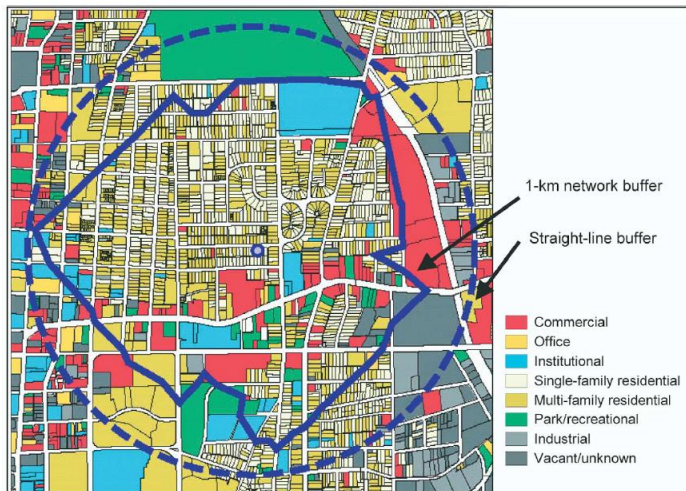|	Utilitarian	Recreational	Data
Duration	<		NHTS, NHIS
Prevalence	>		ATU, NHIS
Built environment	Strong	Weak	Saelens 2008
Destination	Strong	Weak	Sugiyama 2012

Lack of Specificity

Figure 2. Measuring urban form.

Frank 2005
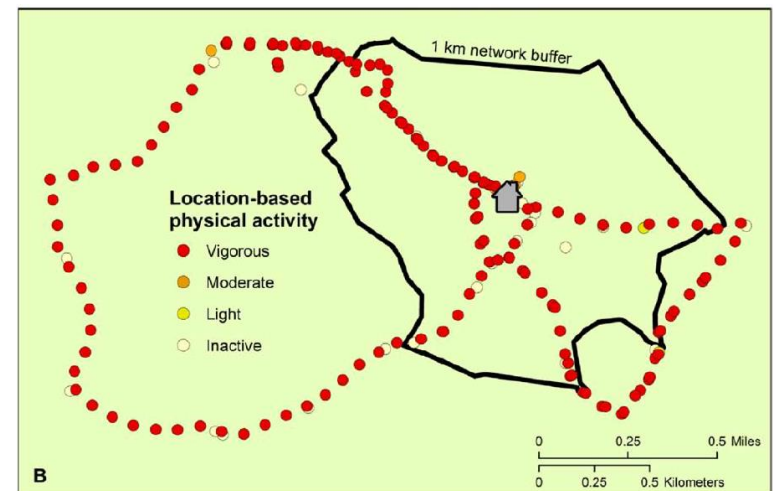

Figure 2. Location-based physical activity for participant overlaid with street showing activity around home (B)

Troped 2010

Objectives

1. Walking classification method
   {util walking UW, rec walking RW}

2. Walking   =   multi-dimensional
                   ≠   singular

3. Locations of walking by type

Data from Travel Assessment and Community (TRAC) Project

- Natural experiment: Impact of LRT on PA

- 3 observations
  - Before: 2008-2009
  - Shortly after: 2010-2011
  - 3-4 years after: 2012~

- 750 participants

Introduced in July 2009
Source: http://www.soundtransit.org

Real-time Activity and Location Tracking

ActiGraph GT1M
27g; 1.5" x 1.44" x 0.70"

GlobalSat DG-100
Data Logger
318g; 3.15" x 2.75" x 0.70"

Travel Diary
10 places x 7 days;
8.5" x 5.5"

Data Processing and Walking Classification

Kang 2013; Hurvitz 2014
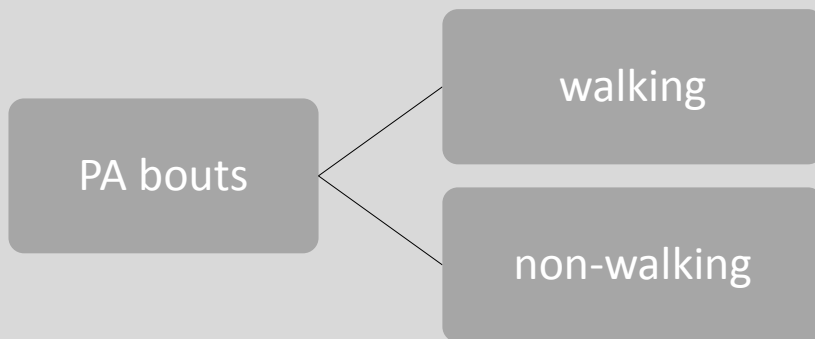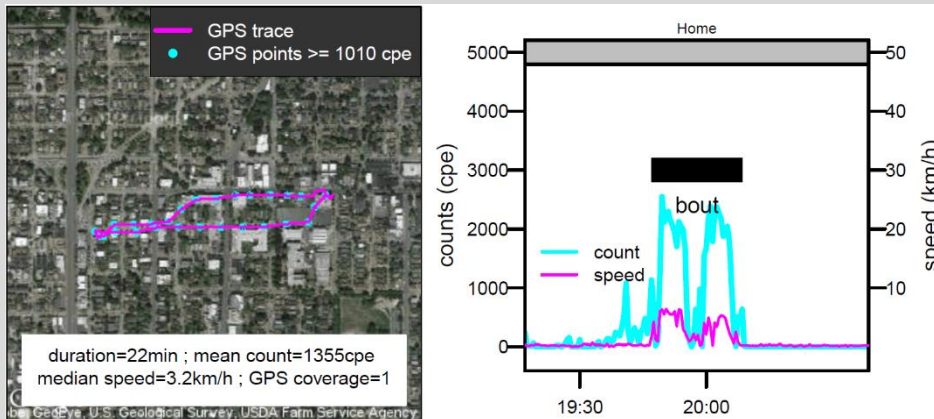
Definition

destination

PA bouts — walking — utilitarian

walking — recreational

non-walking

no destination

Type Classification

- Utilitarian: having a destination
- Recreational: having NO destination

Walking tour
from travel diary
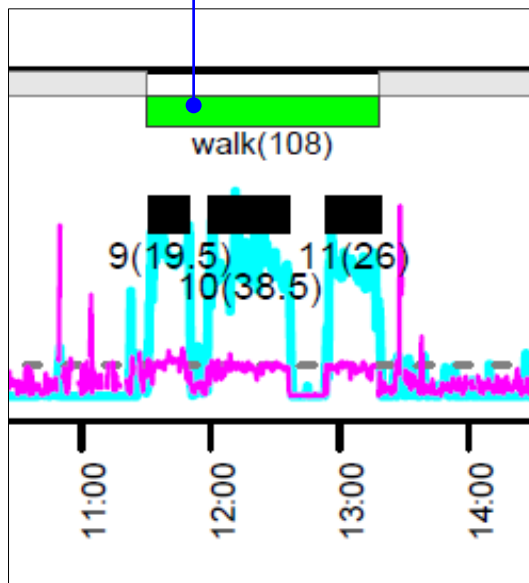
GPS track having
length(P_i, P_N) < 132ft

Diary-derived
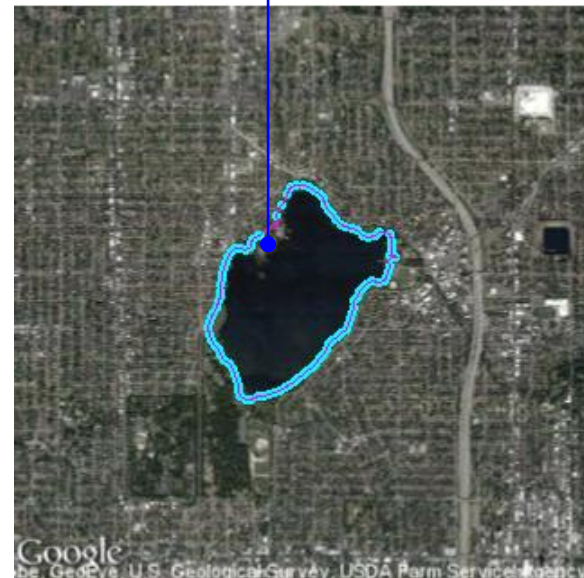
GPS-derived

Location and Built Environment

- Home neighborhood: 833-m buffer

- {home, nonhome}
  - > 50% GPS points in home neighborhood
  - <= 50% GPS points in home neighborhood

- BE measure
  - at home
  - at walking
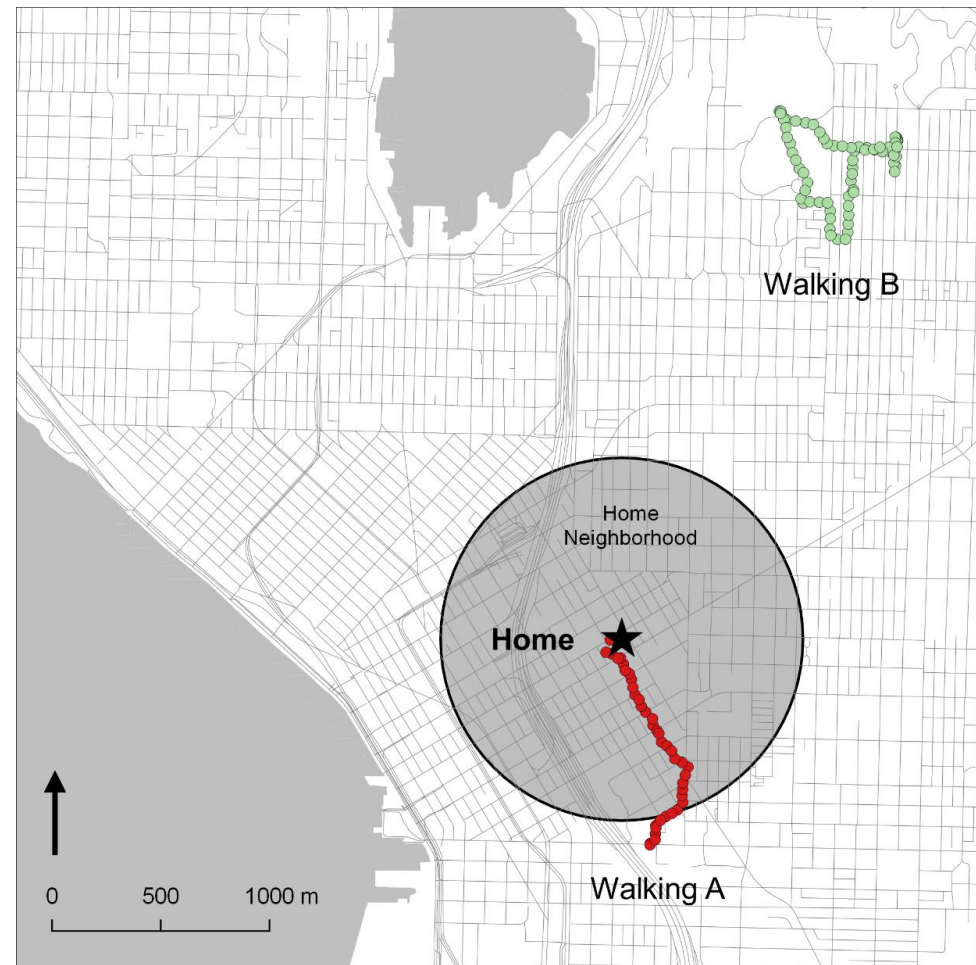
BE Characteristics

- Residential unit density
- Average property value
- Job density
- Street intersection density
- Area % parks/trails
- Area % clustered neighborhood destinations
  - {supermarket, restaurant, retail}
- Slope

residential units / acre
High : 39.236
Low : 0
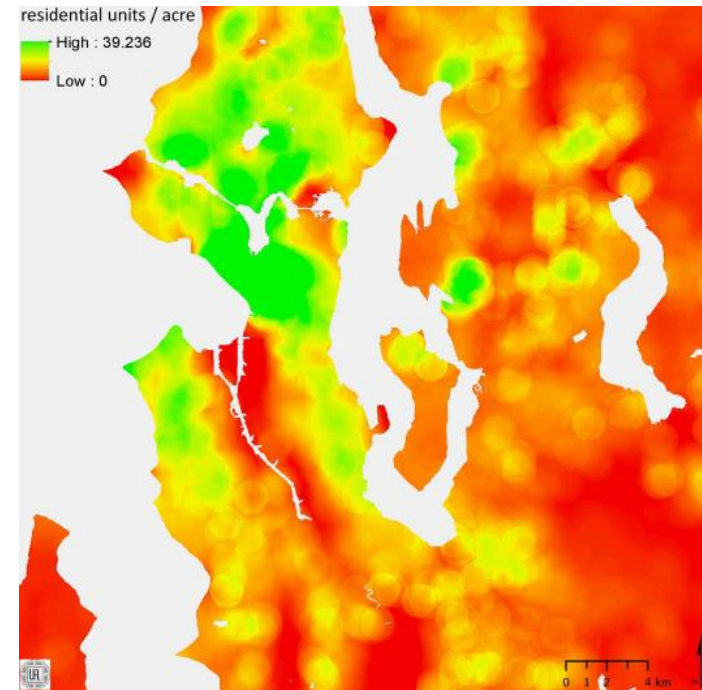
Hurvitz 2014

Sample

- 651 participants (6.6 d / p)
  - 62% Female
  - 63% Age 40-64
  - 79% non-Hispanic White
  - 63% HHD income $50K-$100K
  - 52% employed
  - BE at home
    - Medium density 20.5 du/ha
- 138,160 GPS points

Walking Classification

- 6,528 walking bouts
  - 5,060 GPS walking bouts
  - 1,468 non-GPS walking bouts

Classification data
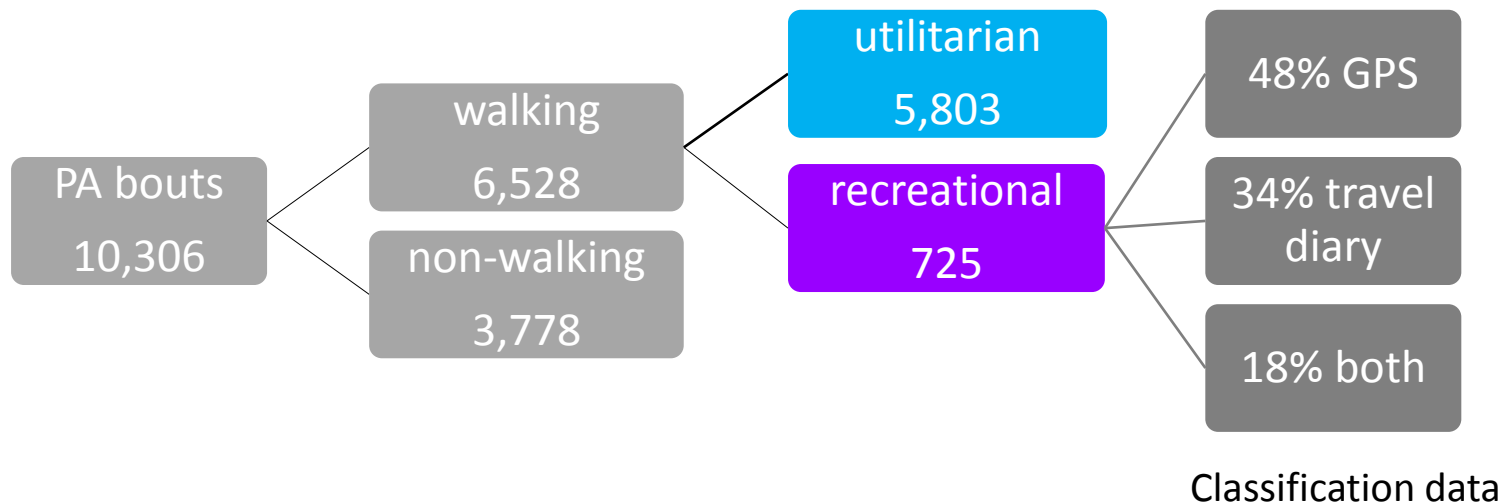
Walking Bouts

- Significantly different!

Walking bouts	Utilitarian (n=5,803)		Recreational (n=725)		P^b	All (n=6,528)	
	Mean	95% CI	Mean	95% CI		Mean	95% CI
Duration [min]	14.3	[13.8, 14.9]	26.6	[24.6, 28.7]	<.001	15.8	[15.2, 16.4]
Accelerometer count mean [counts/30 s]	1,448.0	[1,416.8, 1,479.3]	1,543.5	[1,486.1, 1,600.9]	<.001	1,457.9	[1,427.8, 1,488.0]
GPS coverage [a] [%]	63.4	[61.1, 65.8]	80.4	[76.9, 83.9]	<.001	65.4	[63.1, 67.7]
	Count	(%)	Count	(%)	P^c	Count	(%)
Day of week					<.001		
- Week days	4,449	(76.7)	508	(70.1)		4,957	(75.9)
- Weekend days	1,354	(23.3)	217	(29.9)		1,571	(24.1)
Time of day					.006		
- 4:00am - 6:59am (early morning)	176	(3.0)	30	(4.1)		206	(3.2)
- 7:00am - 10:59am (morning)	1,344	(23.2)	194	(26.8)		1,538	(23.6)
- 11:00am - 1:59pm (lunch)	1,432	(24.7)	146	(20.1)		1,578	(24.2)
- 2:00pm - 3:59pm (afternoon)	806	(13.9)	120	(16.6)		926	(14.2)
- 4:00pm - 6:59pm (late afternoon)	1,389	(23.9)	156	(21.5)		1,545	(23.7)
- after 7:00pm & before 3:59am (evening and before morning)	656	(11.3)	79	(10.9)		735	(11.3)

Walking Bouts

- Recreational walking were longer and more physically intense than utilitarian walking.

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Walking Bouts

- Temporal distribution of utilitarian walking was similar with *all trips*.

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Utilitarian walking ≈ 2009 NHTS all trips

GPS Walking Bouts

- Significantly different!

GPS walking bouts	Utilitarian (n=4,407)		Recreational (n=653)			All (n=5,060)	
	Mean	95% CI	Mean	95% CI	P [b]	Mean	95% CI
Duration [min]	14.7	[14.1, 15.3]	26.8	[24.7, 29.0]	<.001	16.3	[15.6, 17.0]
Accelerometer count mean [counts/30 s]	1,463.6	[1,430.5, 1,496.7]	1,538.3	[1,479.5, 1,597.1]	.011	1,472.1	[1,440.7, 1,503.6]
GPS coverage [a] [%]	80.6	[79.1, 82.1]	87.7	[85.4, 90.0]	<.001	81.4	[80.0, 82.9]
GPS speed mean [km/h]	3.8	[3.7, 3.8]	3.5	[3.4, 3.6]	<.001	3.7	[3.7, 3.8]
% of GPS points within NCs [d] [%]	21.5	[19.6, 23.5]	12.0	[8.9, 15.1]	<.001	20.0	[18.2, 21.9]
% of GPS points within parks or trails [%]	11.8	[10.6, 13.1]	19.9	[16.4, 23.3]	<.001	12.7	[11.4, 14.0]
	Count	%	Count	%	P [c]	Count	%
Home neighborhood	2,256	(51.2)	427	(65.4)	<.001	2,683	(53.0)
Nonhome neighborhood	2,151	(48.8)	226	(34.6)		2,377	(47.0)
GPS Walking bouts in KC UGA [e]	Utilitarian (n=4,285)		Recreational (n=620)			All (n=4,905)	
	Mean	95% CI	Mean	95% CI	P [b]	Mean	95% CI
Residential density [dwelling units/ha]	23.2	[22.1, 24.3]	15.8	[14.3, 17.4]	<.001	22.2	[21.1, 23.2]
Average property value [1,000 USD/unit]	255.2	[249.0, 261.4]	291.0	[275.0, 307.1]	<.001	260.1	[253.5, 266.7]
Job density [jobs/ha]	147.4	[134.1, 160.6]	49.9	[36.0, 63.8]	<.001	134.3	[121.9, 146.8]
Street intersection density [count/km^2]	105.2	[102.4, 108.1]	83.4	[79.3, 87.5]	<.001	102.3	[99.5, 105.0]
Area % of NCs [d] [%]	11.3	[10.5, 12.1]	8.0	[6.8, 9.2]	<.001	10.8	[10.0, 11.5]
Area % of parks or trails [%]	5.2	[4.7, 5.6]	9.4	[8.0, 10.7]	<.001	5.6	[5.2, 6.1]
Average slope in degree [°]	3.9	[3.8, 3.9]	4.2	[4.0, 4.4]	<.001	3.9	[3.8, 4.0]

GPS Walking Bouts

- The same pattern with walking bouts

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GPS Walking bouts in KC UGA [e]	Utilitarian (n=4,285)		Recreational (n=620)			All (n=4,905)	
	Mean	95% CI	Mean	95% CI	P[b]	Mean	95% CI
Residential density [dwelling units/ha]	23.2	[22.1, 24.3]	15.8	[14.3, 17.4]	<.001	22.2	[21.1, 23.2]
Average property value [1,000 USD/unit]	255.2	[249.0, 261.4]	291.0	[275.0, 307.1]	<.001	260.1	[253.5, 266.7]
Job density [jobs/ha]	147.4	[134.1, 160.6]	49.9	[36.0, 63.8]	<.001	134.3	[121.9, 146.8]
Street intersection density [count/km^2]	105.2	[102.4, 108.1]	83.4	[79.3, 87.5]	<.001	102.3	[99.5, 105.0]
Area % of NCs [d] [%]	11.3	[10.5, 12.1]	8.0	[6.8, 9.2]	<.001	10.8	[10.0, 11.5]
Area % of parks or trails [%]	5.2	[4.7, 5.6]	9.4	[8.0, 10.7]	<.001	5.6	[5.2, 6.1]
Average slope in degree [°]	3.9	[3.8, 3.9]	4.2	[4.0, 4.4]	<.001	3.9	[3.8, 4.0]

GPS Walking Bouts

- UW: 1/2 ; RW: 2/3 at home neighborhood

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Area % of parks or trails [%]	5.2	[4.7, 5.6]	9.4	[8.0, 10.7]	<.001	5.6	[5.2, 6.1]
Average slope in degree [°]	3.9	[3.8, 3.9]	4.2	[4.0, 4.4]	<.001	3.9	[3.8, 4.0]

GPS Walking Bouts

- UW: 22% GPS points in NC; RW: 20% GPS points in parks

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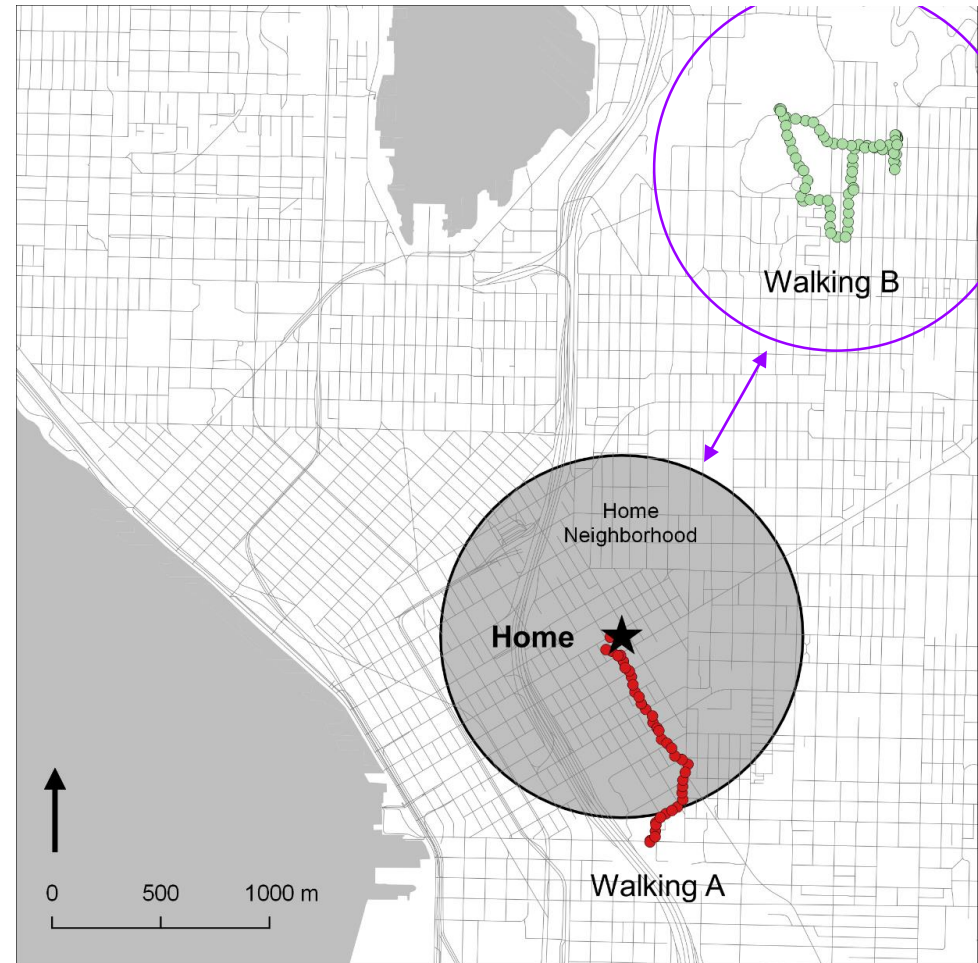| GPS Walking bouts in KC UGA [e]	Utilitarian (n=4,285)		Recreational (n=620)			All (n=4,905)	
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GPS Walking Bouts

- U: density, street, destination; R: wealthy, park, slope

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Duration [min]	14.7	[14.1, 15.3]	26.8	[24.7, 29.0]	<.001	16.3	[15.6, 17.0]
Accelerometer count mean [counts/30 s]	1,463.6	[1,430.5, 1,496.7]	1,538.3	[1,479.5, 1,597.1]	.011	1,472.1	[1,440.7, 1,503.6]
GPS coverage [a] [%]	80.6	[79.1, 82.1]	87.7	[85.4, 90.0]	<.001	81.4	[80.0, 82.9]
GPS speed mean [km/h]	3.8	[3.7, 3.8]	3.5	[3.4, 3.6]	<.001	3.7	[3.7, 3.8]
% of GPS points within NCs [d] [%]	21.5	[19.6, 23.5]	12.0	[8.9, 15.1]	<.001	20.0	[18.2, 21.9]
% of GPS points within parks or trails [%]	11.8	[10.6, 13.1]	19.9	[16.4, 23.3]	<.001	12.7	[11.4, 14.0]
	Count	%	Count	%	P^c	Count	%
Home neighborhood	2,256	(51.2)	427	(65.4)	<.001	2,683	(53.0)
Nonhome neighborhood	2,151	(48.8)	226	(34.6)		2,377	(47.0)
GPS Walking bouts in KC UGA [e]	**Utilitarian** (n=4,285)		**Recreational** (n=620)			**All** (n=4,905)	
	Mean	95% CI	Mean	95% CI	P^b	Mean	95% CI
Residential density [dwelling units/ha]	23.2	[22.1, 24.3]	15.8	[14.3, 17.4]	<.001	22.2	[21.1, 23.2]
Average property value [1,000 USD/unit]	255.2	[249.0, 261.4]	291.0	[275.0, 307.1]	<.001	260.1	[253.5, 266.7]
Job density [jobs/ha]	147.4	[134.1, 160.6]	49.9	[36.0, 63.8]	<.001	134.3	[121.9, 146.8]
Street intersection density [count/km²]	105.2	[102.4, 108.1]	83.4	[79.3, 87.5]	<.001	102.3	[99.5, 105.0]
Area % of NCs [d] [%]	11.3	[10.5, 12.1]	8.0	[6.8, 9.2]	<.001	10.8	[10.0, 11.5]
Area % of parks or trails [%]	5.2	[4.7, 5.6]	9.4	[8.0, 10.7]	<.001	5.6	[5.2, 6.1]
Average slope in degree [°]	3.9	[3.8, 3.9]	4.2	[4.0, 4.4]	<.001	3.9	[3.8, 4.0]

Nonhome Walking

- 1/2 UW ; 1/3 RW away from home

- Where walking occurred outside home neighborhoods?

- Walking location vs. walkers home neighborhood

What is that location compared to the walker's home?

Nonhome Walking

- UW: 105% more jobs than home
- RW: $75,000 / unit more expensive
         163% more park areas than home

Nonhome GPS walking bouts in KC UGA [a]	Utilitarian (n=2,029)		Recreational (n=193)			All (n=2,222)	
	Mean	95% CI	Mean	95% CI	P [c]	Mean	95% CI
Residential density [dwelling units/ha]	+0.3	[-1.2, +1.8]	-4.9	[-7.3, -2.4]	<.001	-0.2	[-1.6, +1.2]
Average property value [1,000 USD/unit]	+15.8	[+5.2, +26.4]	+75.2	[+48.1, +102.4]	<.001	+21.5	[+11.2, +31.9]
Job density [jobs/ha]	+87.6	[+67.4, +107.8]	+22.0	[-6.2, +50.3]	<.001	+79.1	[+60.3, +98.0]
Street intersection density [count/km^2]	+3.0	[-1.2, +7.3]	-15.0	[-22.3, -7.6]	<.001	+1.1	[-2.9, +5.1]
Area % of NCs [b] [%]	+0.2	[-1.1, +1.6]	-2.9	[-5.3, -0.5]	<.001	+0.0	[-1.3, +1.3]
Area % of parks or trails [%]	+0.7	[-0.1, +1.6]	+8.3	[+5.3, +11.4]	<.001	+1.4	[+0.5, +2.2]
Average slope in degree [°]	-0.6	[-0.8, -0.5]	-0.2	[-0.5, +0.1]	.005	-0.6	[-0.7, -0.5]

Discussion

- UW is more specific and particular behavior.
  - Smaller variances in all variables than RW.
- RW is not like trips.
  - Temporal distributions.
- RW duration = 26.6 min
  - Regularity across data sources
  - 25.3~31.7 min from BRFSS, NHANES, NHTS, NHIS
- 1/2 of UW in nonhome N
- 1/3 of RW in nonhome N
  - Wealthier and larger parks
  - 7.5 min longer than home RW
- 58% of RW in home N were completely outside of parks
  - Mean distance to the closest park = .2 km

Discussion (cont)

- Classification using *revealed* activity outcome, *having a destination*, not *stated* purposes

- Spatial mismatch
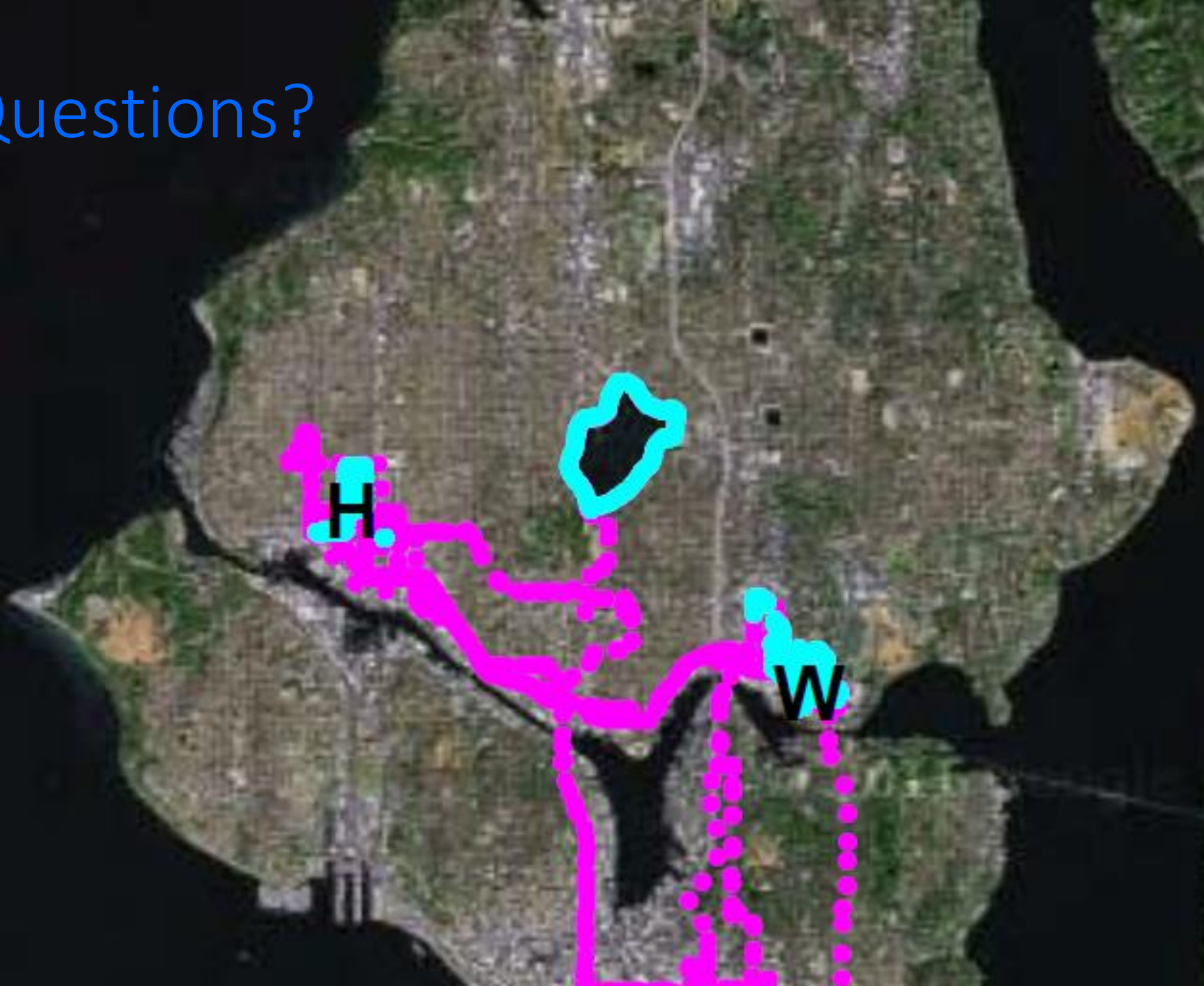
- Missing GPS data issues

Acknowledgements

Questions?

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