



HEART HEALTHY HOODS



*Validación de una herramienta
para medir el entorno de las
calles para andar y usar la
bicicleta en Madrid: medición
directa y con Google Street View*

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Grupo de Epidemiología Social y Cardiovascular

<http://www3.uah.es/cardiosocialepi>

LOS AUTORES DECLARAN NO TENER CONFLICTOS DE INTERÉS



JUSTIFICACIÓN



Estrategia poblacional actividad física: entorno residencial

Más de 30 herramientas se han desarrollado para medir el entorno urbano en relación a la actividad física

Métodos “subjetivos”

- Cuestionarios
- Entrevistas

Métodos “objetivos”

- Datos secundarios: censos, SIG
- **Herramientas de observación sistemática**



JUSTIFICACIÓN



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Review Essay

Using remote sensing to define environmental characteristics related to physical activity and dietary behaviours: A systematic review (the SPOTLIGHT project)



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Charreire H, Mackenbach JD, Ouasti M, Lakerveld J, Compernelle S, Ben-Rebah M, et al. Using remote sensing to define environmental characteristics related to physical activity and dietary behaviours: A systematic review (the SPOTLIGHT project). Health & place. 2013 Oct 23;25C:1-9. PubMed PMID: 24211730. Epub 2013/11/12. Eng.



OBJETIVOS



- Comprobar la capacidad de discriminación de una herramienta para medir el entorno residencial en relación a la actividad física en Madrid
- Validar la medición de esta herramienta con plataformas virtuales, usando la medición directa como Gold-standard
- Estudiar la concordancia inter-observador e intra-observador de la herramienta

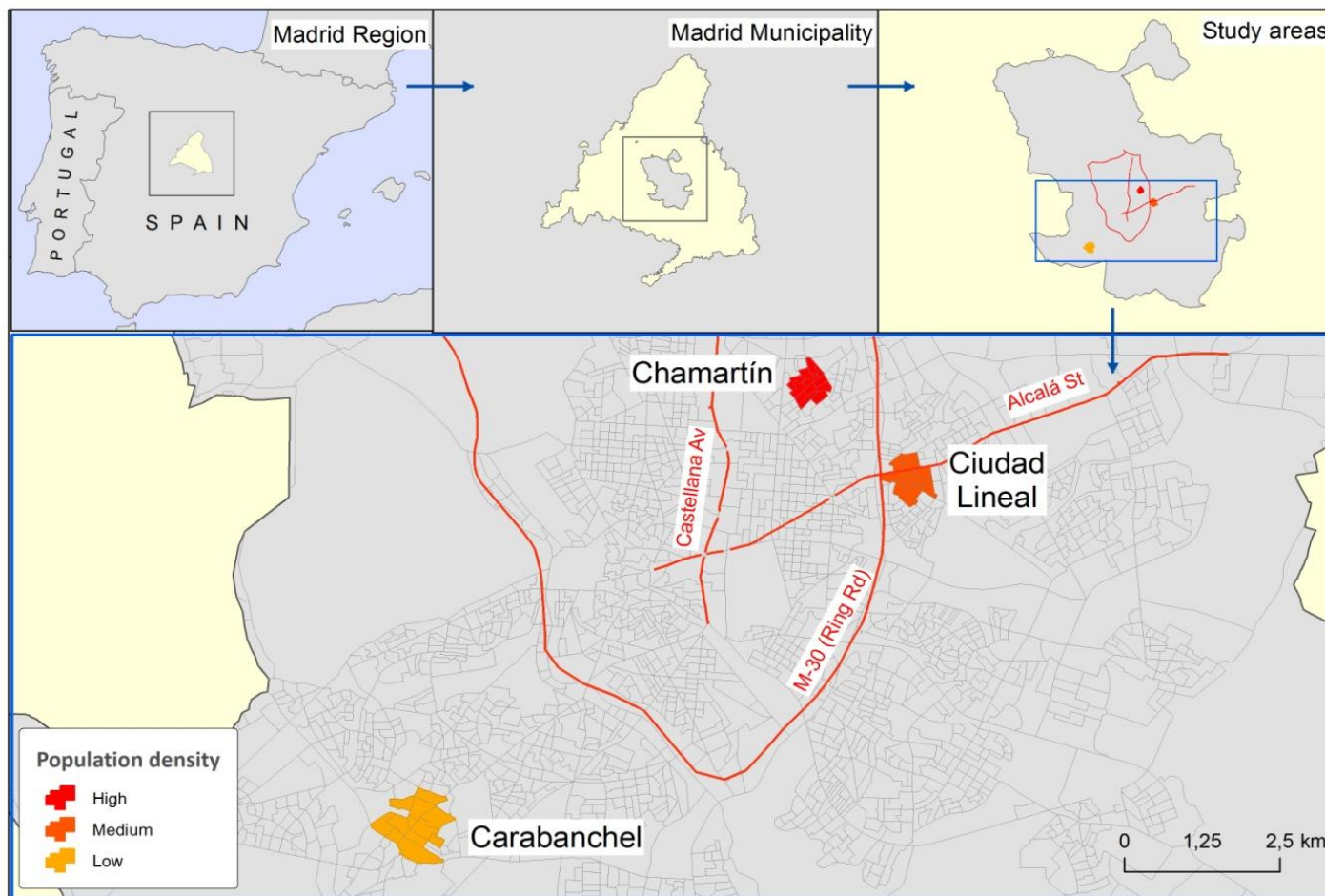


Barrios Cardio-Saludables

HEART HEALTHY HOODS



MATERIAL Y MÉTODOS





MATERIAL Y MÉTODOS

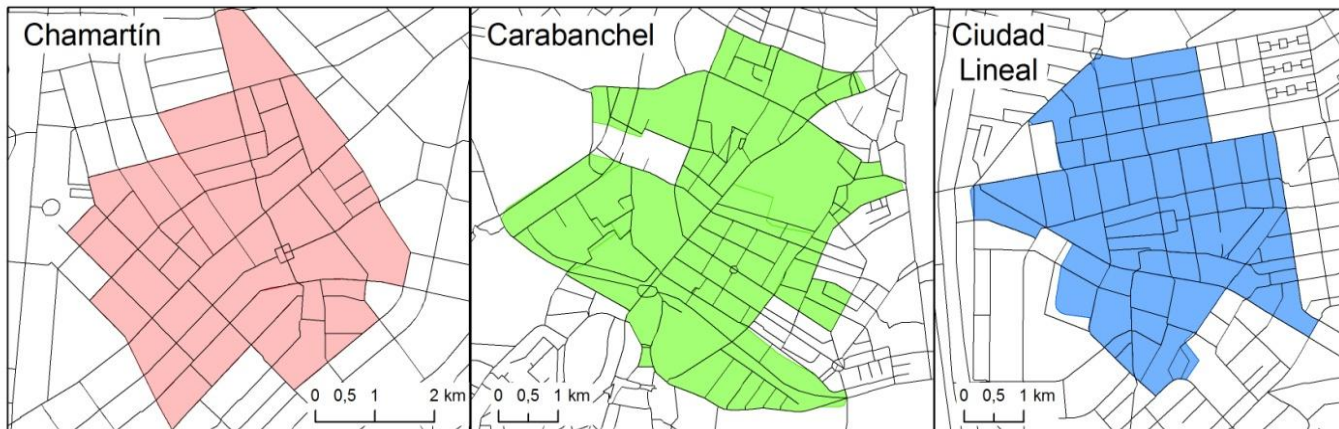


36 secciones censales (12 por área)

500 segmentos (NOMECALLES)

454 (90.8%) finalmente medidos

- 124 Chamartín
- 152 CL
- 178 Carabanchel





MATERIAL Y MÉTODOS



Function	Element	Element Weight	Item	Item weight	
Walking Function	Walking surface	1.00	Type of path	0.25	
			Path smoothness	0.20	
			Path material	0.10	
			Slope	0.20	
			Continuity	0.20	
	Neighborhood Permeability	1.00	Curb type	0.05	
			Other routes available	0.50	
			Neighborhood legibility	0.50	
	Walking infrastructure	0.33	Seats	0.50	
	Safety	Street (lanes)	0.33	Trees/verandas	0.50
Number of lanes				1.00	
Fixed traffic controls		0.33	Traffic control devices present	1.00	
			Path safety	0.66	
Aesthetics		Streetscape aesthetics	0.66	Path location	0.30
				Fixed obstacles on path	0.10
				Street lights	0.20
				Surveillance	0.20
				Graffiti/vandalism	0.20
		Traffic safety	0.66	Crossing type	0.50
	Crossing aids			0.30	
	Visible driveways			0.20	
	Trees			0.25	
	Gardens maintained			0.25	
View aesthetics Subjective walking assessment	0.66	0.33	Verges maintained	0.25	
			Cleanliness	0.25	
			Views	1.00	
			Attractiveness	0.50	
			Physical difficulty	0.50	
Destinations	Land use mix	1.00	Number of destinations presents	Out of 10	

Cycling Function	Element	Element Weight	Item	Item weight		
Cycling Function	Cycling surface	1.00	Path type	0.30		
			On-road cycle lane	0.30		
			Slope	0.20		
			Road condition	0.10		
			Curb type	0.10		
	Neighborhood permeability	1.00	Other routes available	0.50		
			Neighborhood legibility	0.50		
			Cycling infrastructure	0.33		
			Cycle storage	1.00		
			Safety	Streets (lanes)	0.66	Number of lanes
Aesthetics	Fixed traffic controls	0.66	Traffic control devices present	1.00		
			Traffic safety	0.33		
			Streetscape aesthetics	0.33	Crossing type	0.50
					Crossing aids	0.30
					Visible driveways	0.20
	Trees	0.25				
	Gardens maintained	0.25				
	View aesthetics Subjective cycling assessment	0.33	0.33	Verges maintained	0.25	
				Cleanliness	0.25	
				Views	1.00	
Attractiveness				0.50		
Physical difficulty				0.50		
Destinations	Land use mix	1.00	Number of destinations presents	Out of 10		



MATERIAL Y MÉTODOS



Auditor ID _____ Date _____
 Hood _____ Street _____
 Seg ID _____
 Hour _____ Time _____

1a. Type of buildings/ features: (tick all applicable):

	Side 1	Side 2
Transport infrastructure	<input type="checkbox"/>	<input type="checkbox"/>
Housing	<input type="checkbox"/>	<input type="checkbox"/>
Office	<input type="checkbox"/>	<input type="checkbox"/>
Convenience stores	<input type="checkbox"/>	<input type="checkbox"/>
Other retail	<input type="checkbox"/>	<input type="checkbox"/>
Industrial	<input type="checkbox"/>	<input type="checkbox"/>
Educational	<input type="checkbox"/>	<input type="checkbox"/>
Service	<input type="checkbox"/>	<input type="checkbox"/>
Natural features	<input type="checkbox"/>	<input type="checkbox"/>

1b. Predominant buildings/features (tick ONE per side only):

	Side 1	Side 2
Transport infrastructure	<input type="checkbox"/>	<input type="checkbox"/>
Housing	<input type="checkbox"/>	<input type="checkbox"/>
Office	<input type="checkbox"/>	<input type="checkbox"/>
Convenience stores	<input type="checkbox"/>	<input type="checkbox"/>
Other retail	<input type="checkbox"/>	<input type="checkbox"/>
Industrial	<input type="checkbox"/>	<input type="checkbox"/>
Educational	<input type="checkbox"/>	<input type="checkbox"/>
Service	<input type="checkbox"/>	<input type="checkbox"/>
Natural features	<input type="checkbox"/>	<input type="checkbox"/>

1c. Are the predominant buildings/features the same for both sides?

Yes 1

No 2

A. Path for walking &/or cycling (only if a path present)

2. Type of path:

7. Permanent path obstructions:

	Side 1	Side 2
Poles	<input type="checkbox"/> 1	<input type="checkbox"/>
Signs	<input type="checkbox"/> 2	<input type="checkbox"/>
Tables & chairs	<input type="checkbox"/> 3	<input type="checkbox"/>
Trees	<input type="checkbox"/> 4	<input type="checkbox"/>
None	<input type="checkbox"/> 5	<input type="checkbox"/>

B. On-road (all segments)

8. Path type:

On-road cycle lane - marked 1

On-road - no lane marked 2

9. Slope: (only assess on-road if no path is present):

Flat or gentle slope 1

Moderate slope 2

Steep slope 3

10. Condition of road:

Poor (a lot of bumps, cracks, holes) 1

Moderate (some bumps, cracks, holes) 2

Good (very few bumps, cracks, holes) 3

Under repair 4

11. Number of lanes on road (in total):

1 lane 1

2 or 3 lanes 2

4 or 5 lanes 3

6 or more lanes 4

12. Vehicle parking restriction signs present:

	Side 1	Side 2
Yes	<input type="checkbox"/> 1	<input type="checkbox"/>
No	<input type="checkbox"/> 2	<input type="checkbox"/>

20. Are destinations present in segment?

Yes 1

Go to Q24 ← No 2

21. Number of destinations:

0-5 1

5-10 2

10-15 3

22. Number car parking facilities at destinations: (approx.)

	0	1	21	51	71	101
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	(1)	(2)	(3)	(4)	(5)	(6)
Shops	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
School	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

23. Bike parking facilities:

Bike locker or enclosure 1

Bike parking or U rails 2

Rack or stand 3

None 4

24. Driveway crossovers:

Most buildings have one driveway 1

Approx. ½ buildings have one driveway 2

Approx. ¼ buildings have one driveway 3

No driveways 4

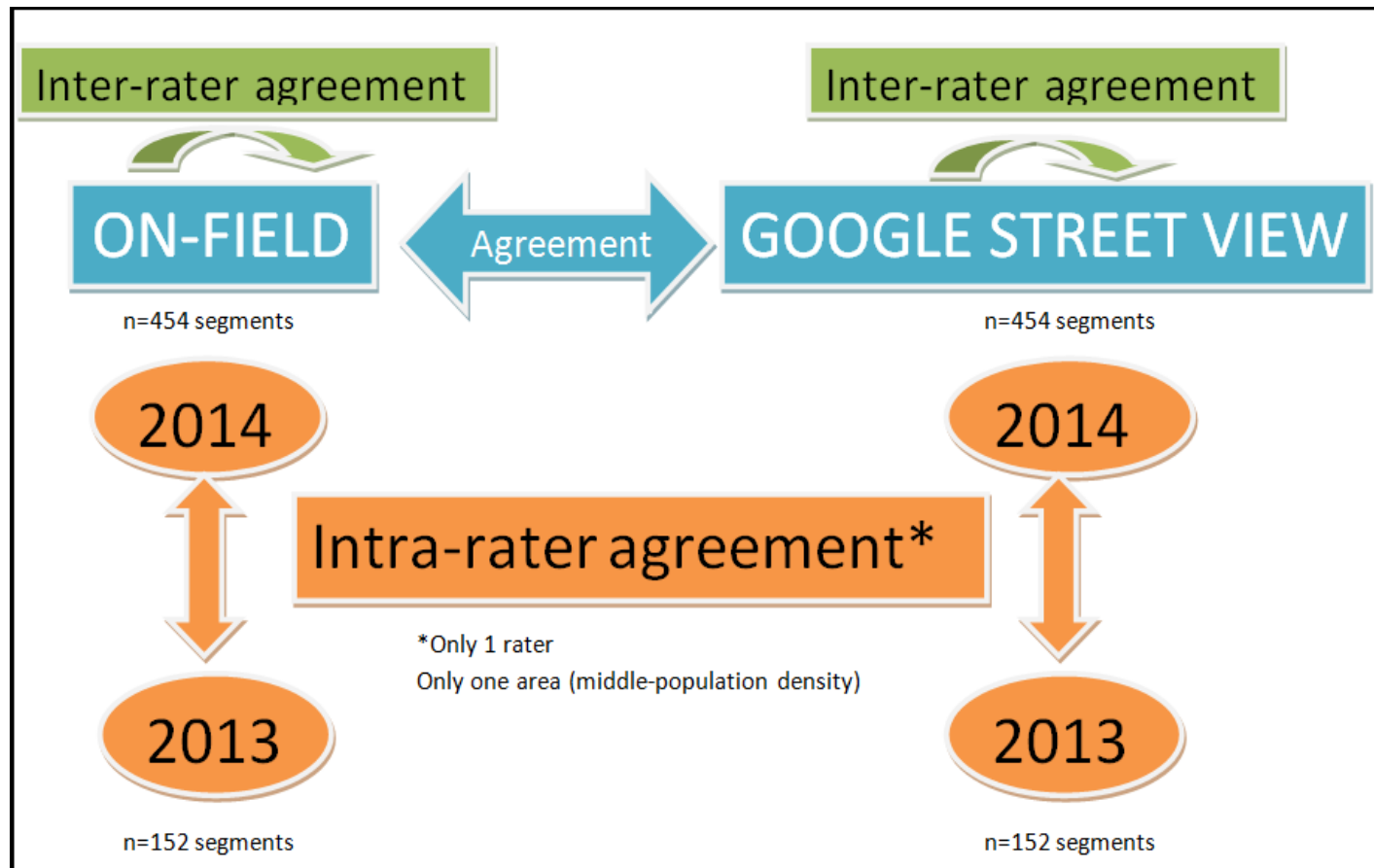
25. Surveillance: (can be observed from a window, verandah, porch, garden)

Can be observed from more than 75% of buildings 1

Can be observed from between 50%- 74% of buildings 2



MATERIAL Y MÉTODOS





MATERIAL Y MÉTODOS



Recogida de datos:
febrero-mayo 2014

Orden de medición:

1. Ciudad Lineal
2. Chamartín
3. Carabanchel

$\frac{1}{2}$ secciones censales
primero medición directa





Medición directa

Google Street View

Imágenes Google Street View: 2008-2014

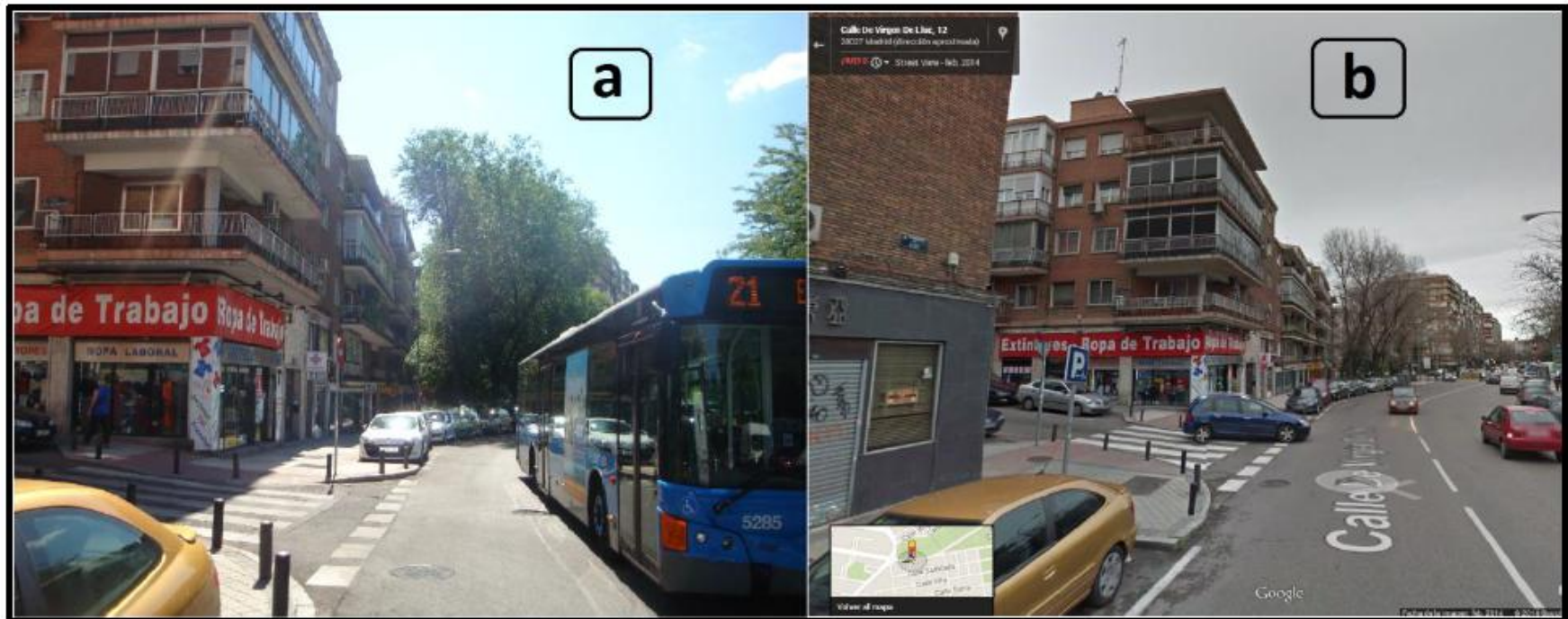


FIGURE 5. Picture of a street feature as it was used in on-field visits (a) and online audit (b). Both images were obtained in May 2014. Virtual picture corresponds to an image taken by Google in February 2014.



- ANOVA para la discriminación entre las áreas
- Índice de Correlación Intraclase (ICC)
 - Medición directa vs medición virtual
 - Inter-observador
 - Intra-observador

Concordancia	Valores ICC
Débil	<0.2
Pobre	0.2-0.4
Moderada	0.4-0.6
Sustancial	0.6-0.8
Casi perfecta	>0.8



RESULTADOS



TABLE 2. Differences in NZ-SPACES factors between the three areas that were measured on-field using data of one rater.

Factors	Mean (SD) (n = 454 segments)			p-value*
	High-density area (Chamartín) n=124 segments	Median-density area (Ciudad Lineal) n=152 segments	Low-density area (Carabanchel) n=178 segments	
<i>Walking factors</i>				
Function	1.18 (0.28)	1.41 (0.31)	1.35 (0.33)	0.002*
Safety	1.07 (0.22)	1.03 (0.24)	1.03 (0.22)	0.026*
Aesthetics	0.75 (0.25)	0.77 (0.27)	0.91 (0.29)	<0.001*
Destinations	0.55 (0.29)	0.43 (0.27)	0.29 (0.21)	<0.001*
<i>Cycling factors</i>				
Function	0.87 (0.24)	0.93 (0.23)	1.00 (0.29)	<0.001*
Safety	1.05 (0.21)	0.94 (0.25)	1.02 (0.23)	0.005*
Aesthetics	0.44 (0.16)	0.45 (0.18)	0.55 (0.17)	<0.001*
Destinations	0.55 (0.29)	0.43 (0.27)	0.29 (0.21)	<0.001*

*p<0.05 ANOVA test (bolded)



RESULTADOS



TABLE 3. Levels of agreement between factors assessed on-field and virtual, measured in three population-density different areas by one rater (n=454 segments)

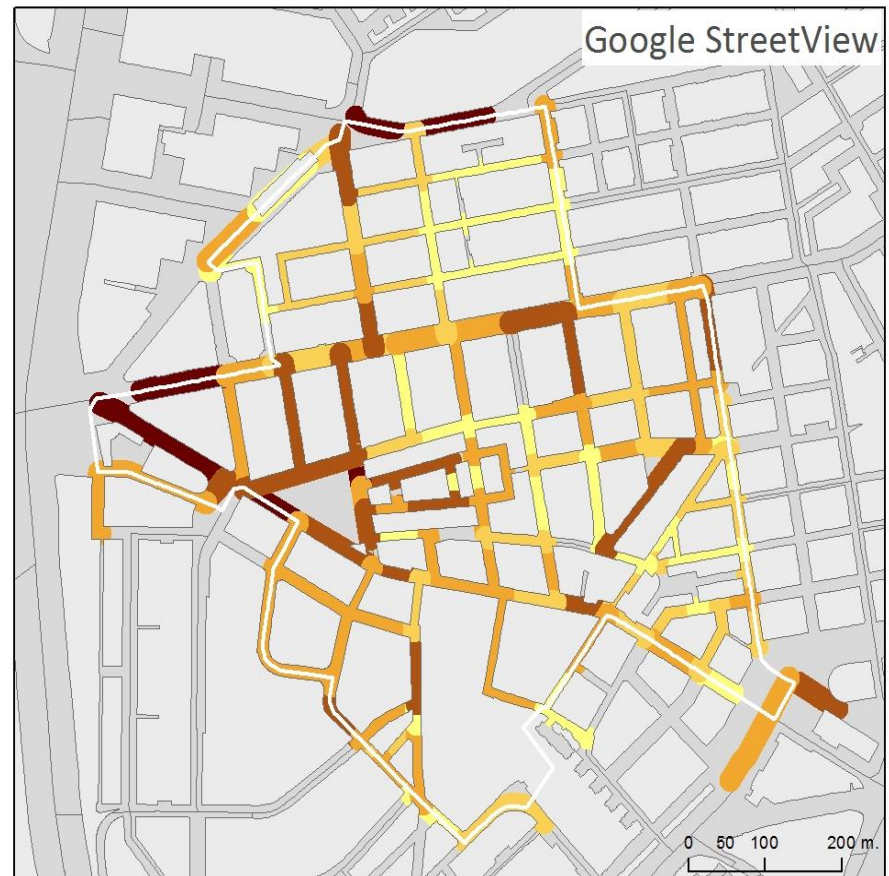
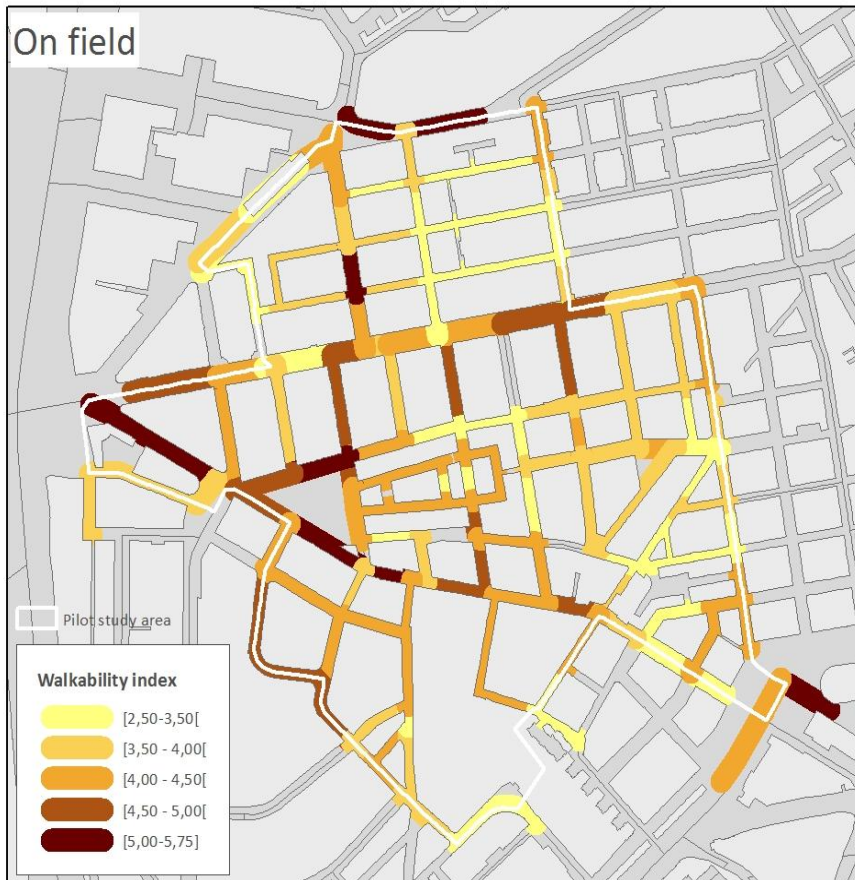
Factor	On-field audit score	Virtual audit score	ICC	CI 95%
<i><u>Walking</u></i>				
Function	1.54	1.58	0.73 ^d	0.69-0.77
Safety	1.26	1.25	0.84 ^e	0.82-0.87
Aesthetics	0.77	0.82	0.82 ^e	0.79-0.85
Destinations	0.41	0.41	0.85 ^e	0.83-0.88
<i><u>Cycling</u></i>				
Function	1.21	1.25	0.66 ^d	0.60-0.71
Safety	1.17	1.17	0.65 ^d	0.60-0.71
Aesthetics	0.48	0.52	0.78 ^d	0.75-0.82
Destinations	0.41	0.41	0.85 ^e	0.83-0.88

ICC Intraclass correlation coefficient.CI: Confidence interval

^aWeak agreement (ICC <0.2); ^b Poor agreement (ICC 0.2-0.4); ^c Moderate agreement (ICC 0.4-0.6); ^d Substantial agreement (ICC 0.6-0.8); ^e Almost perfect agreement (ICC >0.8)

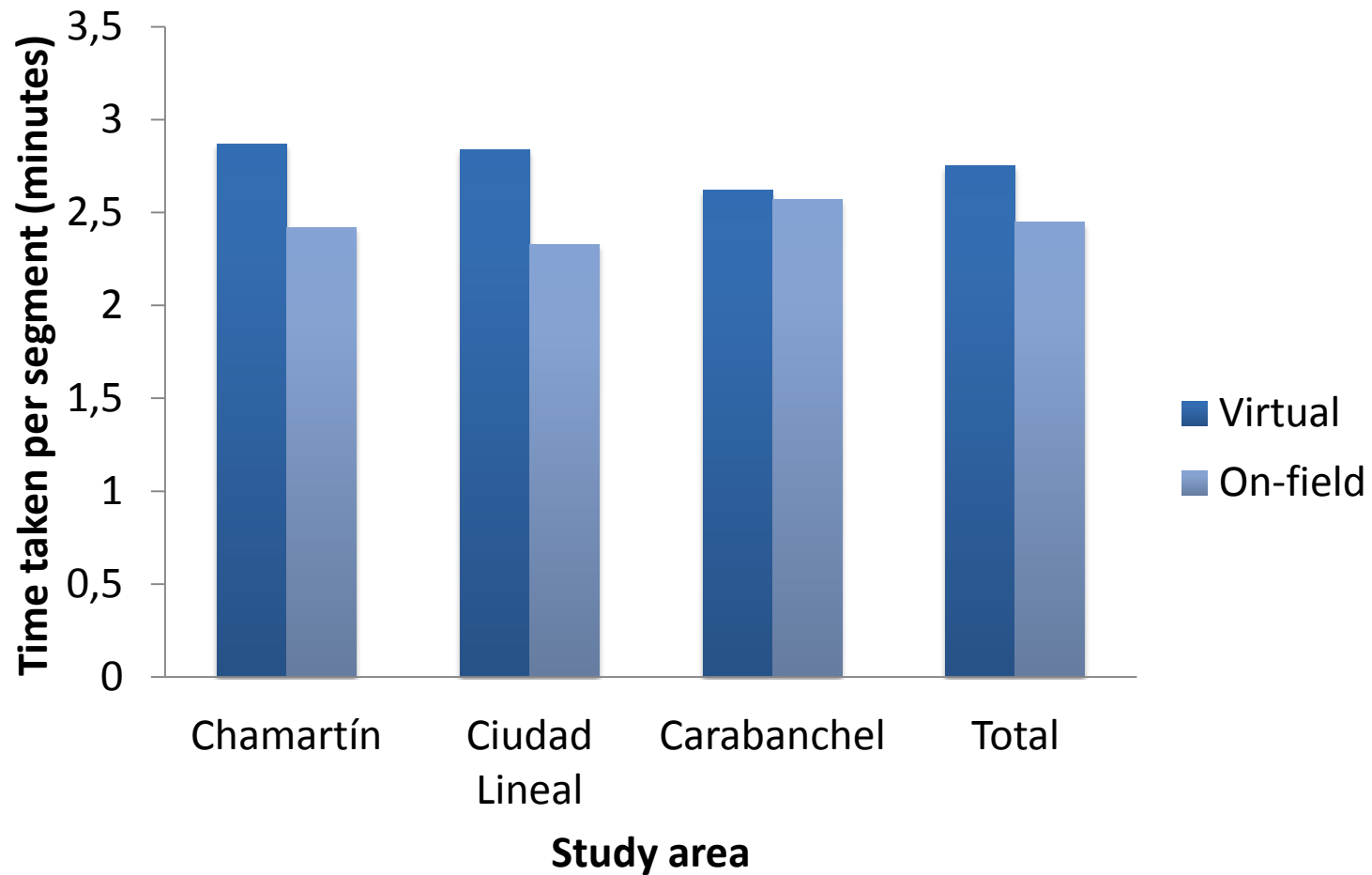


RESULTADOS





RESULTADOS





RESULTADOS



TABLE 5. Inter-rater agreement between factors assessed by two raters, measured in three population-density different areas on-field and virtual (n=454 segments)

Factor	On-Field auditing		Virtual auditing	
	ICC	CI 95%	ICC	CI 95%
<i><u>Walking</u></i>				
Function	0.33 ^b	0.25-0.41	0.32 ^b	0.24-0.40
Safety	0.49 ^c	0.42-0.59	0.44 ^c	0.36-0.51
Aesthetics	0.61 ^d	0.55-0.66	0.57 ^c	0.51-0.63
Destinations	0.67 ^d	0.61-0.72	0.57 ^c	0.51-0.63
<i><u>Cycling</u></i>				
Function	0.22 ^b	0.13-0.41	0.18 ^a	0.09-0.27
Safety	0.53 ^c	0.47-0.60	0.31 ^b	0.23-0.40
Aesthetics	0.62 ^d	0.59-0.67	0.55 ^c	0.49-0.61
Destinations	0.67 ^d	0.61-0.72	0.57 ^c	0.51-0.63

ICC Intraclass correlation coefficient. CI: Confidence interval

^aWeak agreement (ICC <0.2); ^b Poor agreement (ICC 0.2-0.4); ^c Moderate agreement (ICC 0.4-0.6); ^d Substantial agreement (ICC 0.6-0.8); ^e Almost perfect agreement (ICC >0.8)



RESULTADOS



TABLE 7. Intra-rater agreement between factors assessed by one rater in February 2013 and February 2014, measured in a middle population-density area on-field and virtual (n=152 segments)

Factor	On-Field auditing		Virtual auditing	
	ICC	CI 95%	ICC	CI 95%
<i>Walking</i>				
Function	0.67 ^d	0.58-0.76	0.60 ^d	0.50-0.71
Safety	0.78 ^d	0.72-0.84	0.77 ^d	0.70-0.83
Aesthetics	0.45 ^c	0.32-0.57	0.81 ^e	0.76-0.87
Destinations		N.A.		N.A.
<i>Cycling</i>				
Function	0.47 ^c	0.34-0.60	0.39 ^b	0.24-0.54
Safety	0.80 ^e	0.75-0.86	0.81 ^e	0.75-0.86
Aesthetics	0.48 ^c	0.36-0.60	0.75 ^d	0.68-0.82
Destinations		N.A.		N.A.

N.A. not assessed ICC Intraclass correlation coefficient. CI: Confidence interval

^aWeak agreement (ICC <0.2); ^bPoor perfect agreement (ICC 0.2-0.4); ^cModerate agreement (ICC 0.4-0.6); ^dSubstantial agreement (ICC 0.6-0.8); ^eAlmost perfect agreement (ICC >0.8)



Fortalezas

- Primer estudio en Europa en usar herramientas virtuales para medir el entorno residencial para andar y usar la bicicleta.
- Uso de una herramienta que permite comparar entornos
- Medición en 3 áreas con distinta forma urbana.
- Alto tamaño de muestra (454 segmentos)

Limitaciones

- SPACES no recoge conectividad de las calles, parques ni centros deportivos.
- No hay imágenes de las calles peatonales.
- No medir el tiempo de distancia dificulta la comparación de tiempo entre la medición directa y virtual
- Entrenamiento desigual entre los 2 observadores
- No medición de ICC de “Destinos” en el acuerdo intra-observador
- La baja variabilidad de algunos factores limita el uso del ICC



CONCLUSIONES



- La herramienta SPACES tiene capacidad discriminativa entre barrios con diferente forma urbana en Madrid
- La medición con Google Street View es equivalente a la medición directa
- El acuerdo inter-observador es pobre, debido a entrenamiento no estandarizado
- El acuerdo intra-observador es sustancial, mejor en las mediciones virtuales que en las directas



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