

# El estado de la micromovilidad en Barcelona, Tendencias, impactos y futuro de patinetes y bicicletas compartidas.





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Stephanie Madrid



Pablo Villar



Natividad Franco



Serena Mombelli



Judith Ceballos



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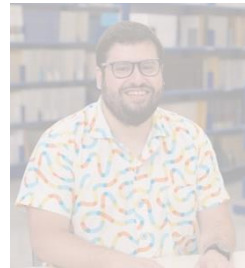
Monika Maciejewska



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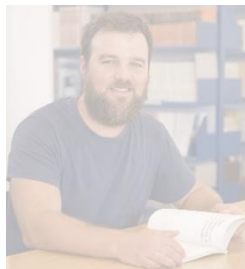
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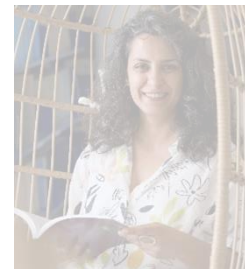
Jerònia Vadell



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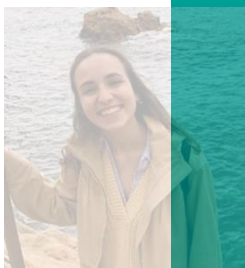
Pablo Villar



Natividad Franco



Serena Mombelli



Judith Ceballos

# Micromobility projects

## New mobility in the city (NEWMOB)

01/01/2020 - 31/01/2022



Ajuntament  
de Barcelona

ICUB Institut  
de Cultura

## Electric, light and shared. Micromobility in Spain and its environmental, social and health implications.

01/06/2020 - 31/05/2023



GOBIERNO  
DE ESPAÑA

MINISTERIO  
DE CIENCIA  
E INNOVACION



## Inclusive, sustainable and resilient. Mobility and the city in the post-pandemic scenario

14/05/2021 - 13/11/2022



Agència  
de Gestió  
d'Ajuts  
Universitaris  
i de Recerca



# Objetivos

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1. Identidad y comportamiento de las personas que eligen nuevos modos de transporte
2. Impacto en el sistema de transporte de Barcelona
3. Implicaciones del auge de la micromovilidad
  1. Implicaciones ambientales
  2. Implicaciones sociales
  3. Implicaciones para la salud



# Métodos

1. Análisis de datos oficiales disponibles
2. Encuestas ad hoc
3. Estudios de GPS y acelerometría en Barcelona
4. Acompañamientos en viajes
5. Encuestas de interceptación



# Study methods

## (1) Survey

Transport Mode	Num of users	%
Electric scooter	326	36,1
Electric moped scooter	251	27,8
Shared electric bike	108	12,0
Shared conventional bike	217	24,1
Total	902	100,0

## (2) Tracking Living Lab

Transport Mode	Num of users	%
Electric scooter	65	31,9
Electric moped scooter	28	13,7
Shared electric bike	37	18,1
Shared conventional bike	74	36,3
Total	204	100,0

+ Control group (no micro users) = 43 =

247 total sample

# Definiendo micromovilidad



Station-based Bikeshearing



Dockless Bikeshearing



Micro e-cars



E-Skateboards



Standing Electric Scooter Sharing



Moped-style Scooter Sharing



Cargo e-bikes



Monowheels

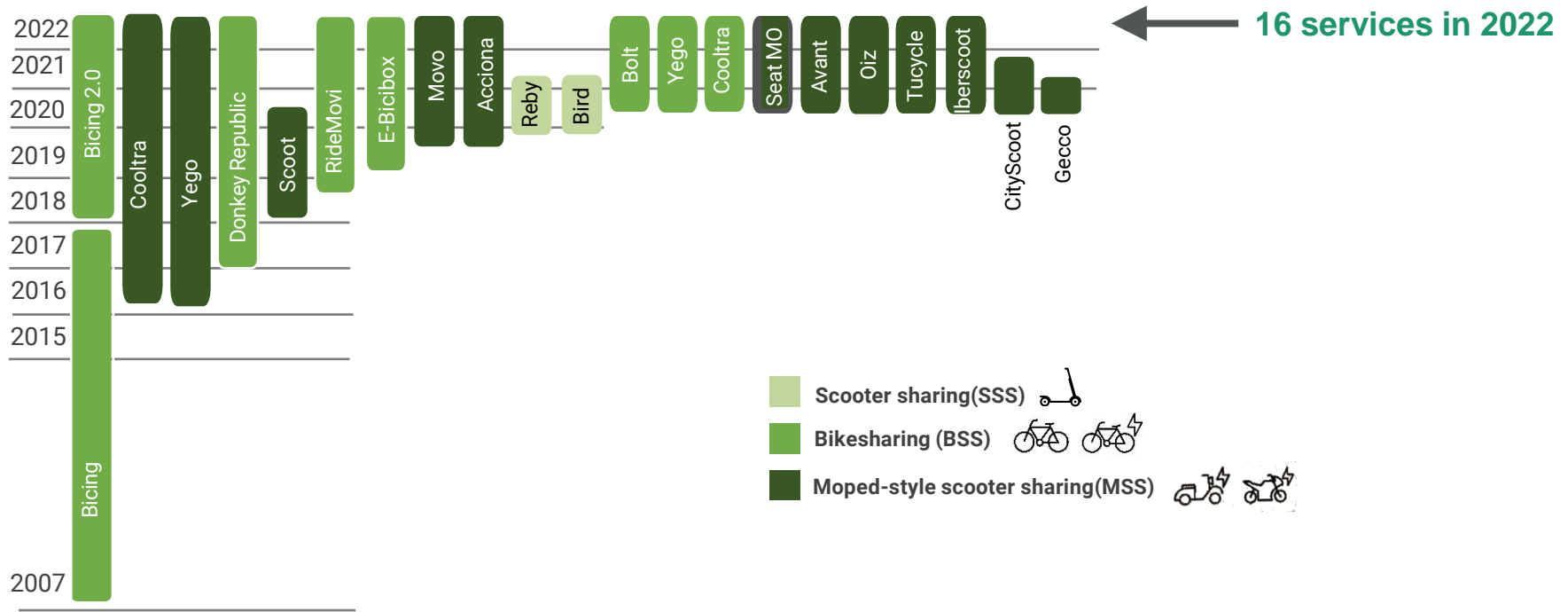


Etc...







Vehículos de menor escala y ligeros, impulsados eléctricamente, que operan a velocidades de hasta 25 km/h, y que se utilizan principalmente para viajes de hasta 10 km (Bretones and Marquet, 2022)



# Historia de la micromovilidad en Barcelona









# ¿Qué servicios de micromovilidad existen?

Vehicle	Docked services		Free-floating services	
e-scooter	-	-	-	-
Bicycle	 Bicing	 Donkey Republic, RideMovi		
e-Bike	 Bicing, e-Bicibox	 Bolt, Cooltra, Yego, RideMovi		
e-moped	-	 Cooltra, Yego, Movo, Avant, Oiz, Tucycle, Iberscot		
e-motorbike	-	 SeatMo, Acciona Mobility		









**Anomalía europea. No hay servicio compartido de scooters eléctricos. Otras excepciones en grandes ciudades: Luxemburgo, Ginebra,... Paris!**

# ¿Qué servicios de micromovilidad existen?

Vehicle	Docked services	Free-floating services
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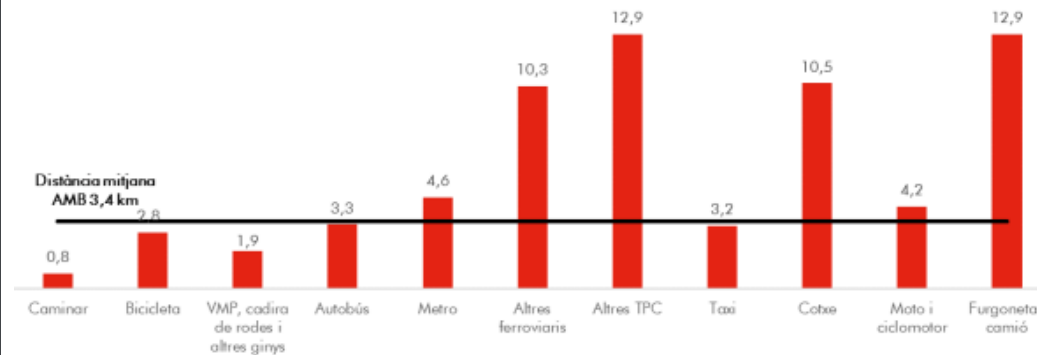
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# El uso del e-scooter en la ciudad

Mode de transport	Trips (%)	Distance (%)
Caminant	51,8%	11,8%
Bicideta	2,9%	2,4%
VMP (Patinet, segway o altres ginys) cadira de rodes	0,8%	0,4%
<b>Total mobilitat activa</b>	<b>55,5%</b>	<b>14,6%</b>
Autobús	8,8%	8,4%
Metro	10,9%	14,7%
Altres ferroviaris (FGC, Rodalies Renfe, Tramvia)	2,9%	8,8%
Resta transport públic	..	..
Taxi	0,9%	0,8%
<b>Total transport públic</b>	<b>23,5%</b>	<b>33,5%</b>
Cotxe	13,9%	42,2%
Moto i ciclomotor	6,3%	7,7%
Furgoneta, camió	0,5%	1,9%
<b>Total vehicle privat</b>	<b>20,7%</b>	<b>51,9%</b>
Altres modes de transport	..	..
<b>Total SIMMB</b>	<b>100%</b>	<b>100%</b>



# El uso del e-scooter en la ciudad

**Taula 1.** Desplaçaments en patinet elèctric a l'àrea metropolitana de Barcelona, en dia feiner. Desplaçaments origen i/o destinació a l'àmbit de l'àrea metropolitana de Barcelona

Any	Patinet elèctric	Quota modal global
2017	13.505	0,1%
2018	45.014	0,4%
2019	46.709	0,4%
2020	85.066	0,8%
2021	81.184	0,8%

**Taula 2.** Característiques de la mobilitat en patinet (autocontenció municipal, durada mitjana i distància mitjana) segons mode de transport, en dia feiner. Residents a l'àrea metropolitana de Barcelona.

Mitjà de transport	Autocontenció municipal (%)	Durada mitjana (minuts)	Distància mitjana (km)
Patinet	76,9%	13,3	1,8
Bicicleta	80,0%	25,1	3,3
Caminant	94,9%	15,3	0,7
Transport públic	58,7%	32,9	5,5
Vehicle privat	42,4%	22,0	8,2

2022 E-scooter – 1%





# Usuarios de la micromovilidad

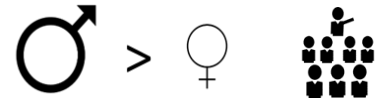
## Diferentes vehículos, diferentes perfiles



- Desequilibrio de género
- Perfil socioeconómico bajo



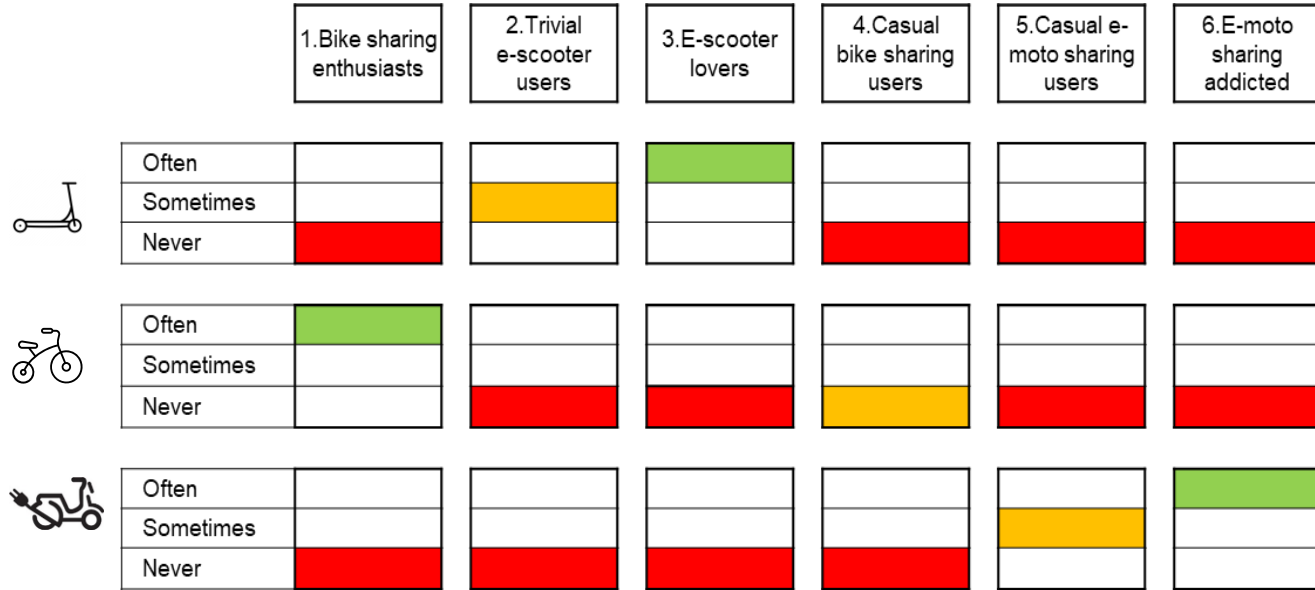
- Gender gap cerrándose
- Perfil socioeconómico alto



- Alto desequilibrio de género
- Alta presencia de estudiantes

# Uso de la micromovilidad

Aplicamos técnicas de cluster para perfilar a los usuarios de micromovilidad de acuerdo con la frecuencia de uso autoinformada de la micromovilidad



# Uso de la micromovilidad

## ¿Quién compone estos clusters?

	1. Bike sharing enthusiasts	2. Trivial e-scooter users	3. E-scooter lovers	4. Casual bike sharing users	5. Casual e-moto sharing users	6. E-moto sharing addicted		1. Bike sharing enthusiasts	2. Trivial e-scooter users	3. E-scooter lovers	4. Casual bike sharing users	5. Casual e-moto sharing users	6. E-moto sharing addicted
Gender							Level of studies						
Woman	<b>48,20</b>	37,40	38,40	38,00	<b>28,90</b>	<b>24,20</b>	Primary	8,50	4,00	<b>9,70</b>	3,00	<b>1,60</b>	1,50
Man	<b>51,80</b>	62,60	61,60	62,00	<b>71,10</b>	<b>75,80</b>	Secondary	<b>34,50</b>	50,50	<b>48,50</b>	36,60	40,60	<b>60,30</b>
Age							University	<b>57,00</b>	45,50	<b>41,80</b>	<b>60,40</b>	<b>57,80</b>	<b>38,20</b>
< 25 yrs	36,00	<b>46,50</b>	33,60	34,70	41,40	36,80	Place of residency						
25 - 34 yrs	33,00	25,30	30,20	35,60	25,00	<b>42,60</b>	Barcelona	<b>93,50</b>	80,80	<b>79,30</b>	<b>96,00</b>	<b>79,70</b>	89,70
35 - 44 yrs	14,00	<b>11,10</b>	<b>25,20</b>	16,80	18,00	13,20	Out of Barcelona	<b>6,50</b>	19,20	<b>20,70</b>	<b>4,00</b>	<b>20,30</b>	10,30
45 - 54 yrs	11,50	12,10	8,40	<b>4,00</b>	13,30	5,90	Place of work						
> 55 yrs	5,50	5,10	2,70	<b>8,90</b>	2,30	1,50	Barcelona	<b>57,50</b>	<b>56,60</b>	<b>73,90</b>	61,40	66,40	<b>80,90</b>
Prof. status							Out of Barcelona	<b>42,50</b>	<b>43,40</b>	<b>26,10</b>	38,60	33,60	<b>19,10</b>
Employed	67,00	<b>54,50</b>	<b>77,60</b>	70,30	71,10	80,90	Access to car						
Unemployed	5,50	3,00	6,00	3,00	3,10	0,00	Yes	<b>66,50</b>	70,80	<b>82,30</b>	<b>67,00</b>	<b>92,20</b>	<b>88,20</b>
Retired and others	1,00	2,00	2,00	2,00	0,00	0,00	No	<b>33,50</b>	29,20	<b>17,70</b>	<b>33,00</b>	<b>7,80</b>	<b>11,80</b>
Student	26,50	<b>40,40</b>	<b>14,40</b>	24,80	25,80	19,10							



# Micromobility in relation to other modes

## How wide are micromobility users' modal mixes?



# Publicaciones relacionadas

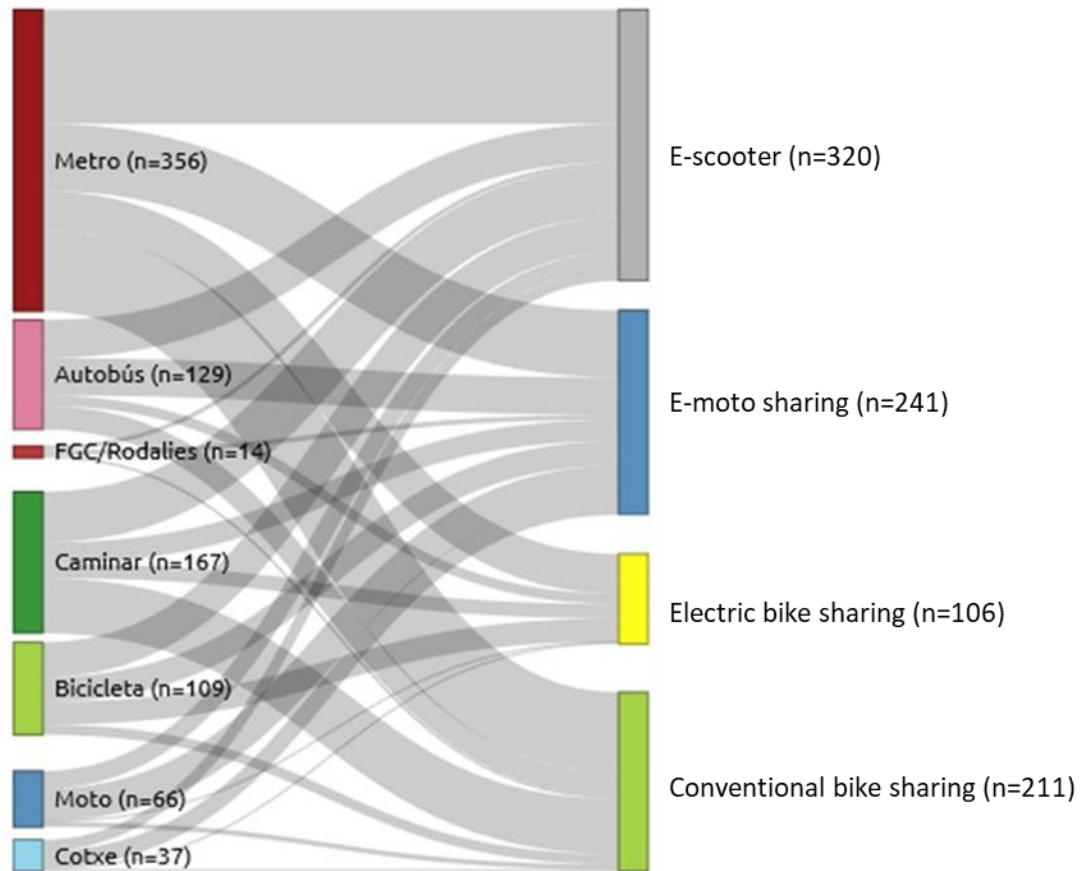
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- Roig-Costa, O., Van Acker, V., Arranz-Lopez, A., & Marquet, O. (2024). Multimodal travel behaviour in micromobility? Exploring the potential of emergent modes in shaping more sustainable cities. *Sustainable Cities and Society*. Under review
- Roig-Costa, O., Miralles-Guasch, C., & Marquet, O. (2024). Shared bikes vs. private e-scooters. Understanding patterns of use and demand in a policy-constrained micromobility environment. *Travel Behaviour and Society*. Accepted, forthcoming
- Miralles-Guasch, C., Roig-Costa, O., & Marquet, O. (2022). Patinetes eléctricos y bicicletas compartidas. Nuevos transportes urbanos, nuevos usuarios. El caso de Barcelona. *Papeles de Economía Española*, 171, 148–158.
- Roig-Costa, O., Gómez-Varo, I., Cubells, J., & Marquet, O. (2021). La movilidad post-pandemia: Perfiles y usos de la micromovilidad en Barcelona. *Revista Transporte y Territorio*, 25, 72–96.  
<https://doi.org/10.34096/rtt.i25.10958>



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¿Cómo de sostenibles son estos modos?

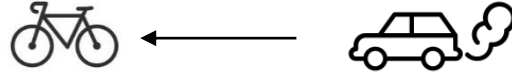


Font: GEMOTT, 2020

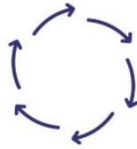
Informació extreta de l'Enquesta de Perfils i Usos de Vehicles de Mobilitat Personal (VMP) a Barcelona

# Impacto ambiental

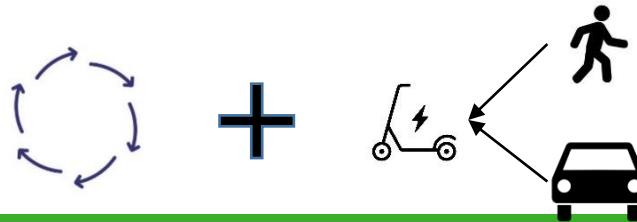
Comparar emisiones



Introducir el ciclo de vida de vida

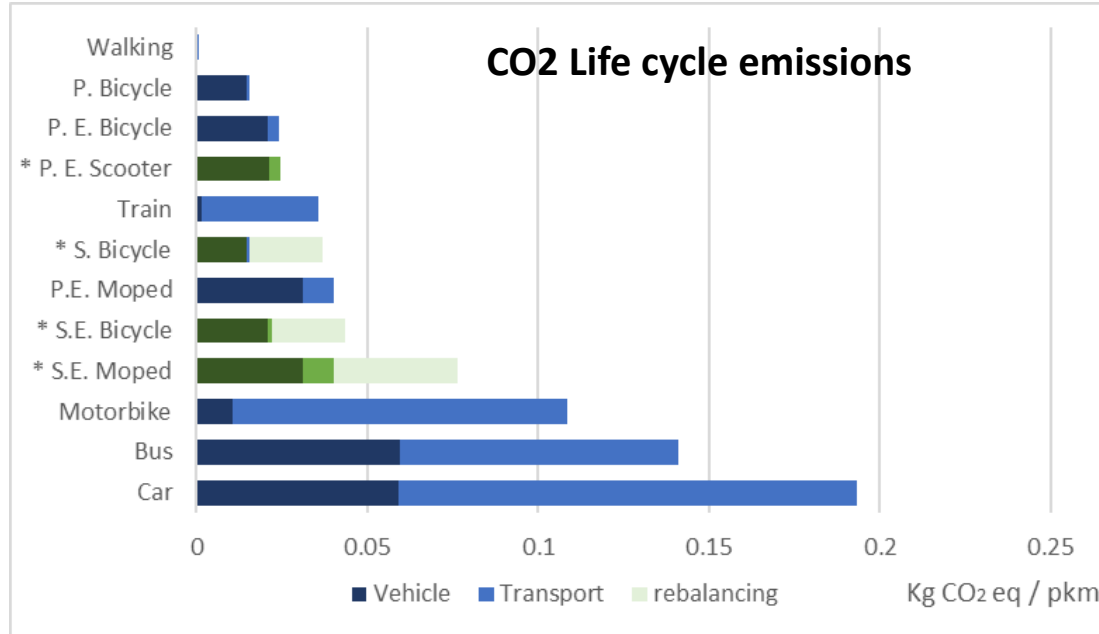


Ciclo de vida + cambio modal



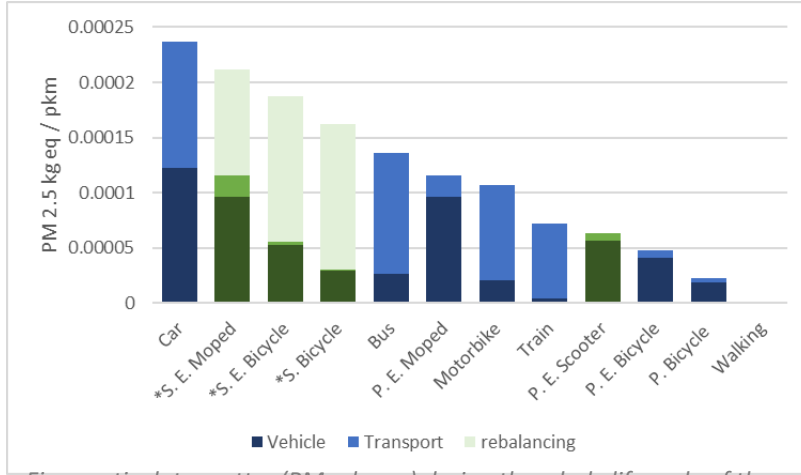
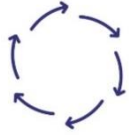


# Impacto ambiental

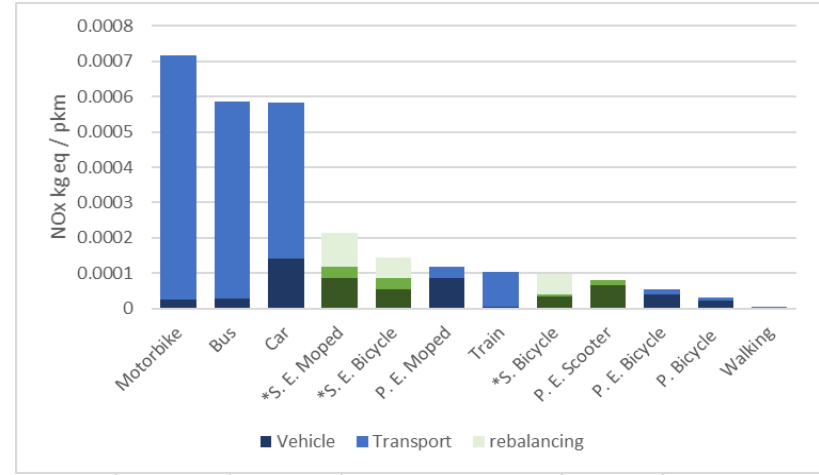


Global warming potential, in Kg CO<sub>2</sub> eq, for the whole life cycle of the different vehicles.





Fine particulate matter ( $PM_{2.5}$  kg eq) during the whole life cycle of the vehicles.



Ozone formation ( $NO_x$  kg eq) during the whole life cycle of the vehicles.



# Impacto ambiental

La micromovilidad debe evaluarse cuidadosamente  
ACV (Análisis de Ciclo de Vida) + Estudio de cambio modal

Enfoque técnico y de comportamiento para mitigar el  
impacto ambiental

El impacto de la micromovilidad podría ser más  
beneficioso en ciudades distintas

Mucho espacio para la mejora



# Publicaciones relacionadas

Felipe-Falgas, P., Madrid-Lopez, C., & Marquet, O. (2022). Assessing Micromobility Environmental Performance Using LCA and Self-reported Modal Change. The Case of Shared e-bikes, e-scooters, and e-mopeds in Barcelona. *Sustainability*, 14, 4139. <https://doi.org/10.3390/su14074139>



Article

## Assessing Environmental Performance of Micromobility Using LCA and Self-Reported Modal Change: The Case of Shared E-Bikes, E-Scooters, and E-Mopeds in Barcelona

Pol Felipe-Falgas <sup>1</sup>, Cristina Madrid-Lopez <sup>2</sup> and Oriol Marquet <sup>1,2,\*</sup>

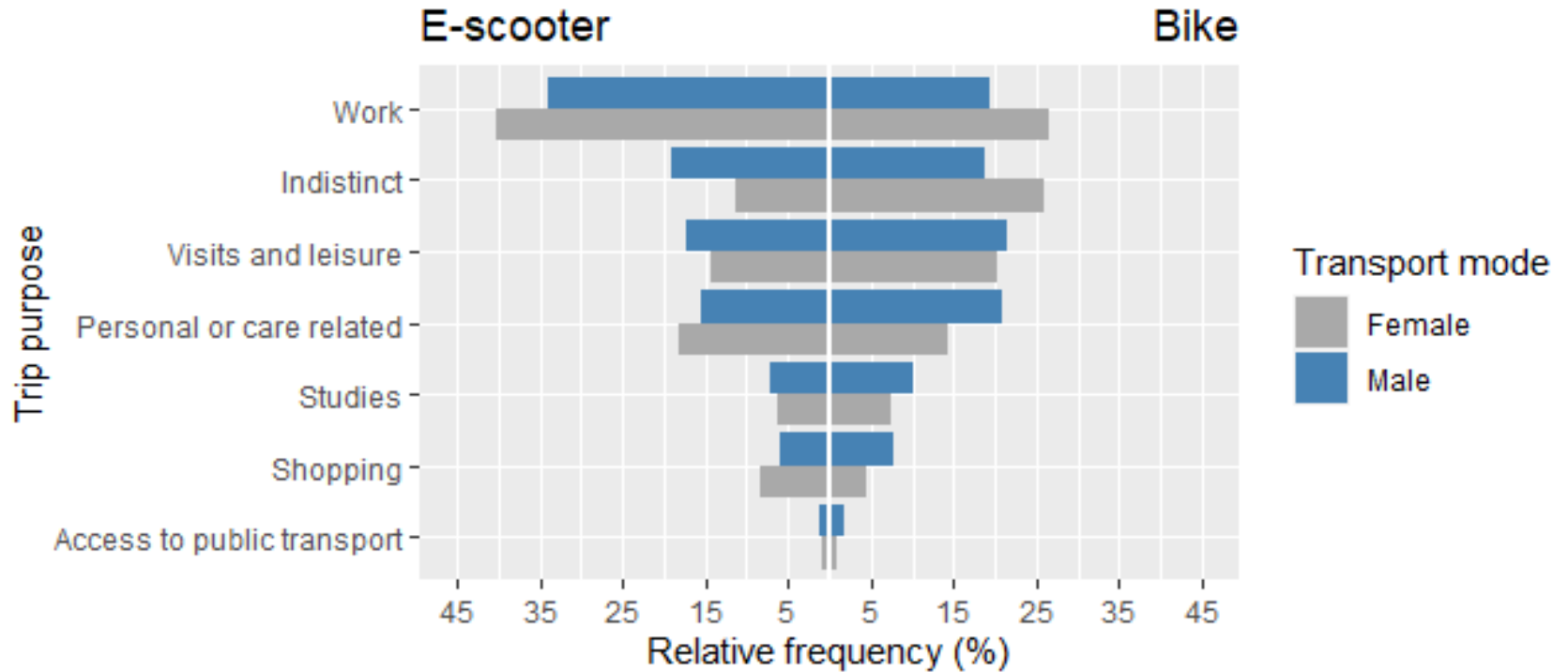
- <sup>1</sup> Grup d'Estudis en Mobilitat, Transport i Territori (GEMOTT), Geography Department, Universitat Autònoma de Barcelona, 08193 Barcelona, Spain; pol.felipe@e-campus.uab.cat
- <sup>2</sup> Institute on Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona, 08193 Barcelona, Spain; cristina.madrid@uab.cat
- \* Correspondence: oriol.marquet@uab.cat



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# Uso por género y implicaciones sociales

# Micromobility and gender



# Micromobility and gender



Date: 2020-09-28 00:00:30



# Micromobility speed

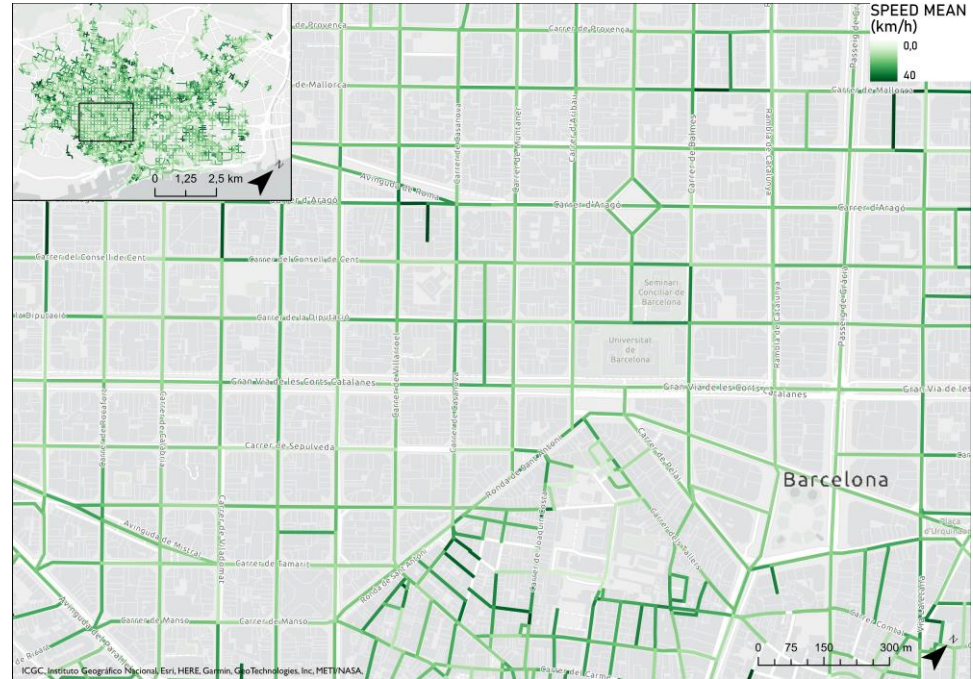
## How?

We modelled **speed** accounting for elements of the **built environment** (intersections, traffic lights, slope, cycling infrastructure), **time** of the day and **sociodemographics** of riders

## Average travel speed

Shared bicycle: 9.23 km/h

Private e-scooter: 9.75 km/h





# Micromobility speed

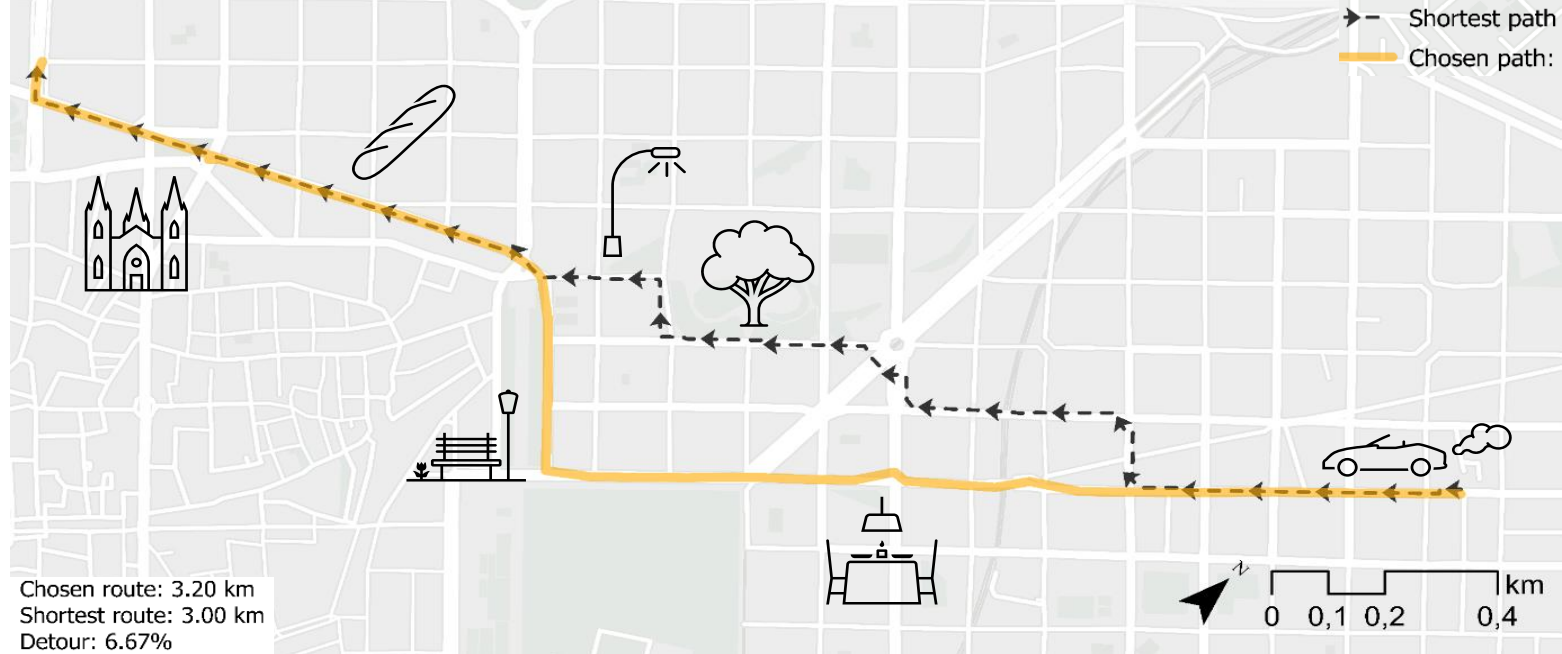
## Cycling facilities influence travel speed

Cycling facilities enable higher speeds, particularly **bike lanes**

**but also does gender**

Similar travel speed between cyclists, regardless of their gender  
**Speed gender gap between e-scooter riders**

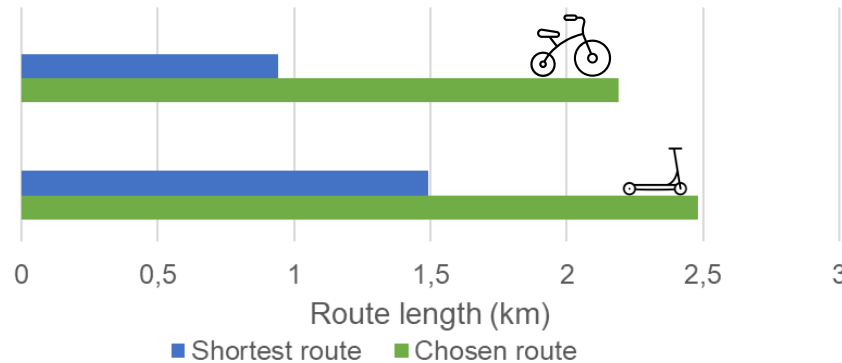




# Route choice

## How?

We compared **chosen** routes to the **shortest** path users could have followed.



Compared to bikes, **e-scooters deviate relatively longer** on average

# Route choice

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## Gender differences?

- **Women take shorter detours than men.**
- Compared to women, **men riding e-scooters**
  - deviate further to **avoid car parking** places and historical **points of interest**
  - while **seeking** to go across **pedestrianised streets** and **green areas**.



# Related publications

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Cubells, J., Miralles-Guasch, C., & Marquet, O. (2023a). E-scooter and bike-share route choice and detours: Modelling the influence of built environment and sociodemographic factors. *Journal of Transport Geography*, 111, 103664. <https://doi.org/10.1016/j.jtrangeo.2023.103664>

Cubells, J., Miralles-Guasch, C., & Marquet, O. (2023b). Gendered travel behaviour in micromobility? Travel speed and route choice through the lens of intersecting identities. *Journal of Transport Geography*, 11. <https://doi.org/10.1016/j.jtrangeo.2022.103502>



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# Es saludable la micromovilidad?

# Accelerometers



247 individuals participated in the tracking study:

- 204 micromobility users (experimental group)
  - 65 e-scooters
  - 28 moped scooters
  - 74 conventional bikers
  - 37 e-bikers
- 43 non-micromobility users (control group)

7 days in the right side of the hip (not when in contact with water or night-time sleeping)

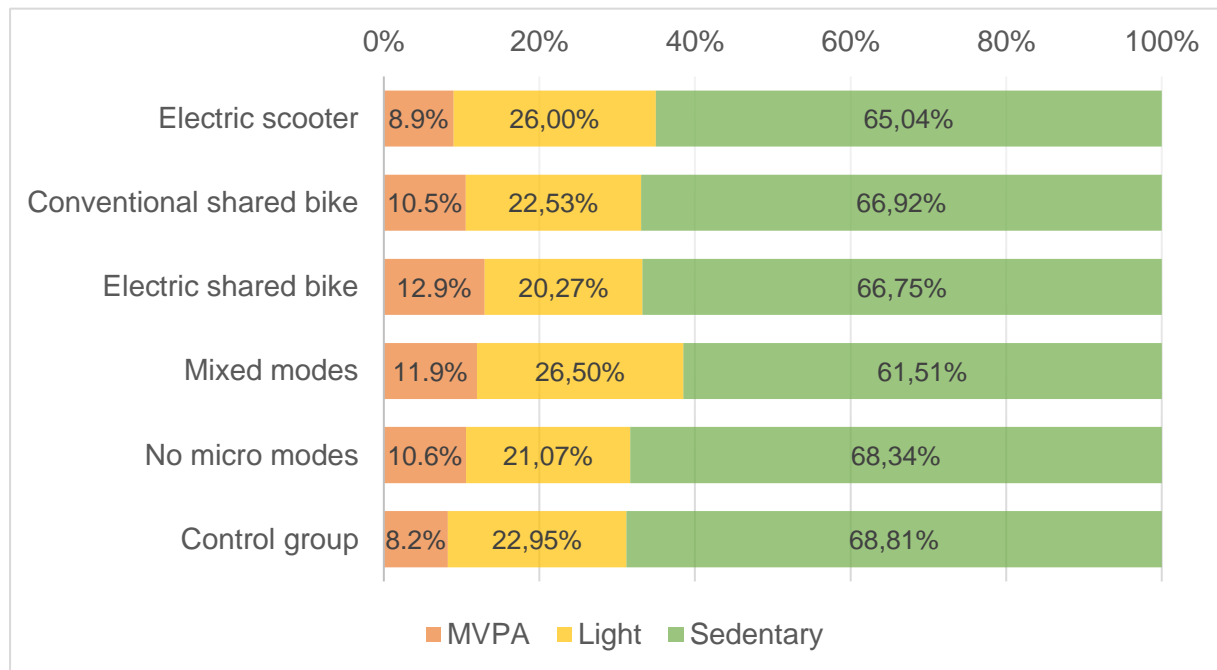
Objective physical activity (PA) -> raw data -> ActiLife software -> Activity intensities obtained (very vigorous, vigorous, moderate, light and sedentary) + (Non)Wearing time

Composite measure created for the analysis (MVPA)

Valid day -> at least 8h of wearing the device



# Daily time spent in MVPA, light and sedentary activity



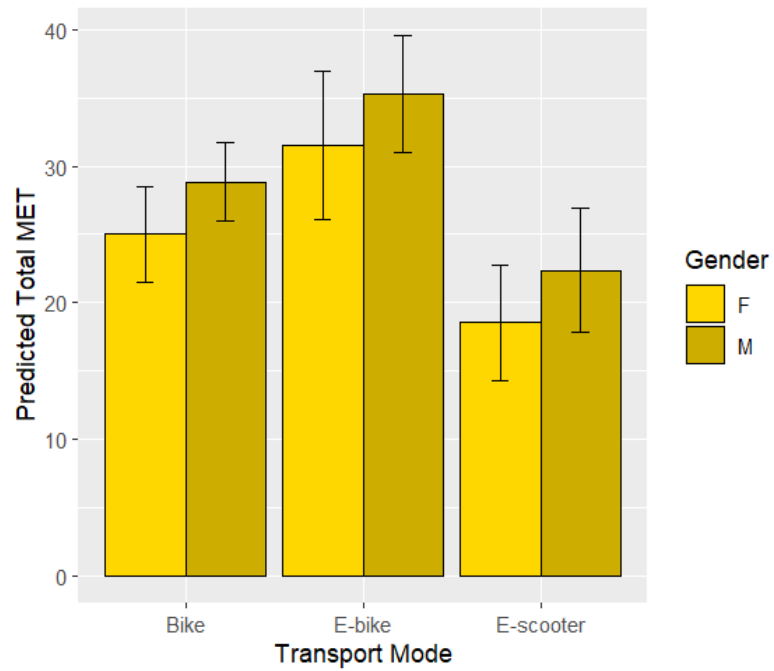
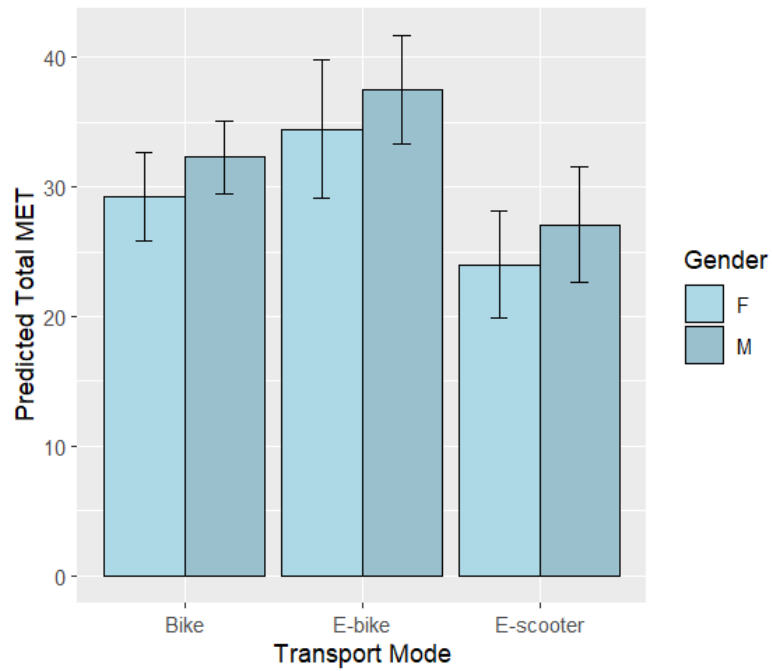
Higher MVPA values on days when using the e-bike or mixing modes

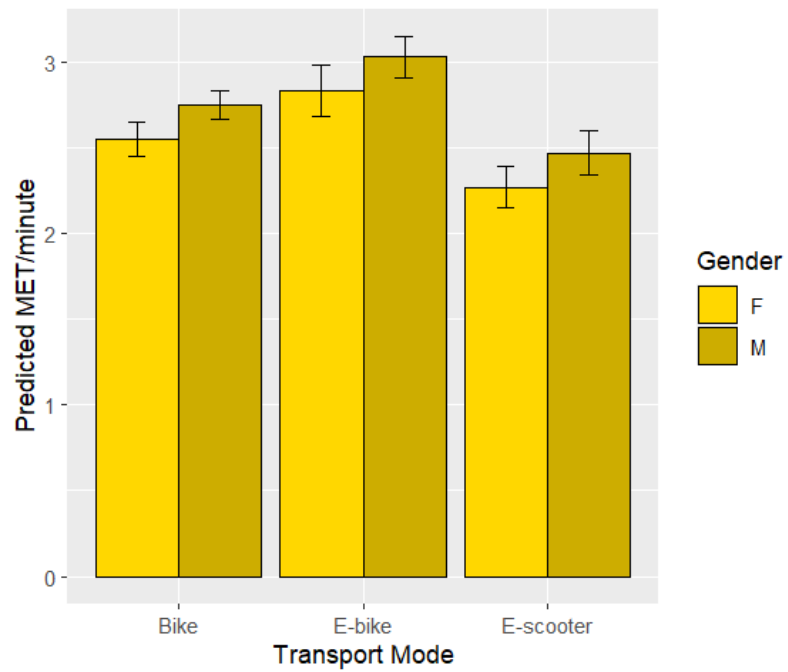
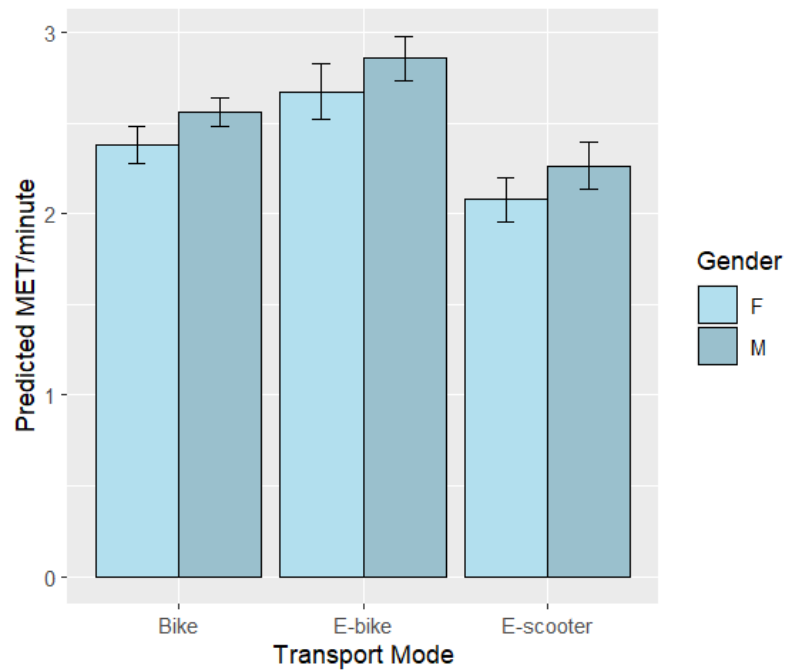
Lowest MVPA values on days when e-scooter are used

But e-scooter present high levels of light PA and low levels of sedentary



	Total METs	MET/minute
Real World Energy Expenditure (RWE)	Total energy expenditure accumulated in a single trip and real world driving conditions for a specific micromobility mode.	Energy expenditure per minute accumulated in a single trip and real world driving conditions for a specific micromobility mode.
	<p><b>Pros</b></p> <ul style="list-style-type: none"> <li>Comprehensive measure of overall PA intensity during the entire trip.</li> </ul> <p><b>Useful for</b></p> <ul style="list-style-type: none"> <li>Providing a more detailed understanding of patterns of physical activity throughout the trip, such as how much time is spent in different activity intensities.</li> </ul>	<p><b>Pros</b></p> <ul style="list-style-type: none"> <li>Provides a more precise measure of the intensity of physical activity by accounting for the duration of the trip.</li> <li>Less prone to measurement errors associated with averaging the intensity of all activities throughout the trip.</li> </ul> <p><b>Useful for</b></p> <ul style="list-style-type: none"> <li>Comparing the relative intensity of trips when using different modes.</li> </ul>
Useful measure to compare WITHIN cities.		
Traffic Adjusted Energy Expenditure (TAE)	Total energy expenditure accumulated in a single trip when accounting only for active phases of the trip, excluding traffic light stops or other sedentary phases of the trip, for a specific micromobility mode.	Energy expenditure per minute accumulated in a single trip when accounting only for active phases of the trip, excluding traffic light stops or other sedentary phases of the trip, for a specific micromobility mode.
	<p><b>Pros</b></p> <ul style="list-style-type: none"> <li>Provides a more precise estimate of the actual physical activity that occurs during the active part of the trip.</li> </ul> <p><b>Useful for</b></p> <ul style="list-style-type: none"> <li>Comparing the overall physical activity intensity of different trips or modes of transportation.</li> </ul>	<p><b>Pros</b></p> <ul style="list-style-type: none"> <li>Provides a precise measure of the active part and intensity of the physical activity, on a per-minute basis.</li> <li>Help standardize the measurement of physical activity across different studies and populations, allowing for more meaningful comparisons.</li> </ul> <p><b>Useful for</b></p> <ul style="list-style-type: none"> <li>Quantifying the health benefits of physical activity during a trip.</li> </ul>
Useful measure to compare BETWEEN cities/urban environments.		



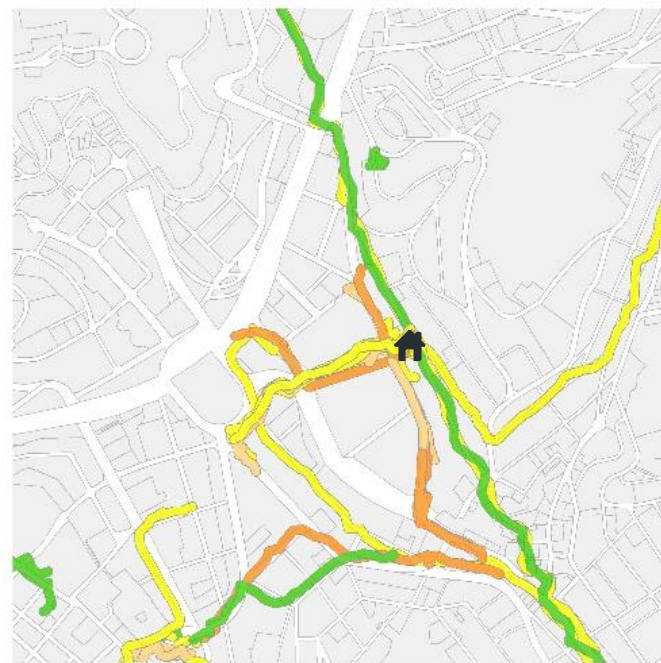
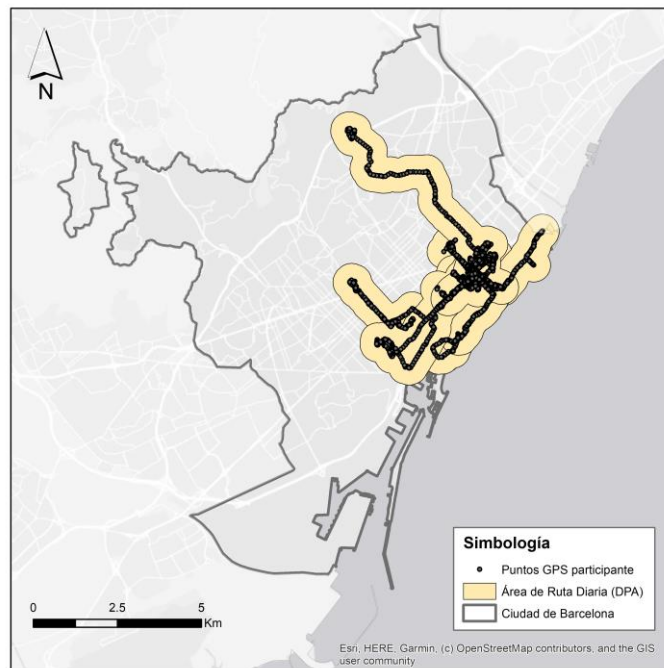


# Conclusiones sobre actividad física

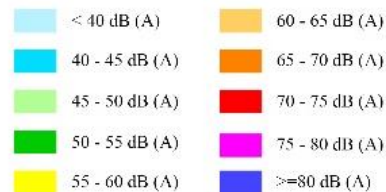
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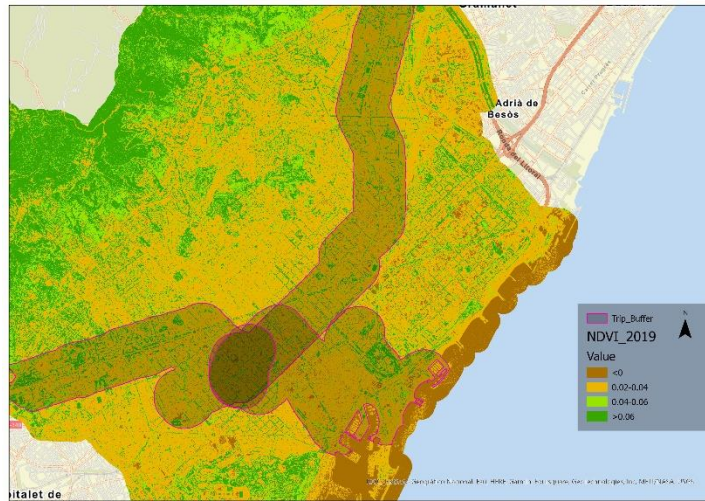
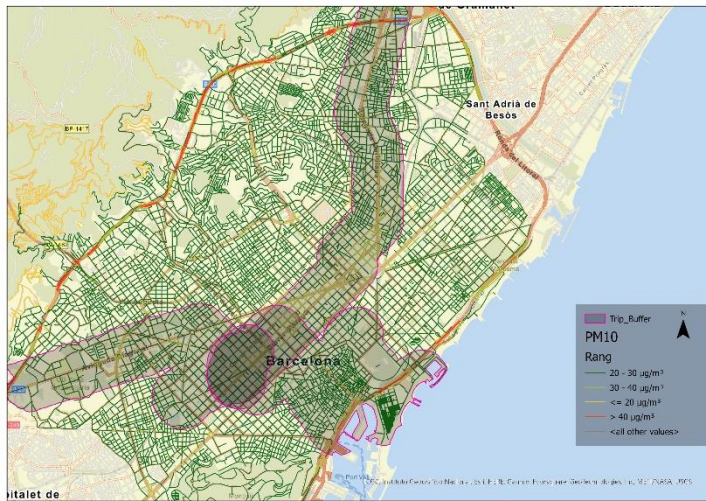
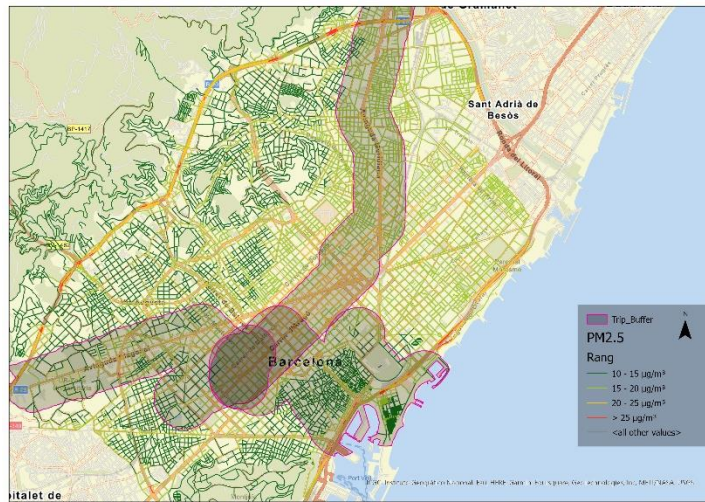
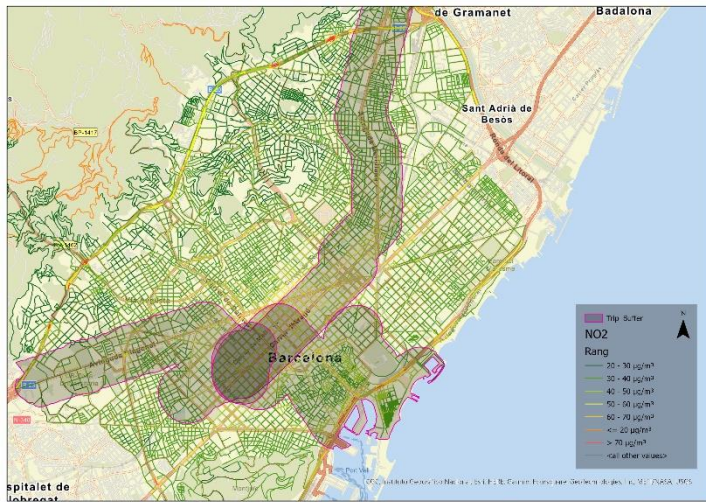
- Los usuarios de micromovilidad son más activos que el grupo de control
- Existen diferencias entre los modos de micromovilidad
- Las bicicletas dedican más tiempo diario que los patinetes eléctricos a la actividad física de intensidad moderada a vigorosa (MVPA por sus siglas en inglés)
- Los usuarios de patinetes eléctricos dedican más tiempo a actividades de intensidad ligera
  
- El patinete no puede ser considerado un modo de transporte activo.

# Exposure assessment



## LEGEND DECIBELS





# Related publications

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Lopez Doriga, I., Vich, G., Koch, S., Marquet, O., Daher, C., Miralles, C., Nieuwenhuijsen, M., & Mueller, N. (2022). Health impacts of electric micro-mobility transitions in Barcelona: A scenario analysis. *Environmental Impact Assessment Review*, 96, 106836. <https://doi.org/10.1016/j.eiar.2022.106836>

Bretones, A., & Marquet, O. (2023). Riding to health: Investigating the relationship between micromobility use and objective physical activity in Barcelona adults. *Journal of Transport and Health*, 29, 101588. <https://doi.org/10.1016/j.jth.2023.101588>

Bretones, A., Marquet, O., Daher, C., Hidalgo, L., Nieuwenhuijsen, M., Miralles-Guasch, C., & Mueller, N. (2023). Public Health-Led Insights on Electric Micro-mobility Adoption and Use: A Scoping Review. *Journal of Urban Health*. <https://doi.org/10.1007/s11524-023-00731-0>



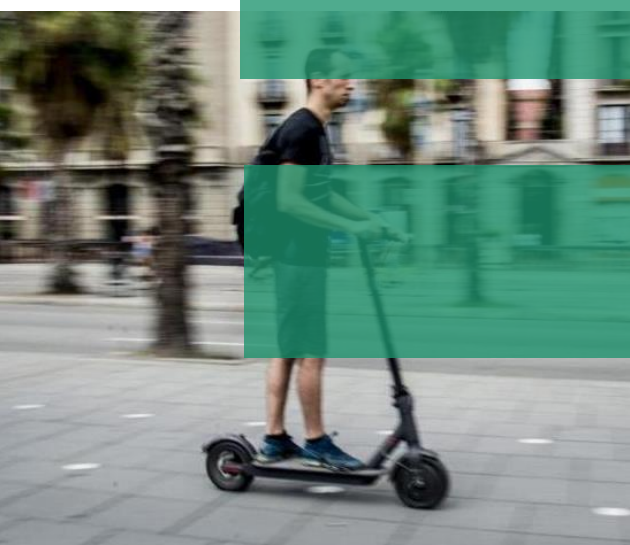








Muchas gracias



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