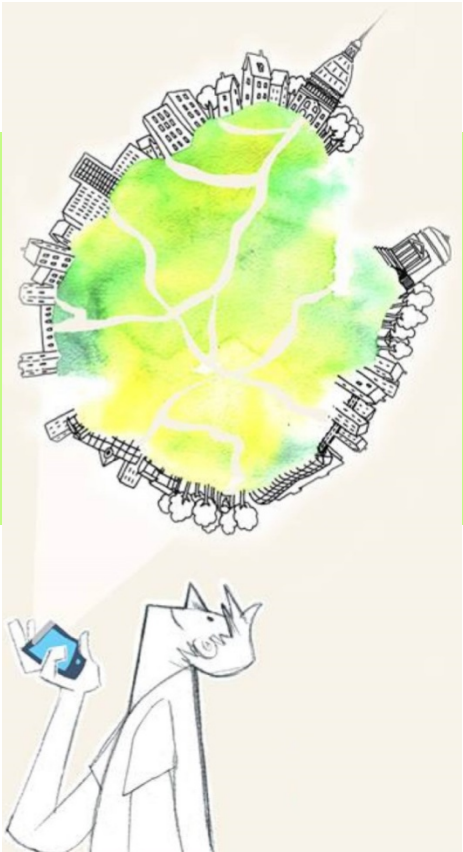
TU1208 Final Conference
Civil Engineering Applications of Ground Penetrating Radar

25 September 2017
Warsaw

Intelligent Transport Systems - Research, innovation and trends

Cristina Pronello

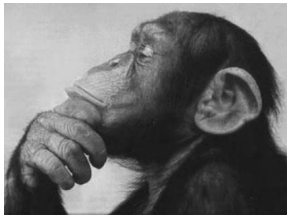
Professor, Chair of ITS and Territorial Dynamics
Sorbonne Universités – UTC
Département Génie des systèmes urbains
(GSU) & EA 7284 AVENUES



What's happening in transport ?

Is there a new revolution of transport ?

- the concept of car use is changing (in dense urban contexts) <u>BUT</u>
- is the attitude towards car changing ?
- are the transport providers changing ?



Have we found innovative and integrated transport systems or solutions ?

Are the new technologies able to change travel behaviour ?

Have we improved the data collection?

Let's start from the travel experience: how many decisions ?

knowledge and beliefs

Values

Worldviews

Norms

Personality traits and lifestyles

Emotions and personal stories

Attitude and intentions

Habits and past behaviour

Post-materialism (for Western countries)

Individualism versus Social cooperation

Ageing

Which solutions ? The sliding door

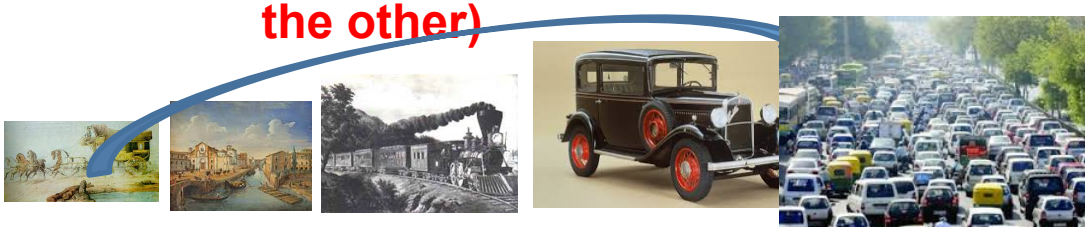
- **KNOW USERS' NEEDS to better plan urban and trasport systems and to increase accessibility and connectivity → BIG DATA: user-centric approach** (transparency)

- **KNOW USERS' NEEDS to give customised services and control people → BIG DATA: big players-centric approach** (privacy violation)

.

- **INTEGRATION AMONG TRANSPORT MODES**

- **COMPETITION AMONG TRANSPORT MODES (one kills the other)**



- **MOBILITY AS A SERVICE: the common good → bottom-up approach (passengers and freight)**

- **MOBILITY AS A SERVICE sharing in competition (companies) → top-down approach**

MaaS, autonomous vehicles, e-mobility … a solution ?

Infrastructure Vehicles Rules of management Ticketing … and the integration ?

Mobility as a Service enables new market approach

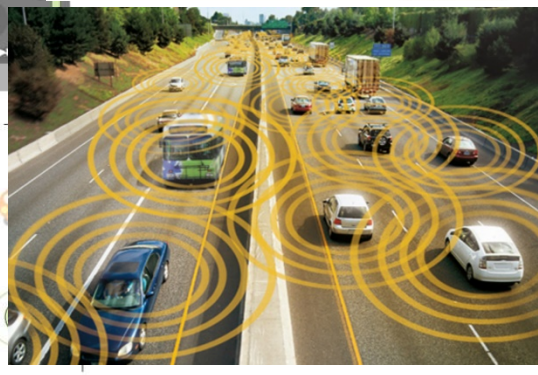
Urban commuter package for 95 €/month:

- Free public transport in home city area
- Up to 100 km free taxi
- Up to 500 km rental car
- Domestic public transport 1500 km

15 minutes package for 135 €/ month:

- 15 minutes from call to pick up by shared taxi
- EU wide roaming for shared taxi at 0,5 €/km
- Free public transport in home city,
- Domestic public transport 1500 km

My mobility operator



Business world package for 800 €/month:

- 5 minutes pickup in all EU
- Free taxi in home city
- Lease car and road use
- Taxi roaming worldwide

Family package for 1 200 €/month:

- Lease car and road use
- Shared taxi for all family with 15 minutes pickup
- Home city public transport for all
- Domestic public transport 2 500 km

People attitudes Age … etc.

WE NEED MORE:

Know more

Understand more

Speak and interact more

Educate more and better

KNOW MORE: OPTICITIES

OPTICITIES

ENHANCING SMART MOBILITY

KNOW MORE: OPTICITIES

Collaborative project (Call: FP7-SST-2013-RTD-1)

→ **CHALLENGE 2. SAFE AND SEAMLESS MOBILITY**

→ **Activity 7.2.3. Ensuring sustainable urban mobility**

→ **SST.2013.3-1. Managing integrated multimodal urban transport network**

→ **Budget: 13 ML Euros**

Objectives

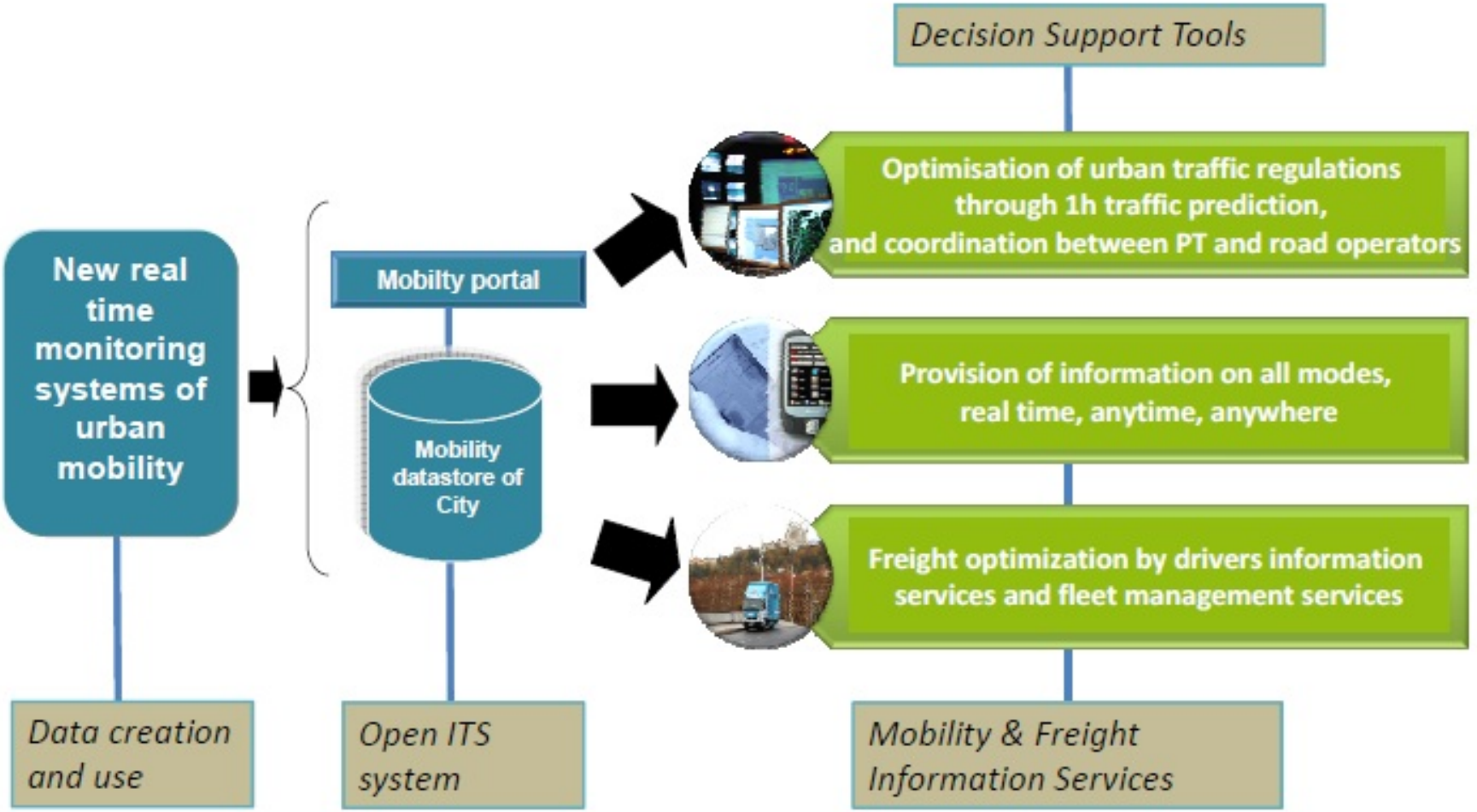
✓ **Improve mobility of people and freight** in an urban context with very high level information and traffic management services, using ITS

✓ **Provide incentive and tools for modal shift** by adapting current mobility habits through information

✓ Help **European cities** tackle complex **mobility challenges**

→ Development of **public/private partnerships** and the experimentation of innovative **ITS** services.

KNOW MORE: OPTICITIES



KNOW MORE: OPTICITIES

http://www.opticities.com/dissemination/media/

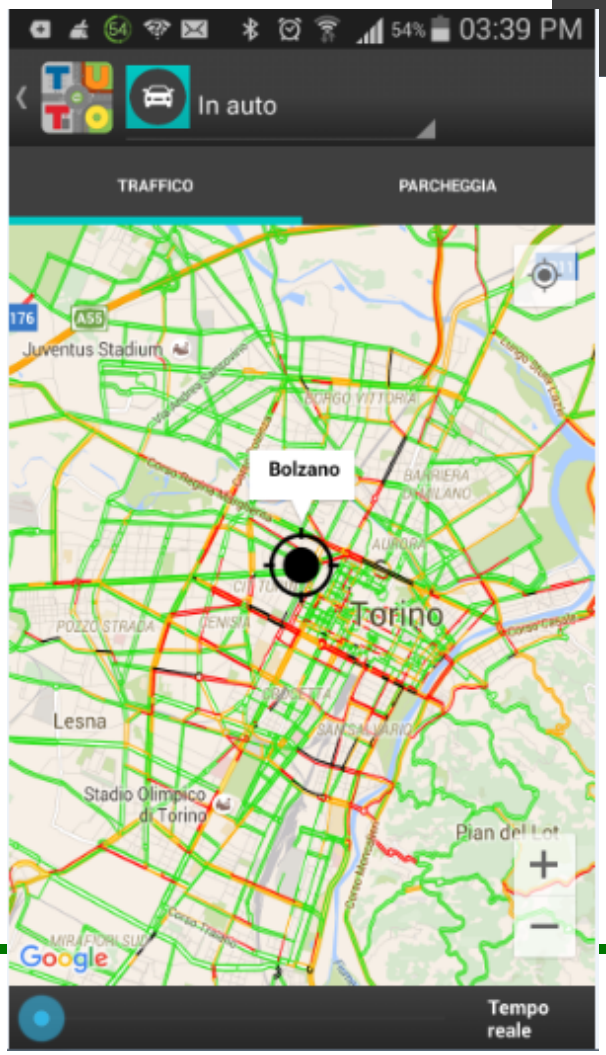
KNOW MORE: OPTICITIES

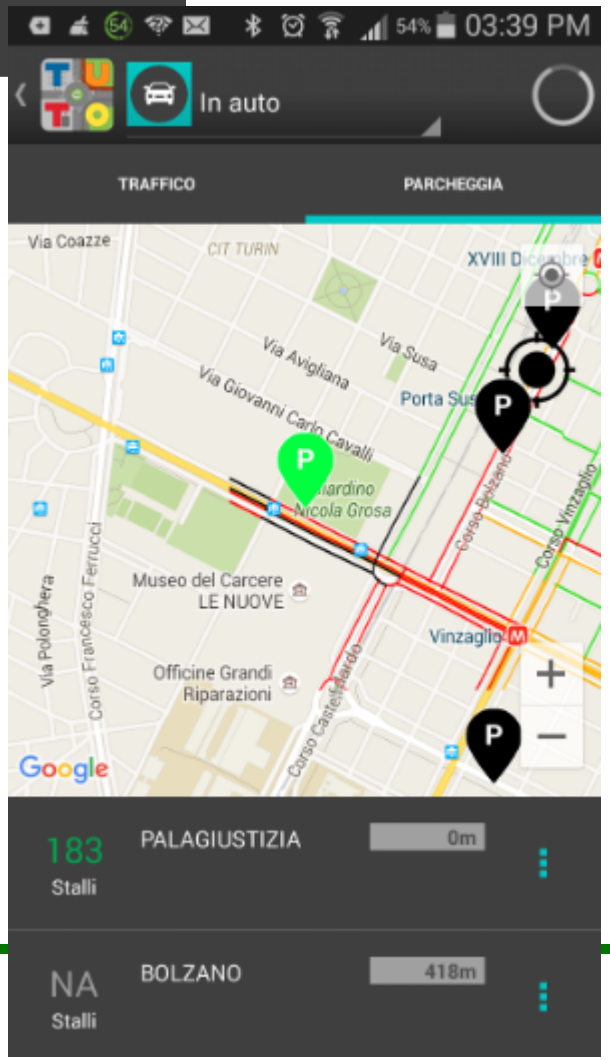
URBAN ITS SERVICE

Transferability handbook

OPTICITIES - Transferability Handbook_web.pdf

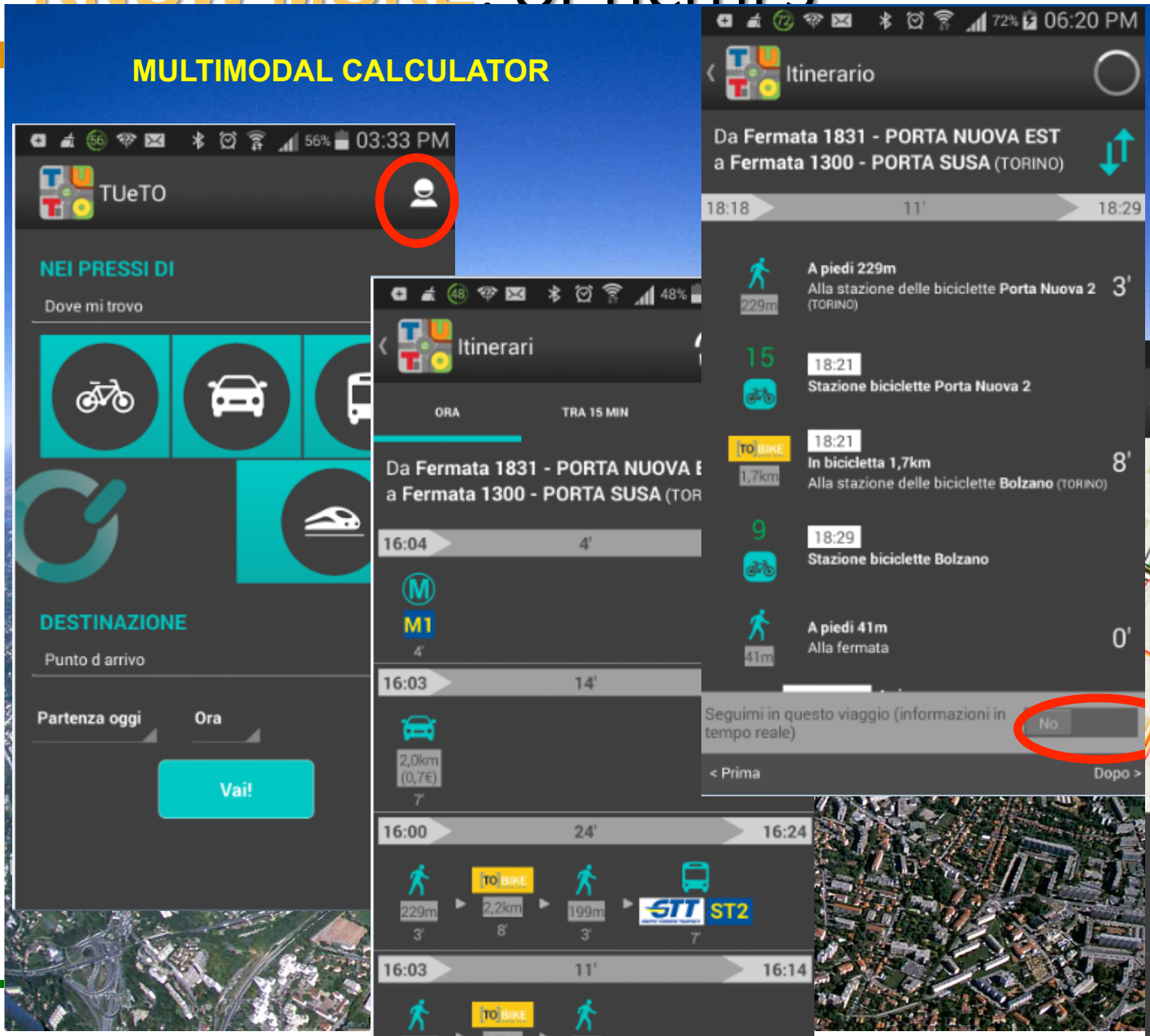
KNOW MORE: OPTICITIES



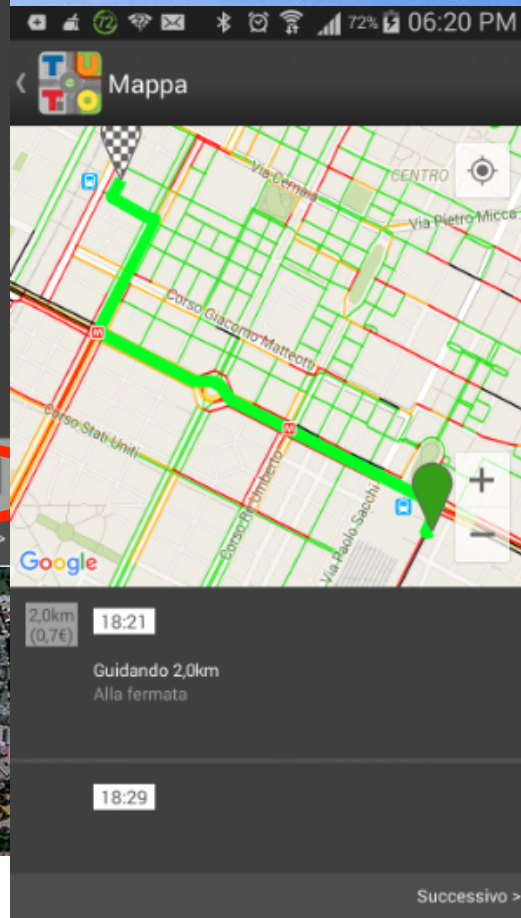


KNOW MORE: OPTICITIES

MULTIMODAL CALCULATOR

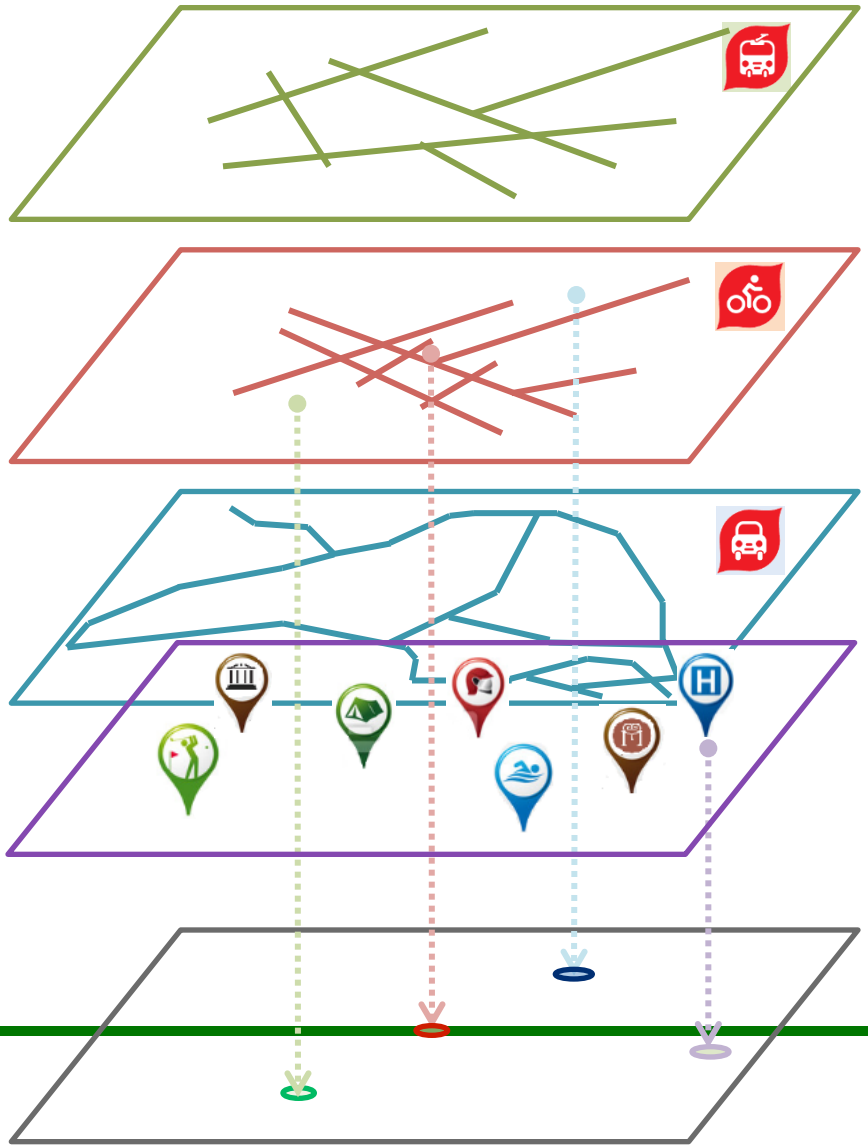


MULTIMODAL GPS



KNOW MORE: OPTICITIES

Decision Support Tool (DST) for transport planning and management



DATA FROM TRANSPORT PROVIDERS

Public Transport
Cycling and walking
Car sharing
Car pooling
Taxi
Road traffic

DATA FROM OTHER SECTORS

Road accidents
Tourism and sport
Demography
Businesses
Events
Points Of Interest (POIs)

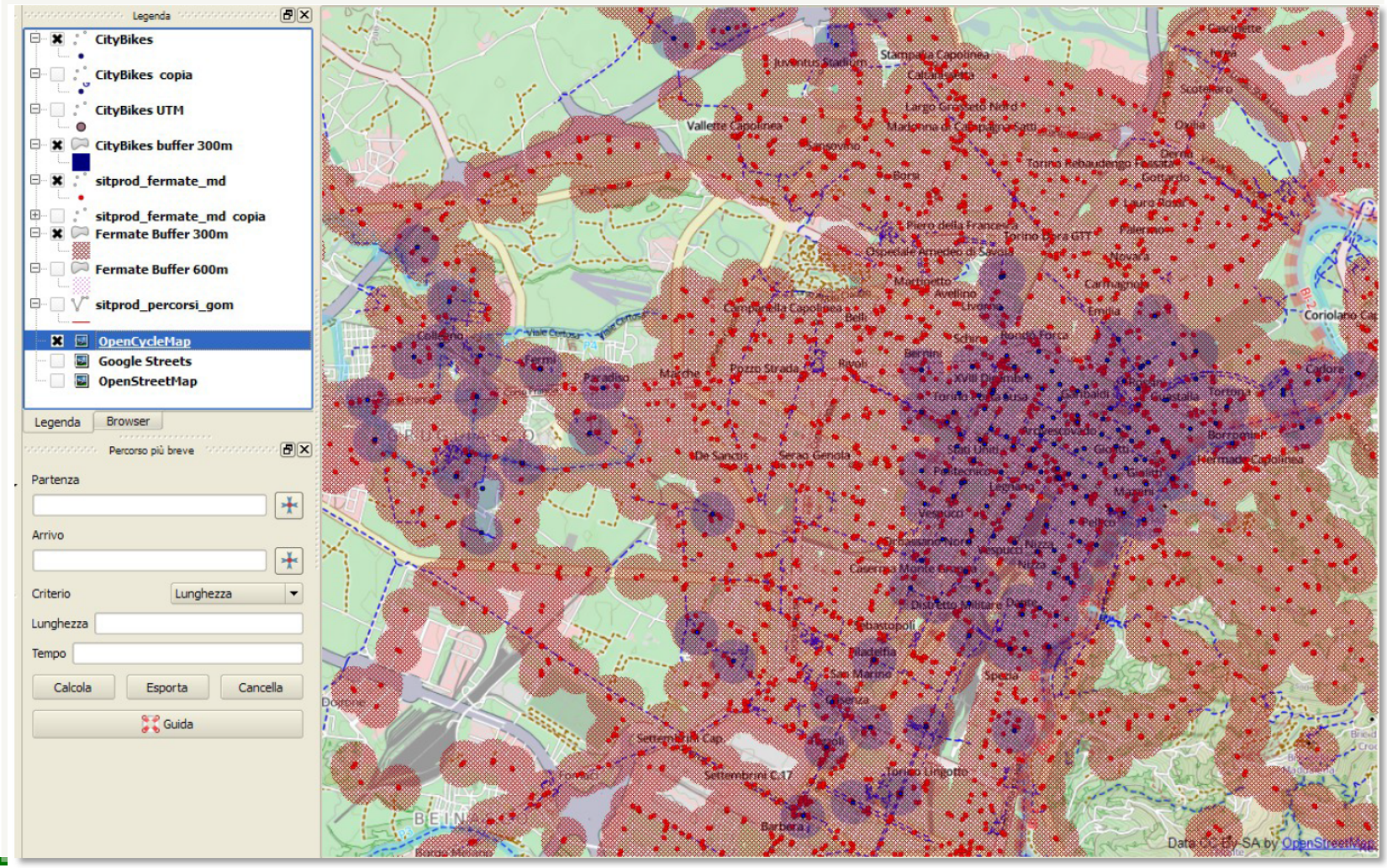
MULTIMODAL MAP

KNOW MORE: OPTICITIES

http://vm-osotp.csi.it/opticities/it/

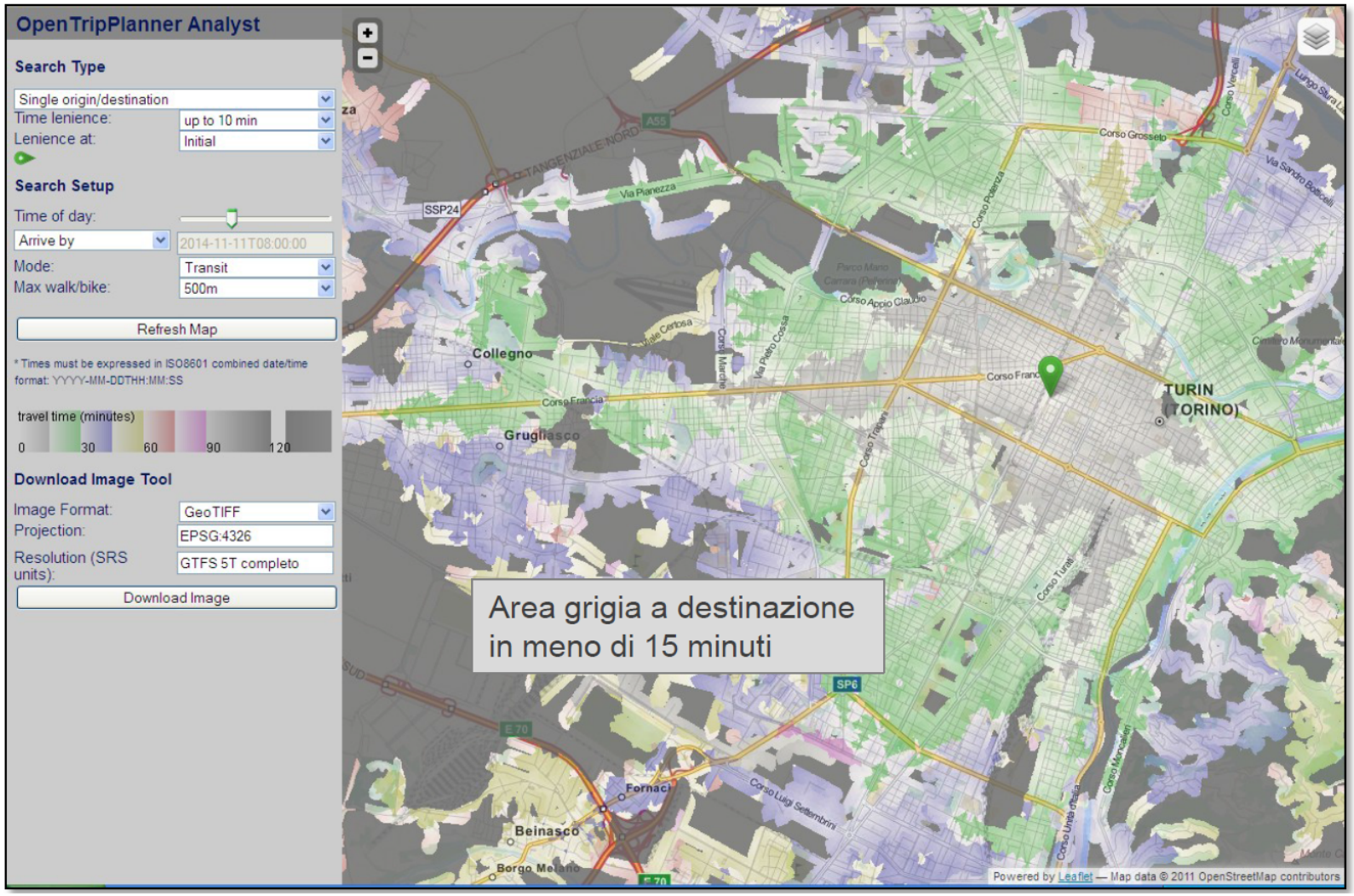
KNOW MORE: OPTICITIES

300 m buffer around PT and bike sharing stops



KNOW MORE: OPTICITIES

Destination: Porta Susa (all PT working)



UNDERSTAND MORE

Evaluate the ATIS from the travellers' point of view, to understand their effect on travel behaviour:

- Opticities project (www.opticities.com): multimodal real time navigator in Lyon, Torino, Madrid and Gothenburg

UNDERSTAND MORE

Oct-Dec 2014

Phase I: ex-ante

Ex-ante survey

Mixed method: quantitative questionnaire + focus group

Users' needs

Expectations

Potential for behavioural change

Selection of the sample

150 participants

Feb-June 2016

Phase II: experiment

In-itinere survey

Questionnaire each month

Technical problems with the app

Ergonomic problems

Users' reactions

Behavioural reactions

A Smartphone Grand Prime Galaxy and one year free pass has been given to participants

July-Sept 2016

Phase III: ex-post

Ex-post survey

Mixed method: quantitative questionnaire + focus group

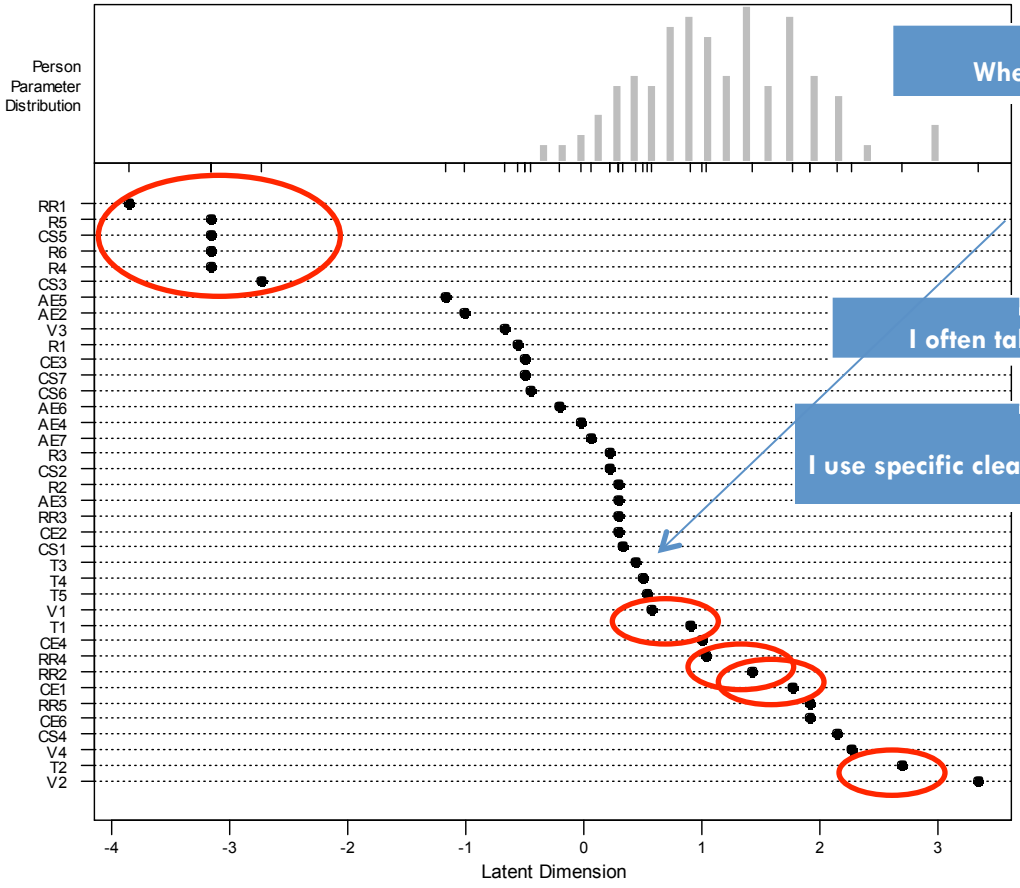
Potential behavioural changes

Sample of 140 participants

UNDERSTAND MORE

From the easier-to-engage item to the most difficult one

The eight easiest items are too easy, not targeting anyone, and so they are not very useful for the GEB measurement



When possible, I do not use a car for distance lower than 30km.	T3
If possible, I do not insist on my right of way and make the traffic stop before entering crossroads.	T4
I walk, ride or take public transport to go to work/university	T5
I often talk with friends about problems related to the environment.	V1
Usually, I do not drive my automobile in the city.	T1
I use specific cleaners for different rooms rather than an all-purpose cleaner.	CE4 (-)
For shopping, I prefer paper bag to plastic ones.	RR4
I sometimes buy beverage in cans.	RR2 (-)
I use fabric softener with my laundry.	CE1 (-)
Usually, I buy water with returnable bottles.	RR5
I always look to buy vegetables from biological agriculture.	CE6
If I were an employer, I would not hesitate hiring a person previously convicted of crime.	CS 4
I sometimes contribute financially to environmental organizations.	V4
I usually drive on freeways at speeds lower than 100km/h.	T2
I am a member of an environmental organization.	V2

UNDERSTAND MORE

Personal norms (PN) **Problem Awareness (PA)** **Adverse Consequences (AC)** **Ascription of Responsibility (AR)** **Subjective Norms (SN)** **Affect (AFF)** **Perceived Accessibility (PAC)** **Perceived Behavioural Control toward bicycle use (PBCb)** **Perceived Behavioural Control toward public transport use (PBCpt)**

psycho-social factors

Transport related Values (Exploratory Factor Analysis)

5-point Likert scale → the level of importance of choosing their mode of transport for their most frequent trip, according to:

"*Cost", "Speed", "Comfort", "Pleasure (I like this mode of transport)", "Flexibility and independence", "Respect towards the environment" and "Reliability of travel time"*.

Two factors

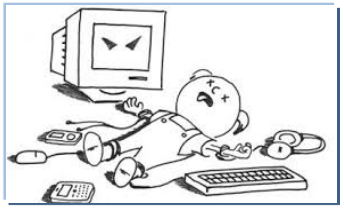
Utilitarian (U) (Speed, Flexibility and independence, Reliability of the travel time, Comfort

Convenience (C) (Cost, Pleasure [I like this mode of transport], Respect towards the environment)

Home localisation (Home), divided into: Urban (U), SubUrban (SU), Rural (R)

UNDERSTAND MORE

THREE CLUSTERS



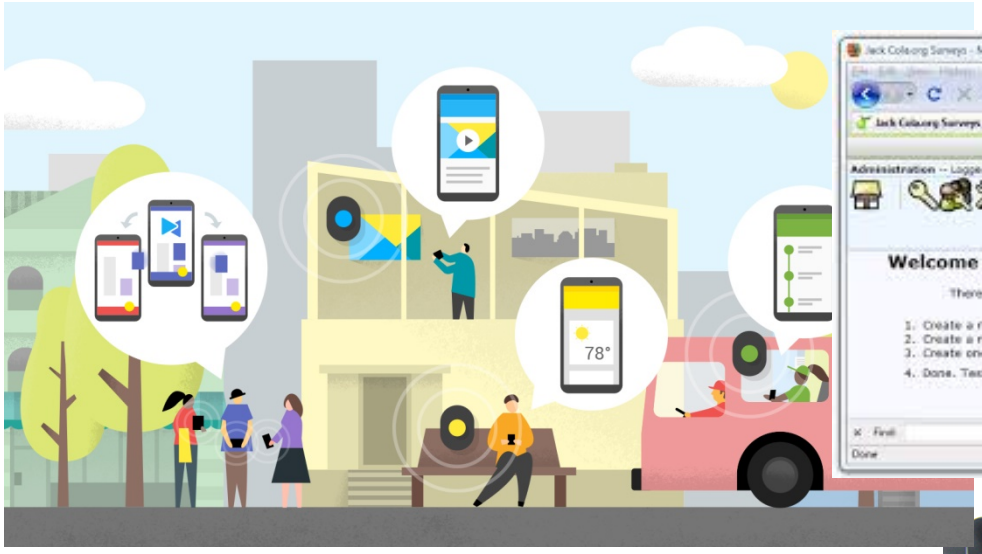
Neo-Luddites Opportunists:
they value whatever they can benefit from
Neo-Luddism identifies people that follows a desire for a simple life where technological tools are restrained to their minimum → *No use of TUeTO*

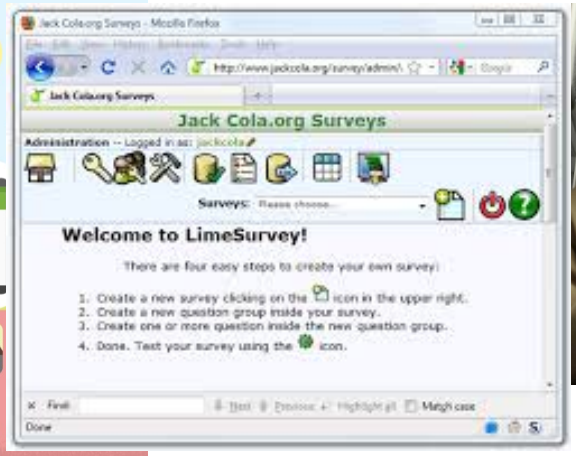
Hedonic Techy Ecologists
in favour of technological use
higher score on the Convenience than on the Utilitarian transport value
they prefer cheap and pleasant trips than fast and efficient ones
They expect that technology will solve many problems, including transport-related ones, and are aware of the need to pay to benefit from a service such as the multimodal navigator. They can represent the main source of revenue in a business model assessment

Neoclassical Agents
Higher score on the utilitarian over the convenience transport related value
low score on the measure of attitude toward the environment →
homo economicus: an agent who will tend to maximize its own short-term utility without consideration for the others or the environment

Even if they may benefit from the multimodal navigator, it is unlikely that they'll will shift from their most favoured mode until economical constraints will force them to do so

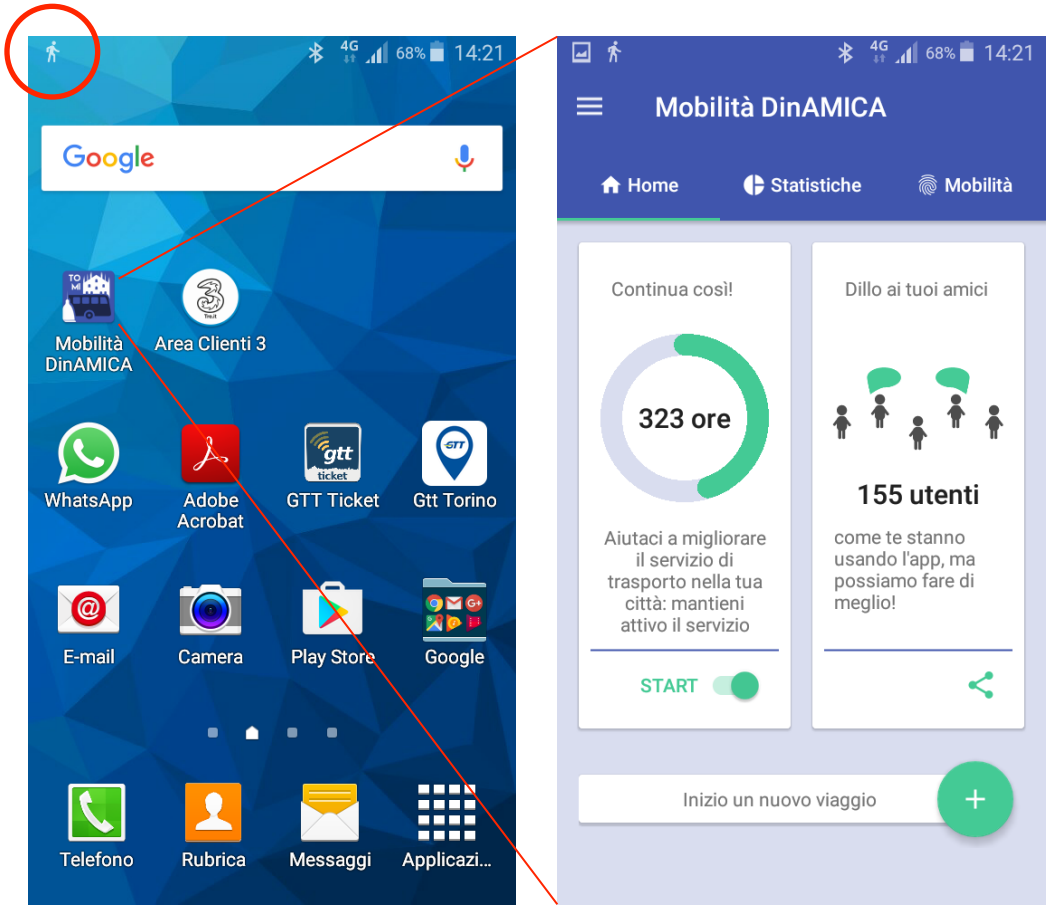
KNOW MORE: collection and investigation of target users' needs



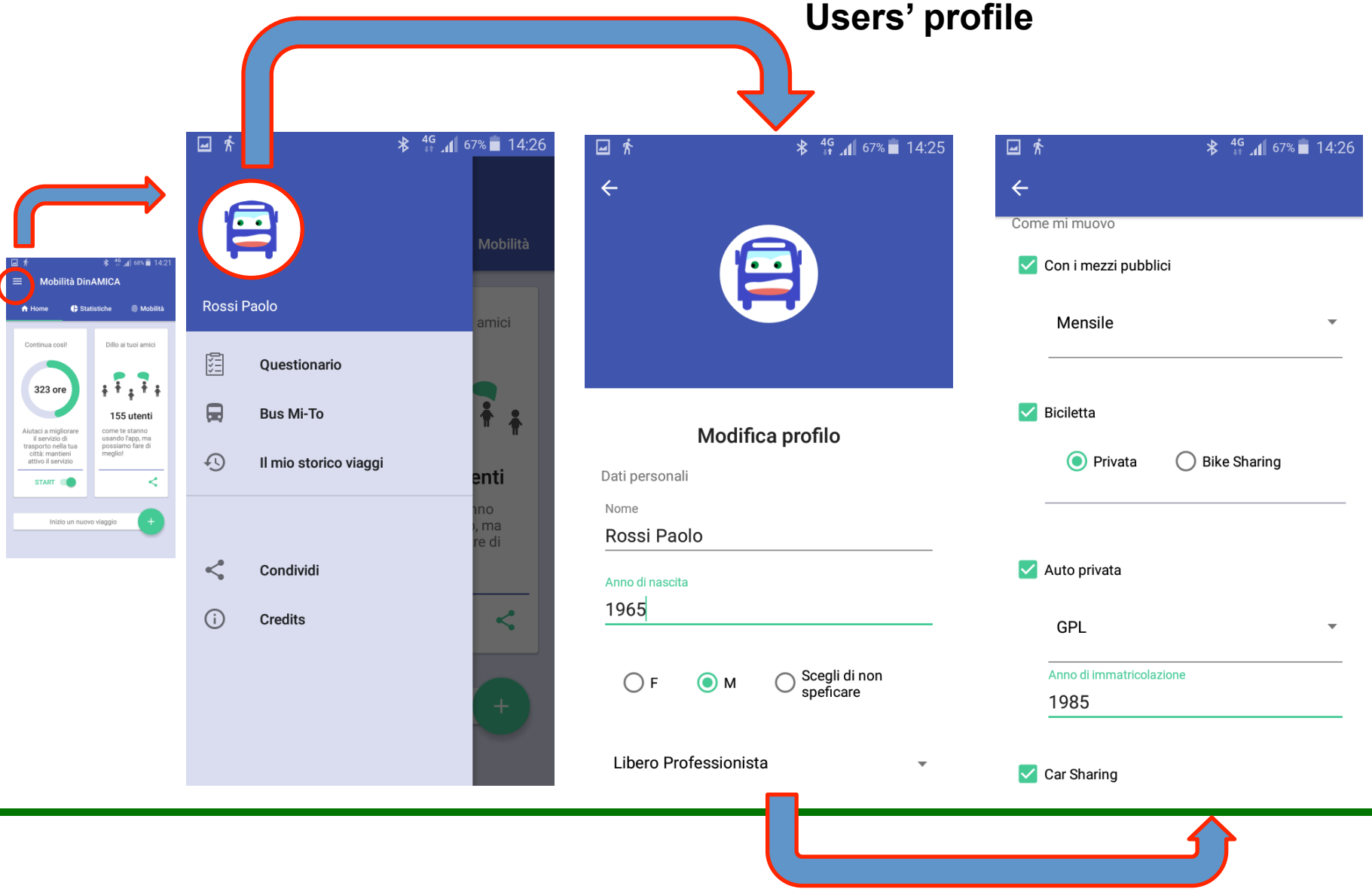


The app MOBILITE DYNAMIQUE

Main Screen



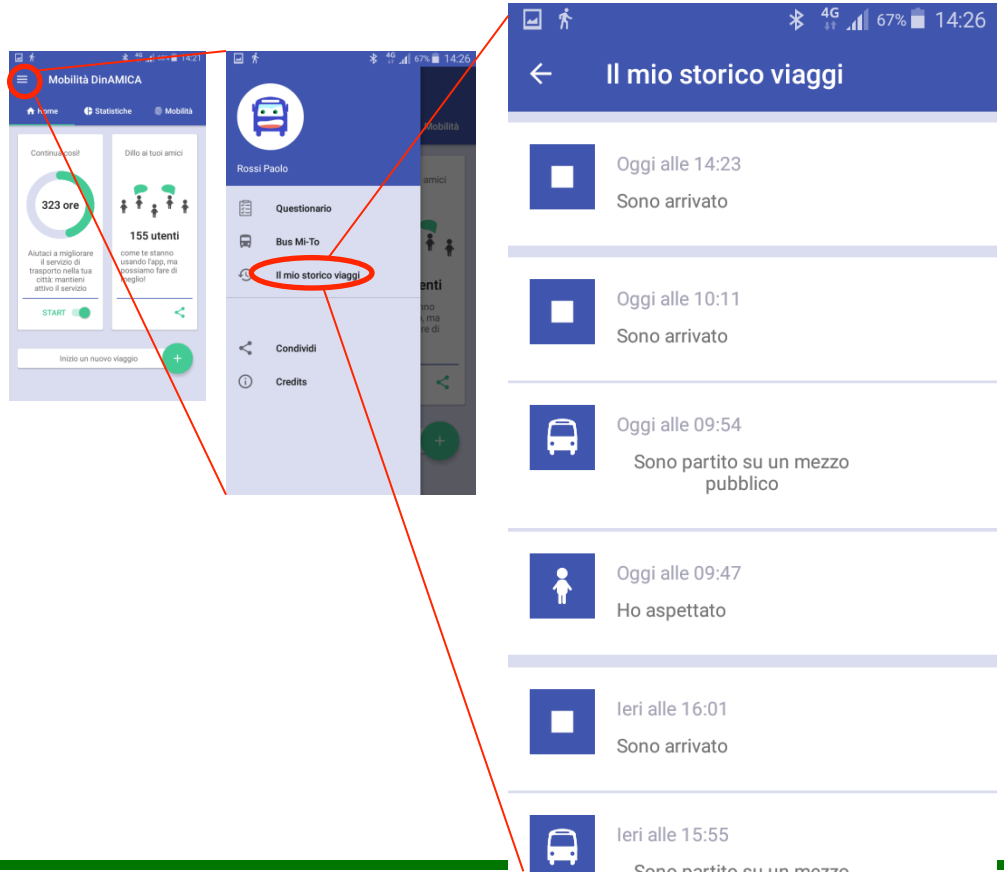
The app MOBILITE DYNAMIQUE



The app MOBILITE DYNAMIQUE

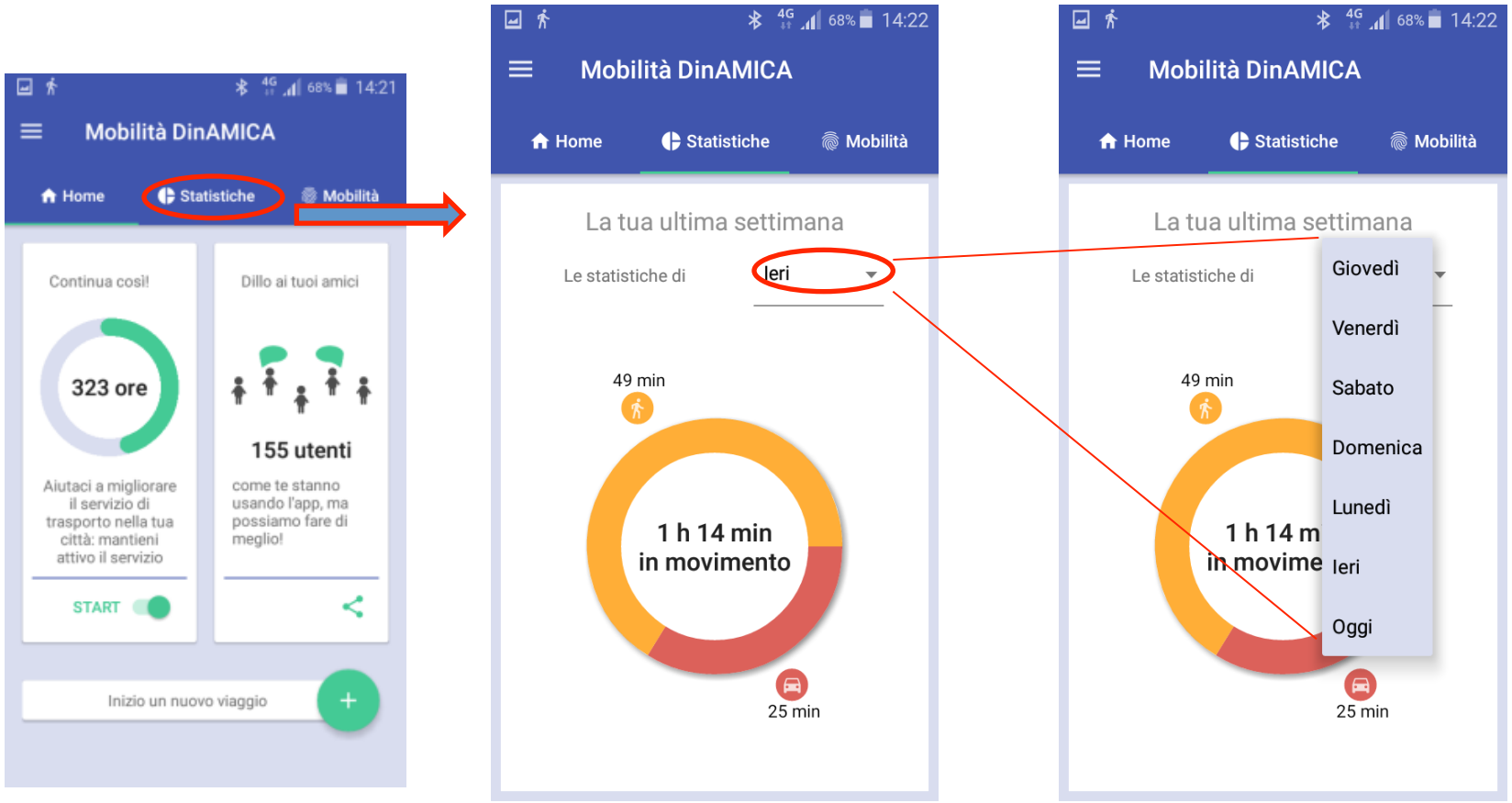
Choice of transport mode to increase precision

Time history of travels



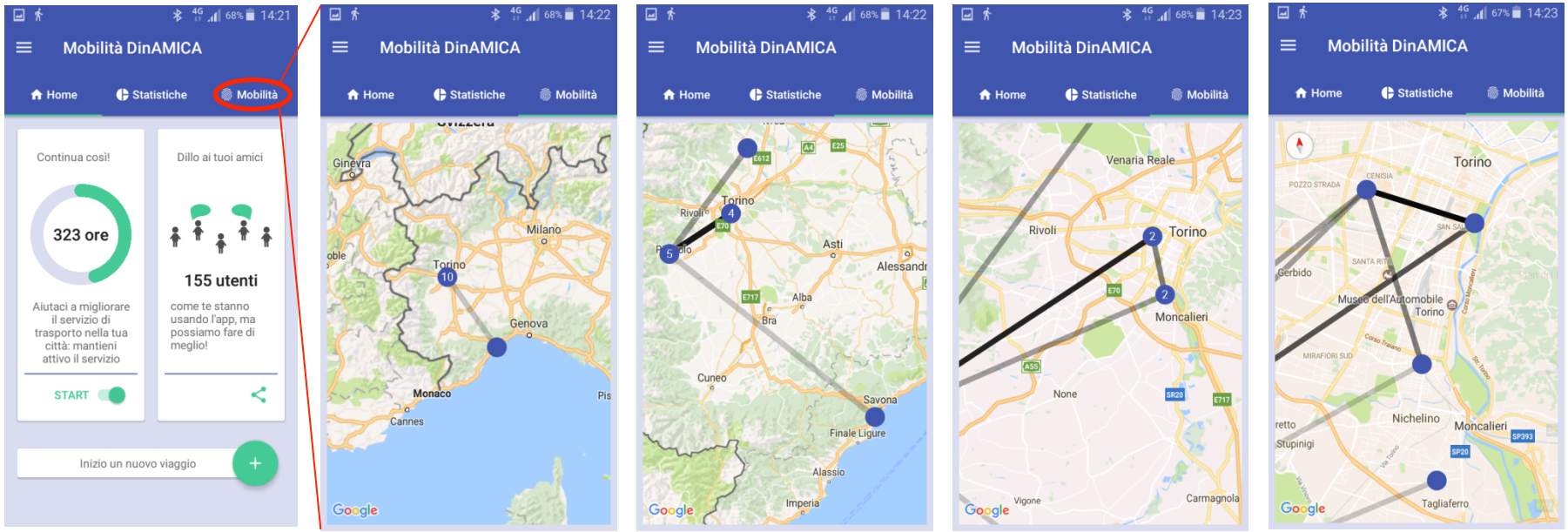
The app MOBILITE DYNAMIQUE

Possibility to show the travel statistics (weekly)
«travel time by transport mode»



The app MOBILITE DYNAMIQUE

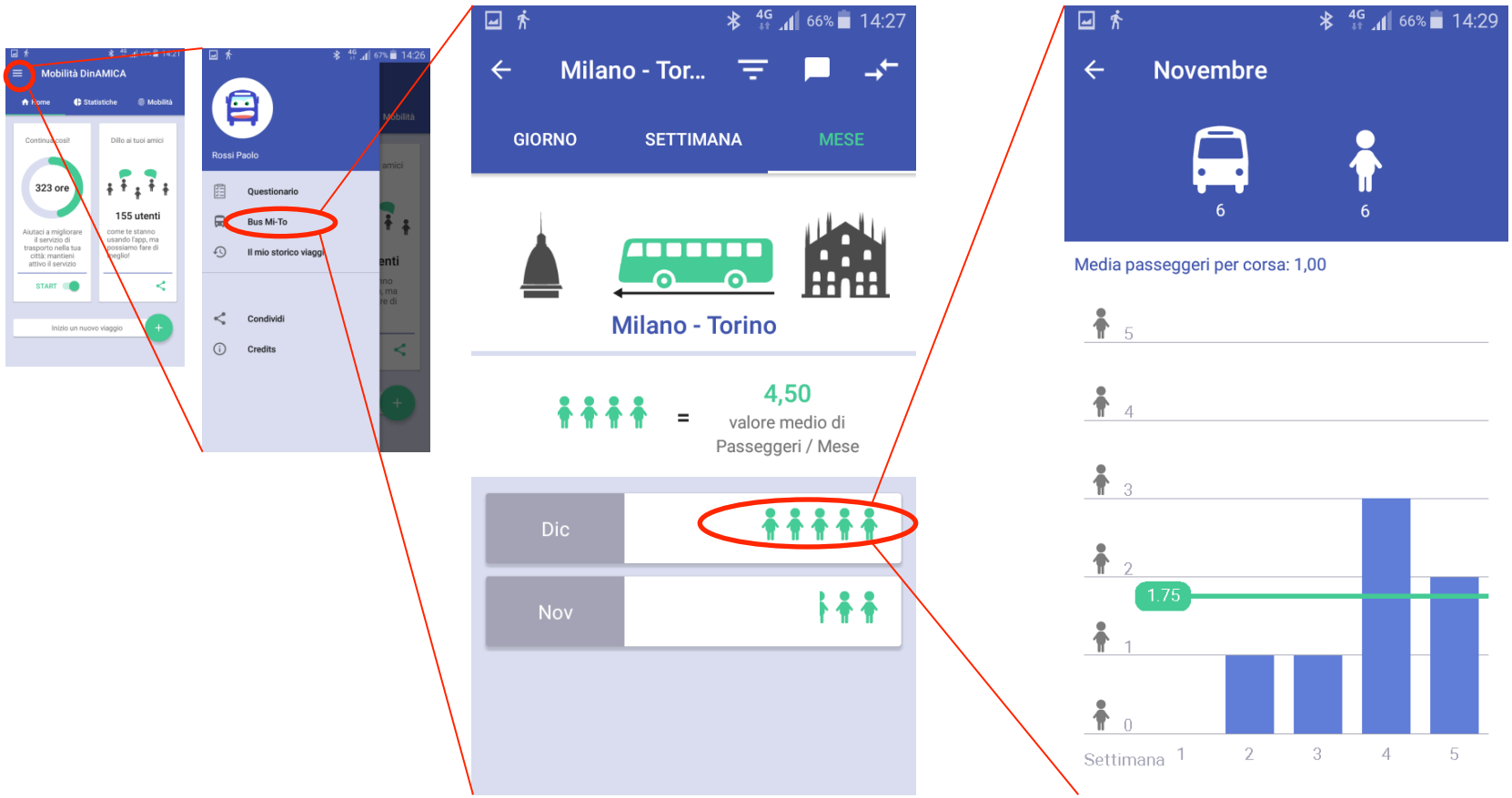
Possibility to show travels
Travel visualisation (O/D)



«images sensible to ZOOM»

The app MOBILITE DYNAMIQUE

Possibility to show information on public transport lines
«Example of load factor »

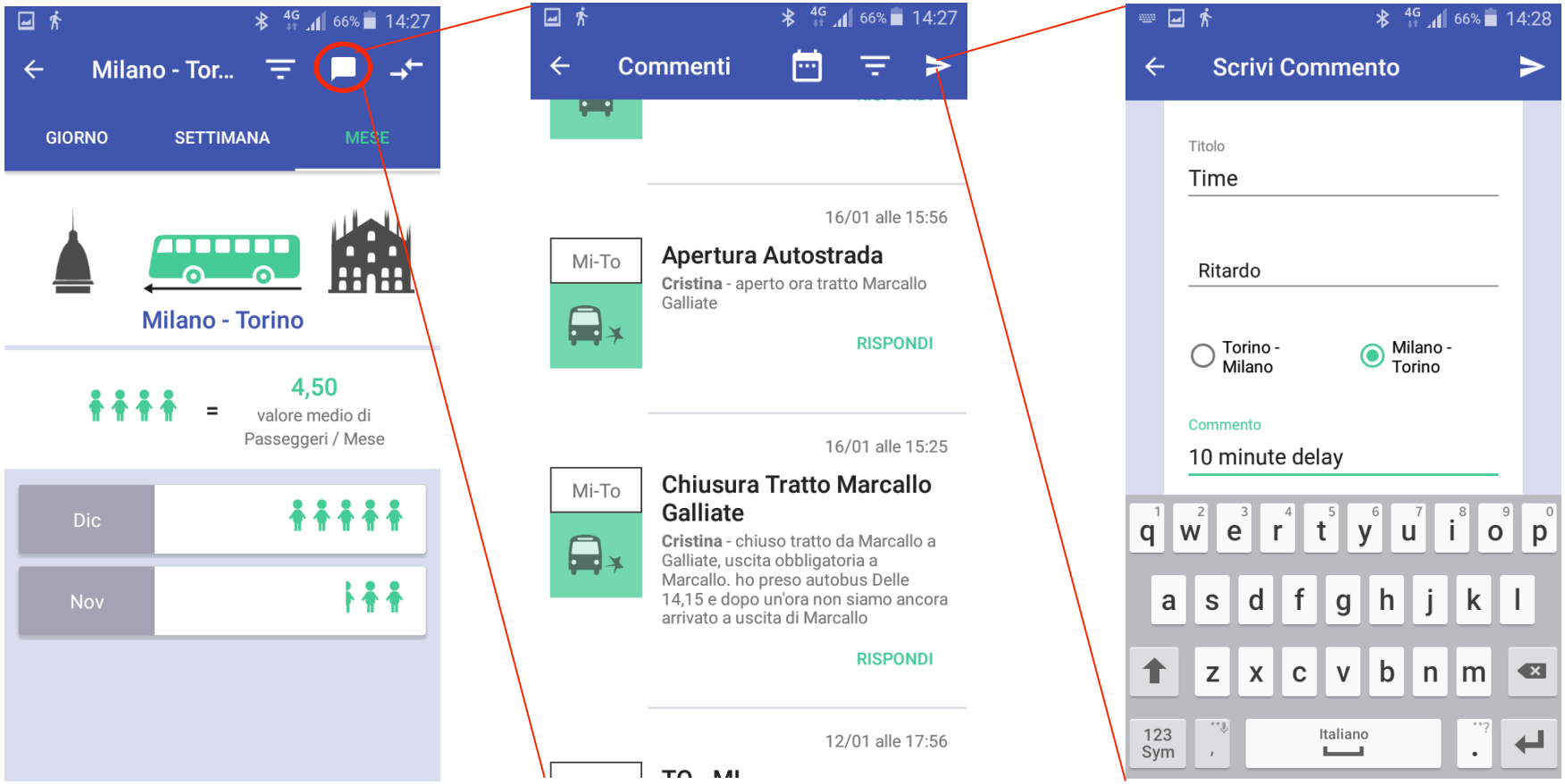


The app MOBILITE DYNAMIQUE

Possibility to speak with the «community»

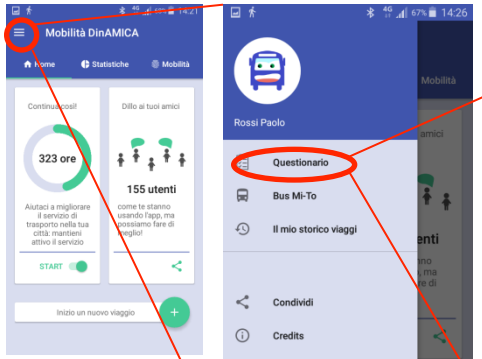
Write

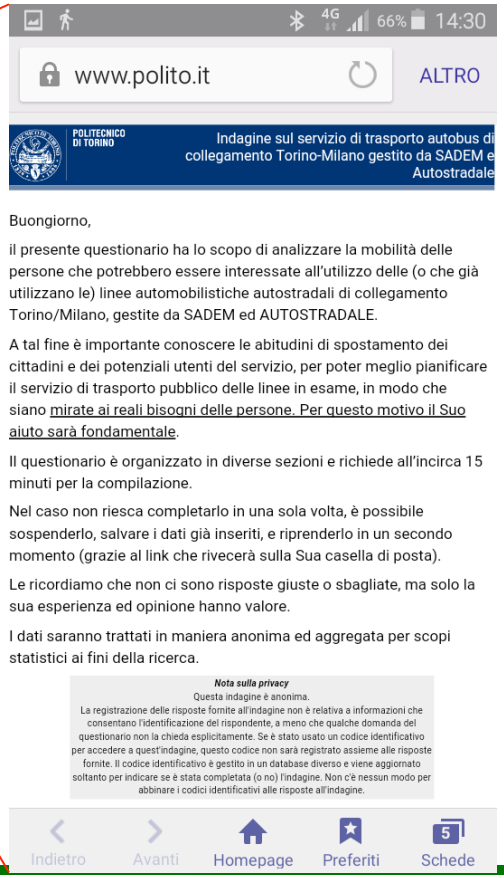
Read

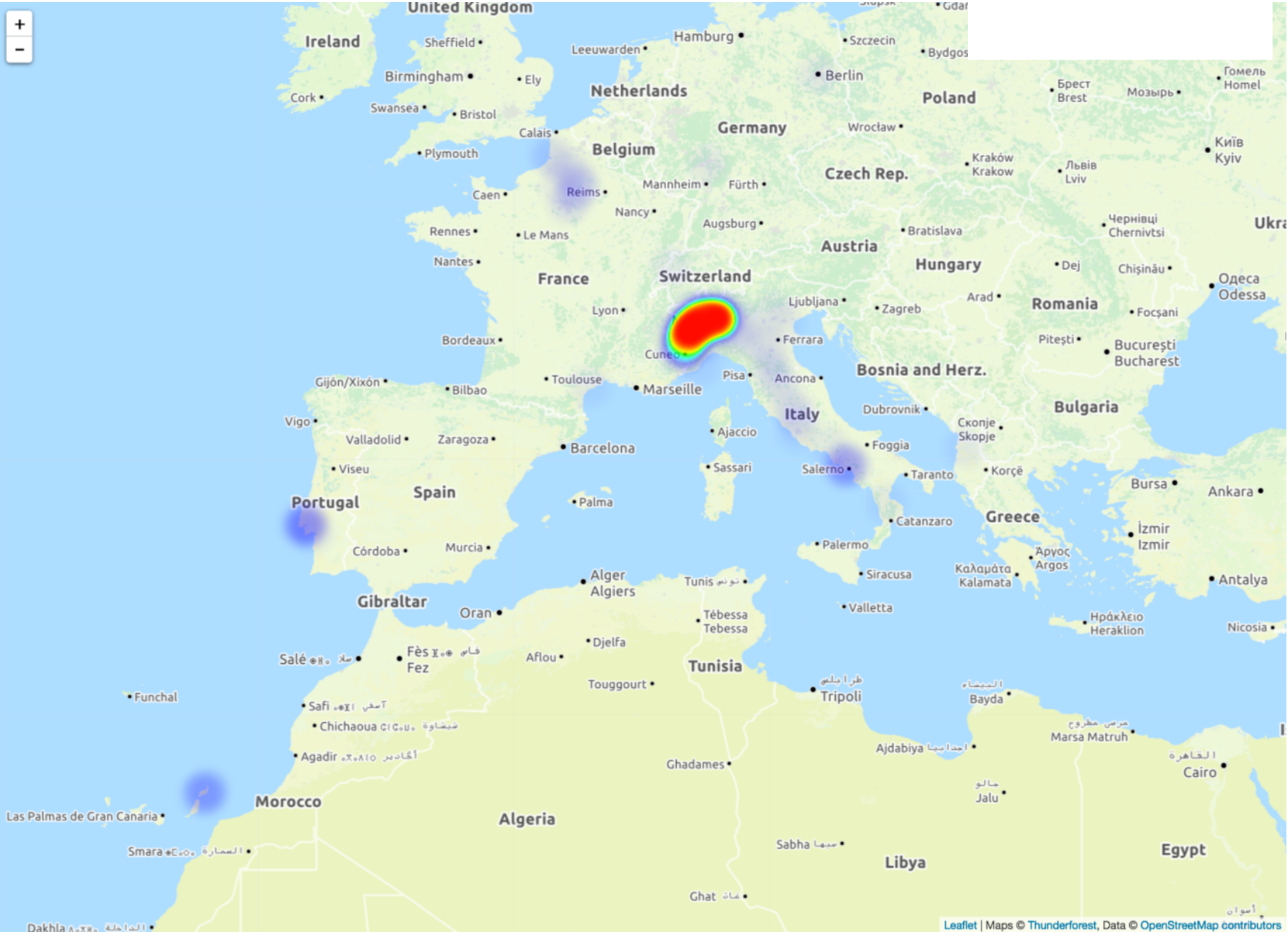


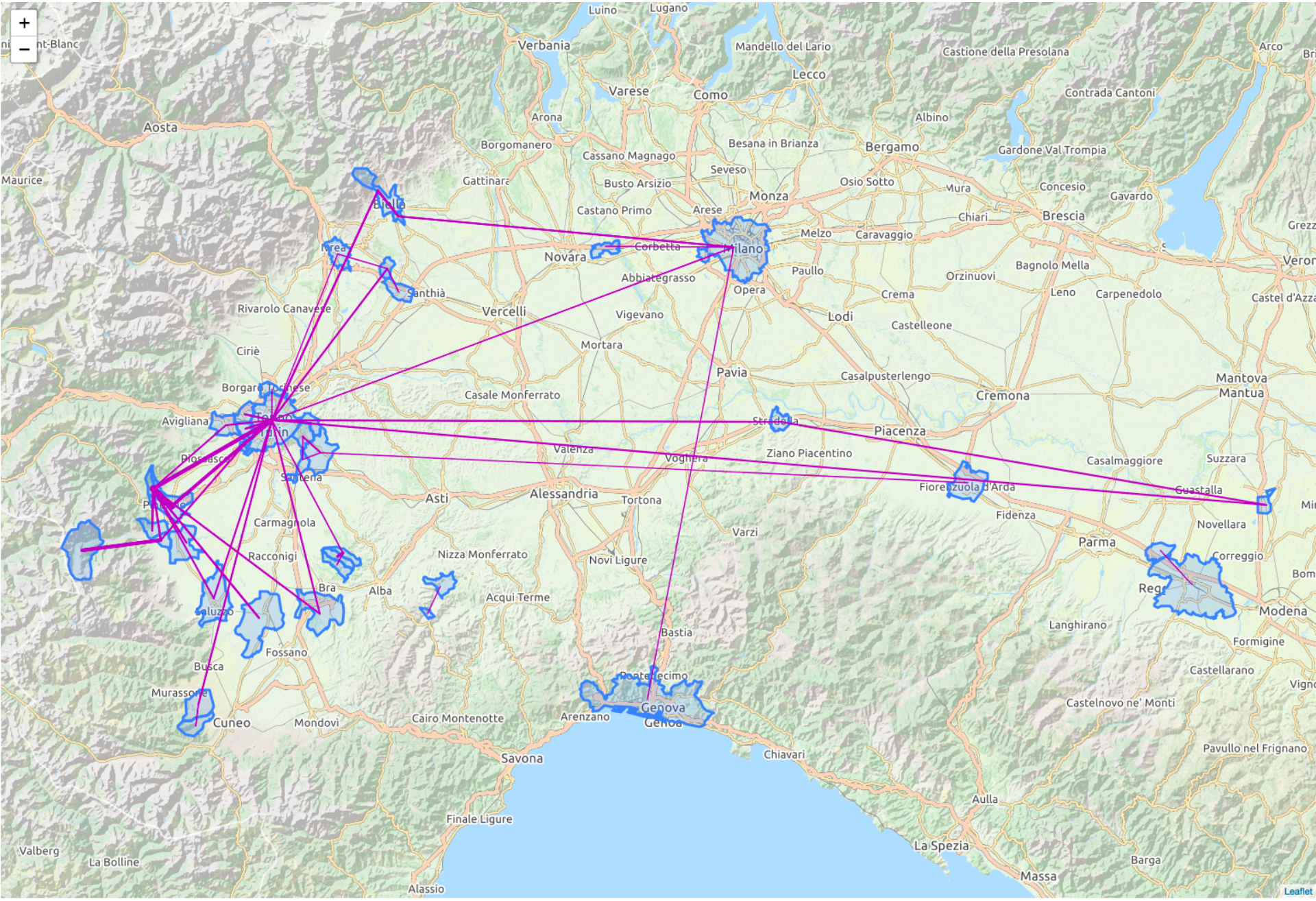
The app MOBILITE DYNAMIQUE

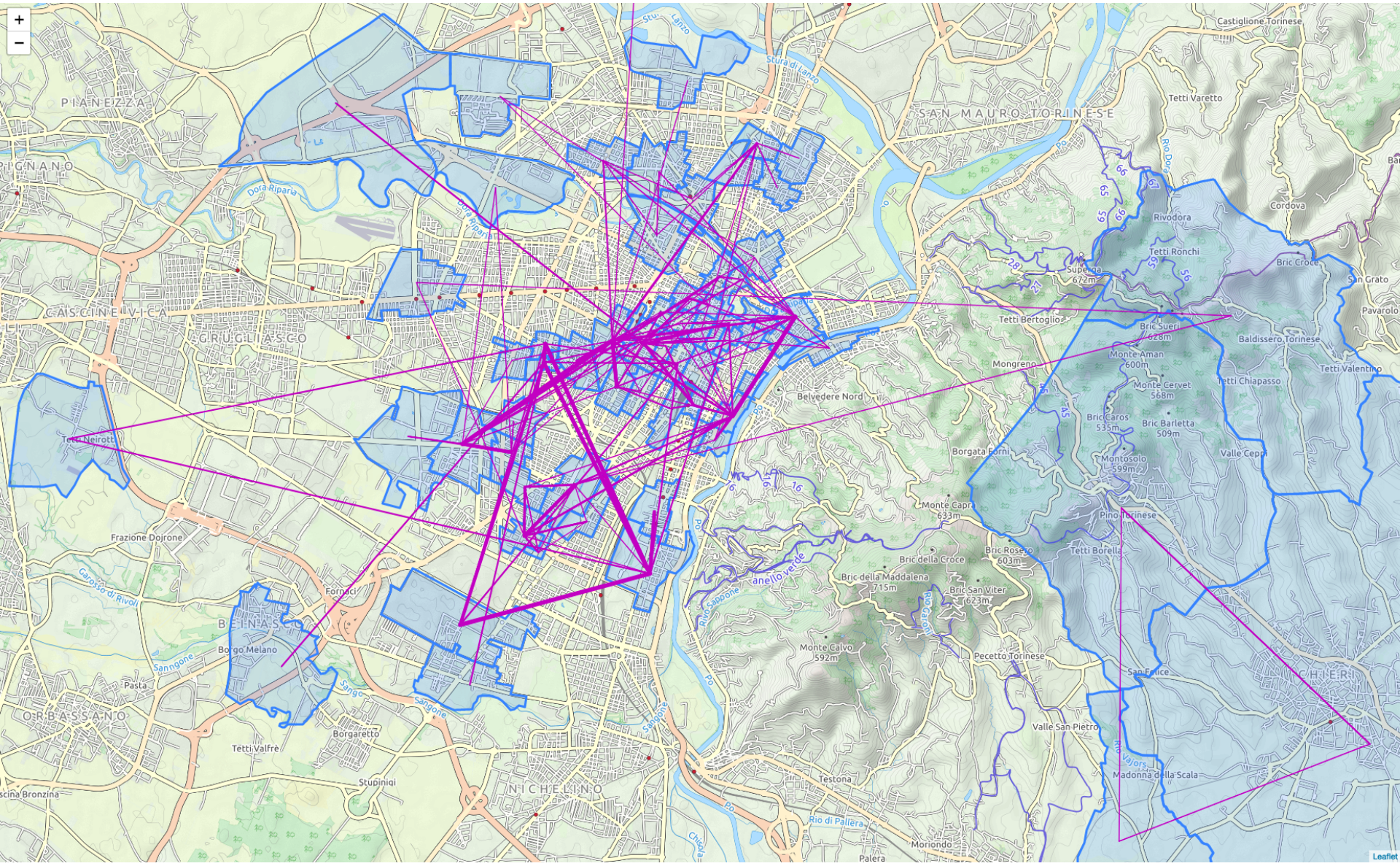
Possibility to share information with the community
Example of «travel survey» administered through the app

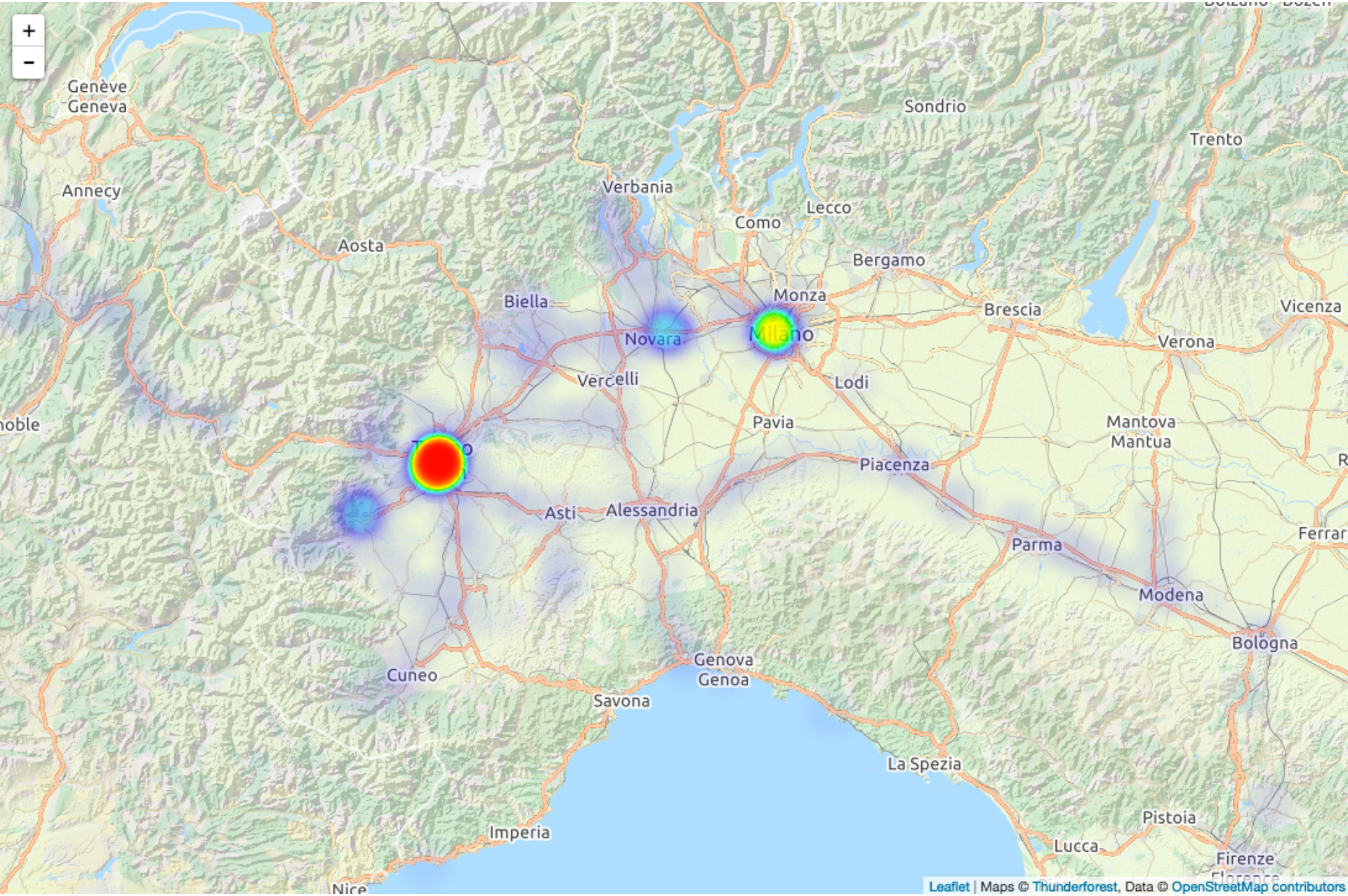


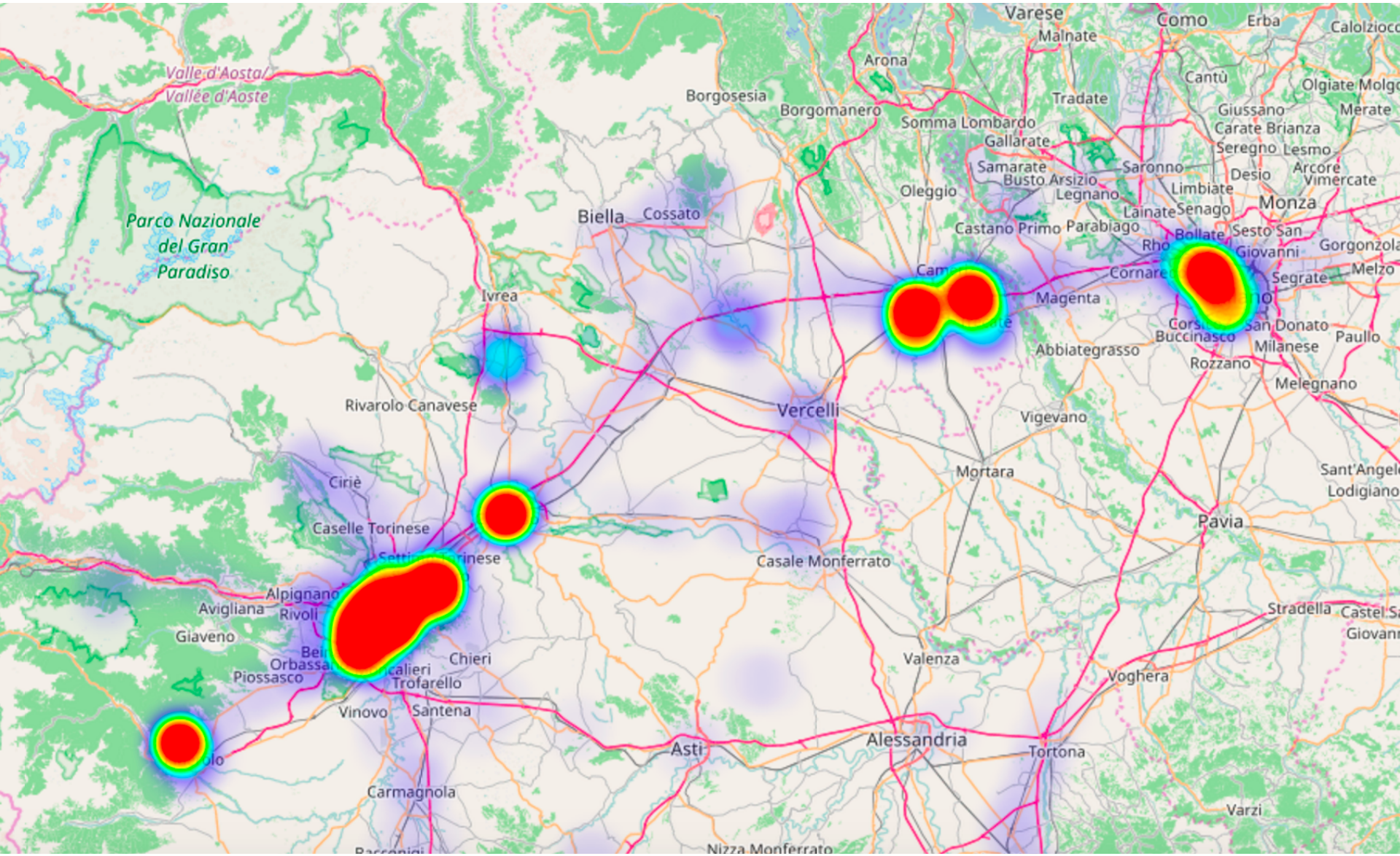


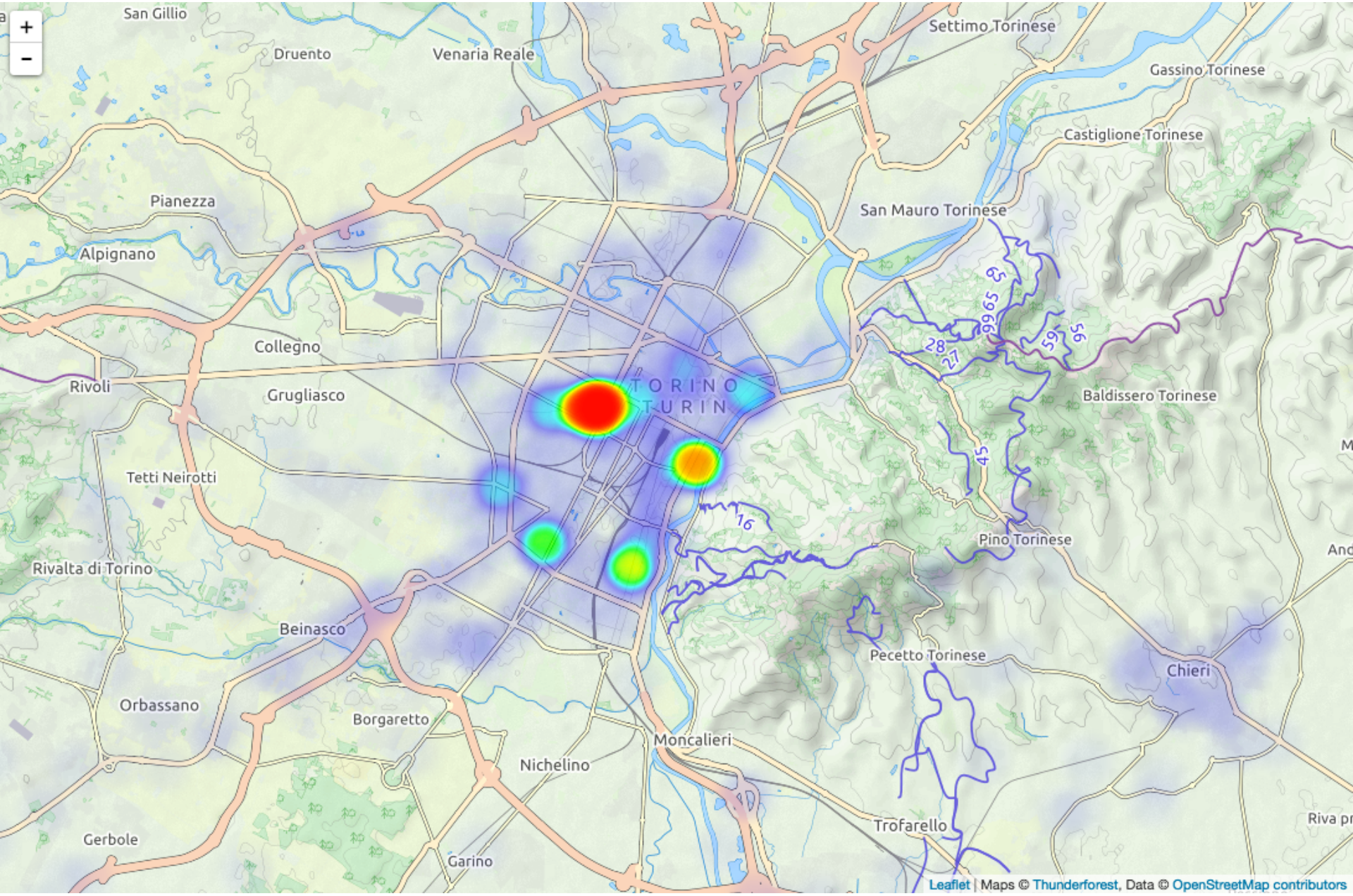

United Kingdom
Ireland
Sheffield
Birmingham
Ely
Cork
Swansea
Bristol
Plymouth
Calais
Leeuwarden
Hamburg
Netherlands
Berlin
Szczecin
Bydgoszcz
Germany
Poland
Wrocław
Брест
Brest
Мозырь
Гомель
Homel
Belgium
Reims
Caen
Mannheim
Fürth
Nancy
Augsburg
Czech Rep.
Kraków
Krakow
Львів
Lviv
Київ
Kyiv
Rennes
Le Mans
Nantes
France
Switzerland
Austria
Bratislava
Чернівці
Chernivtsi
Hungary
Dej
Chişinău
Одеса
Odessa
Lyon
Ljubljana
Zagreb
Arad
Romania
Focşani
Bordeaux
Ferrara
Pitești
București
Bucharest
Cuneo
Bosnia and Herz.
Gijón/Xixón
Bilbao
Toulouse
Marseille
Pisa
Ancona
Vigo
Valladolid
Zaragoza
Barcelona
Italy
Dubrovnik
Bulgaria
Скопје
Skopje
Ajaccio
Foggia
Viseu
Sassari
Salerno
Taranto
Korçë
Bursa
Ankara
Spain
Portugal
Palma
Catanzaro
Greece
İzmir
Córdoba
Murcia
Palermo
Argos
Siracusa
Καλαμάτα
Kalamata
Antalya
Alger
Algiers
Tunis
Gibraltar
Oran
Valletta
Téhessa
Tebessa
Ηράκλειο
Heraklion
Nicosia
Djelfa
Salé
Fès
Fez
Aflou
Tunisia
Touggourt
Tripoli
Bayda
Funchal
Safi
Chichaoua
Agadir
Marsa Matruh
Ajdabiya
Ghadames
Cairo
Morocco
Jalu
Las Palmas de Gran Canaria
Algeria
Smara
Sabha
Egypt
Libya
Ghat
Dakhla
Leaflet | Maps © Thunderforest, Data © OpenStreetMap contributors

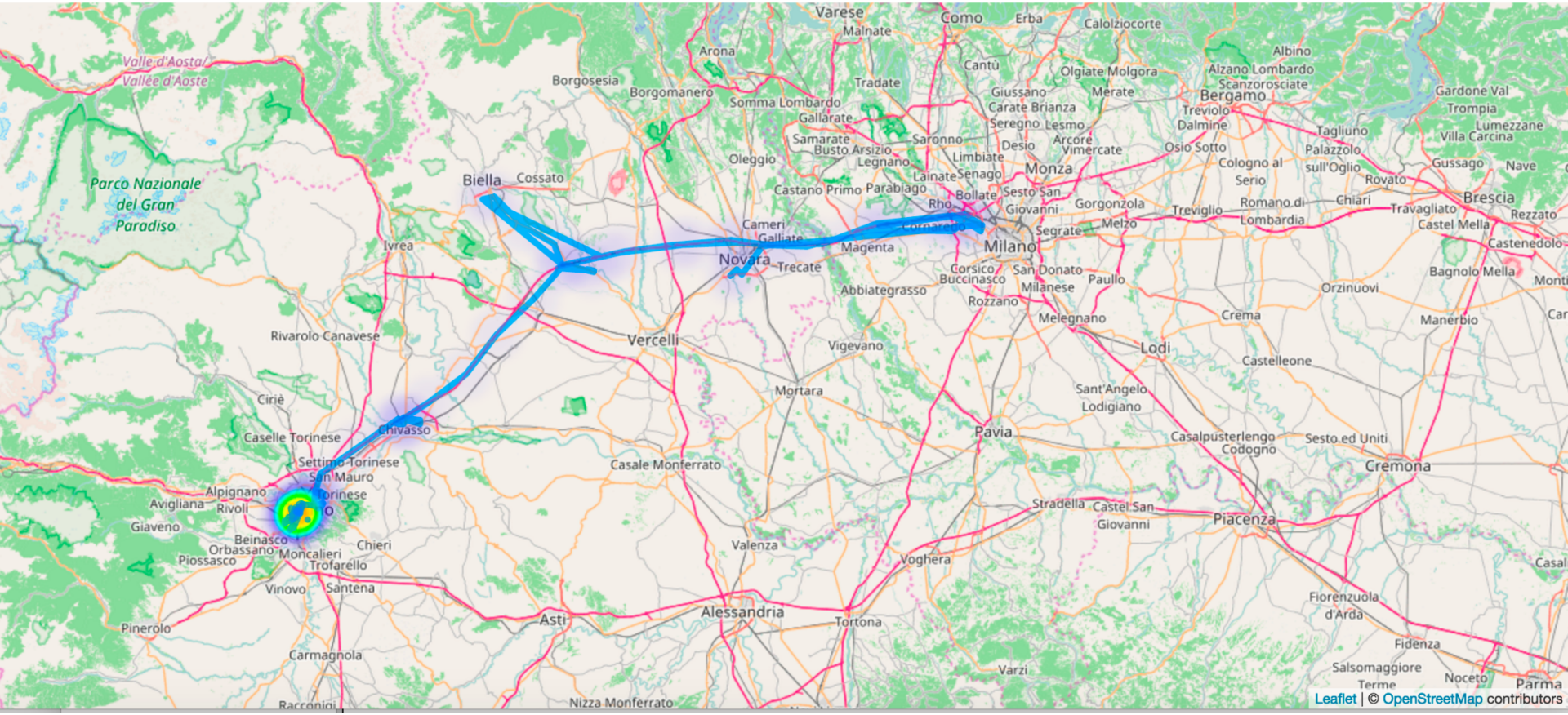

Luino
Lugano
Verbania
Mandello del Lario
Castione della Presolana
Arco
Lecco
Varese
Como
Contrada Cantoni
Aosta
Arona
Albino
Borgomanero
Besana in Brianza
Bergamo
Cassano Magnago
Gardone Val Trompia
Seveso
Busto Arsizio
Osio Sotto
Concesio
Monza
Castano Primo
Arese
Chiari
Brescia
Gavardo
Melzo
Caravaggio
Corbetta
Milano
Novara
Bagnolo Mella
Abbiategrasso
Paullo
Orzinuovi
Opera
Crema
Leno
Carpenedolo
Santhià
Rivarolo Canavese
Vercelli
Vigevano
Lodi
Castelleone
Mortara
Ciriè
Pavia
Casalpusterlengo
Mantova
Mantua
Borgaro Torinese
Casale Monferrato
Cremona
Avigliana
Piacenza
Valenza
Voghera
Ziano Piacentino
Casalmaggiore
Suzzara
Fiorenzuola d'Arda
Guastalla
Asti
Alessandria
Tortona
Fidenza
Carmagnola
Varzi
Novellara
Parma
Racconigi
Nizza Monferrato
Novi Ligure
Correggio
Alba
Bra
Acqui Terme
Modena
Langhirano
Bastia
Fossano
Formigine
Busca
Castellarano
Murassone
Cuneo
Mondovì
Cairo Montenotte
Arenzano
Genova
Castelnovo ne' Monti
Savona
Chiavari
Pavullo nel Frignano
Aulla
Finale Ligure
La Spezia
Valberg
La Bolline
Barga
Massa
Alassio
Leaflet


PIANEZZA
PIGNANO
CASCINE VICA
GRUGLIASCO
SAN MAURO TORINESE
Castiglione Torinese
Tetti Varetto
Rivodora
Cordova
Tetti Ronchi
Bric Croce
San Grato
Pavarolo
Superga
672m
Tetti Bertoglio
Bric Sueri
628m
Baldissero Torinese
Monte Aman
600m
Tetti Valentino
Mongreno
Monte Cervet
568m
Tetti Chiapasso
Belvedere Nord
Bric Caros
535m
Bric Barletta
509m
Tetti Neirotti
Borgata Forni
Montosolo
599m
Valle Ceppi
Monte Capra
633m
Pino Torinese
Frazione Dojrone
Bric della Croce
Bric Rosero
603m
Tetti Borella
Bric della Maddalena
715m
Bric San Viter
623m
Fornaci
BEINASCO
Borgo Melano
Monte Calvo
592m
Pecetto Torinese
Pasta
San Felice
ORBASSANO
Borgaretto
Tetti Valfrè
Valle San Pietro
Stupinigi
NICHELINO
Testona
Madonna della Scala
Moriondo
Palera
Leaflet

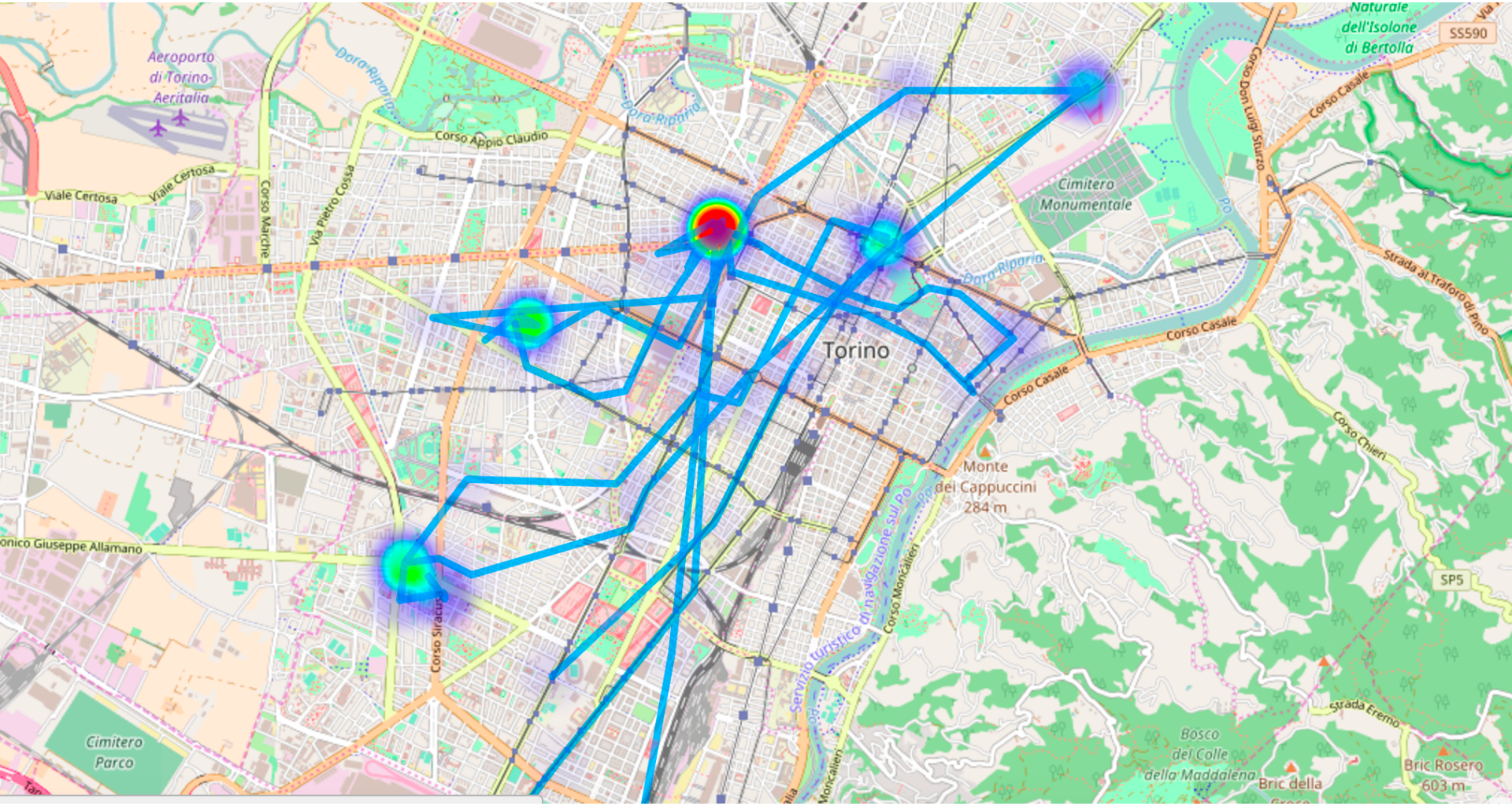

+
−
Genève
Geneva
Annecy
Sondrio
Trento
Verbania
Como
Lecco
Aosta
Bergamo
Biella
Monza
Brescia
Vicenza
Novara
Milano
Verona
Vercelli
Lodi
Pavia
Mantova
Mantua
Piacenza
Asti
Alessandria
Parma
Modena
Bologna
Cuneo
Genova
Genoa
Savona
La Spezia
Pistoia
Imperia
Lucca
Firenze
Nice
Leaflet | Maps © Thunderforest, Data © OpenStreetMap contributors


Varese
Como
Erba
Malnate
Arona
Cantù
Olgiate Molgo
Valle d'Aosta/
Vallée d'Aoste
Borgosesia
Borgomanero
Tradate
Giussano
Merate
Somma Lombardo
Carate Brianza
Gallarate
Seregno
Lesmo
Samarate
Saronno
Arcore
Busto Arsizio
Desio
Vimercate
Oleggio
Limbiate
Legnano
Monza
Parco Nazionale
del Gran
Paradiso
Biella
Cossato
Lainate
Senago
Castano Primo
Parabiago
Bollate
Sesto San
Giovanni
Gorgonzola
Melzo
Cornaredo
Segrate
Ivrea
Magenta
Corsico
San Donato
Milanese
Buccinasco
Paullo
Abbiategrasso
Rozzano
Melegnano
Rivarolo Canavese
Vercelli
Vigevano
Mortara
Sant'Angelo
Lodigiano
Ciriè
Caselle Torinese
Pavia
Casale Monferrato
Alpignano
Avigliana
Rivoli
Stradella
Giaveno
Chieri
Orbassano
Piossasco
Trofarello
Valenza
Voghera
Vinovo
Santena
Asti
Alessandria
Tortona
Carmagnola
Varzi
Nizza Monferrato


San Gillio
Druento
Venaria Reale
Settimo Torinese
Gassino Torinese
Castiglione Torinese
Pianezza
San Mauro Torinese
Alpignano
Collegno
Rivoli
Grugliasco
TORINO
TURIN
Baldissero Torinese
Tetti Neirotti
Pino Torinese
Rivalta di Torino
Beinasco
Pecetto Torinese
Chieri
Orbassano
Borgaretto
Moncalieri
Nichelino
Trofarello
Gerbole
Garino
Riva pr
Leaflet | Maps © Thunderforest, Data © OpenStreetMap contributors

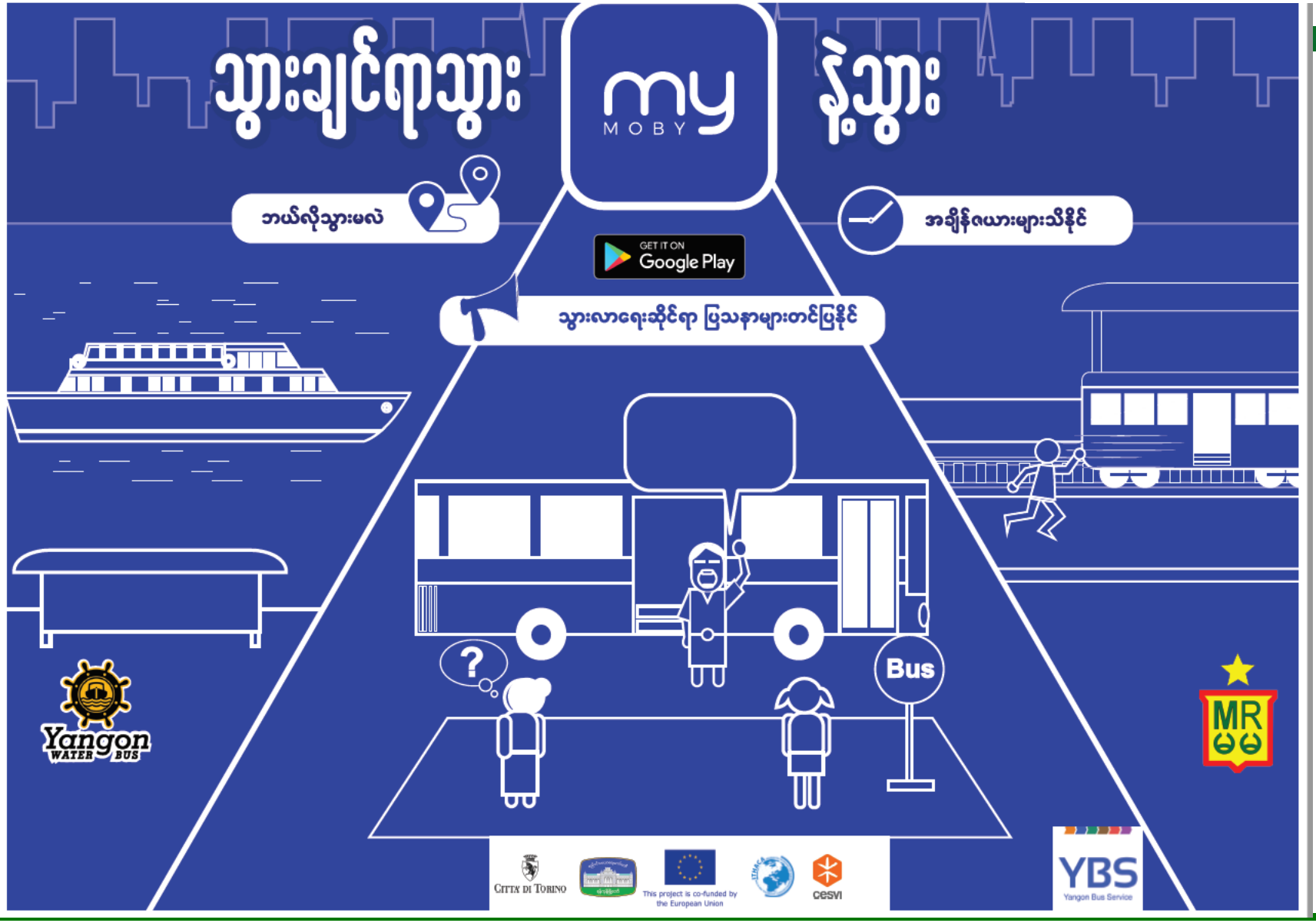


Travel behaviour during the week of a group of users travelling between Torino and Milano

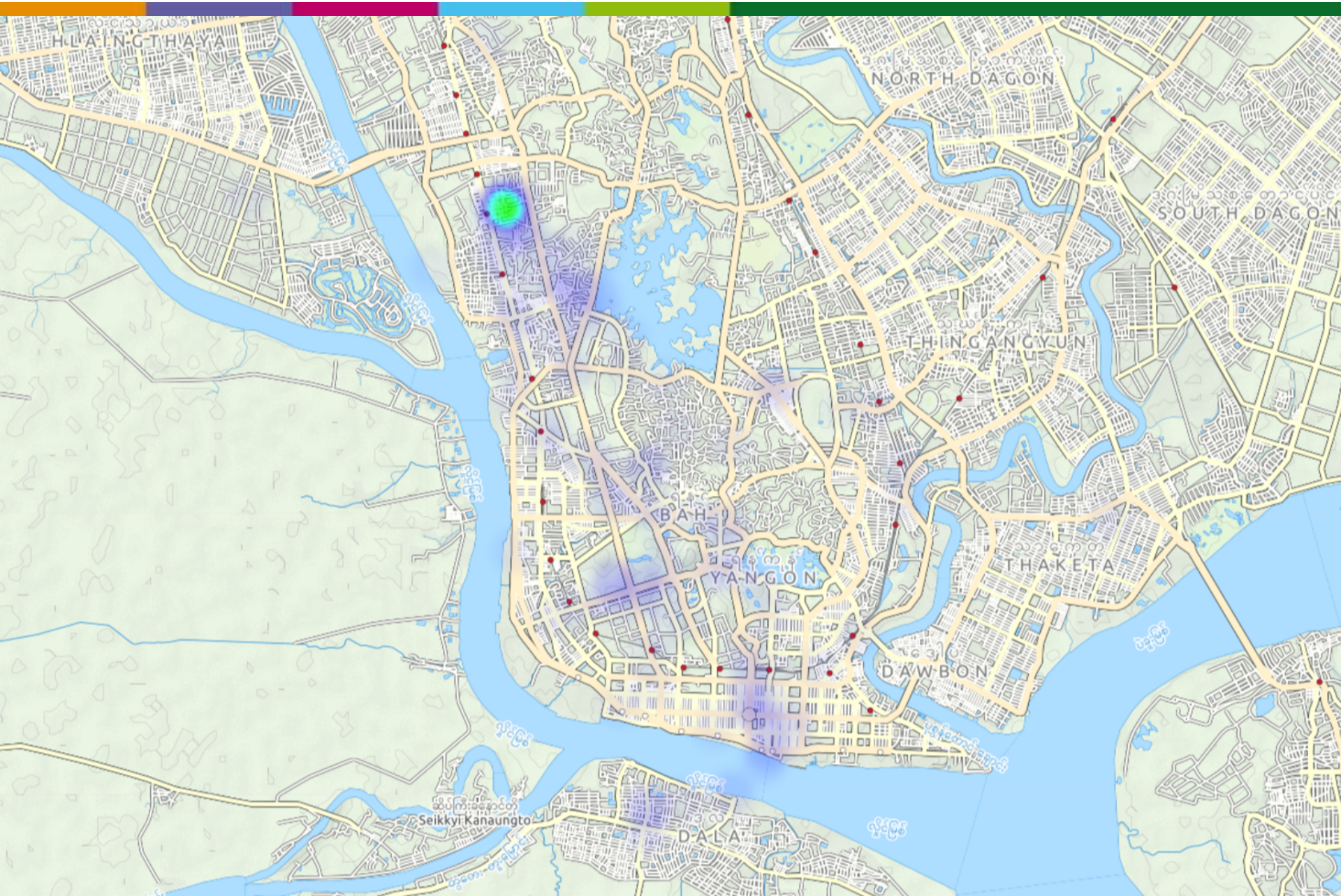


Urban mobility of a group of users on Sunday and potential residential locations

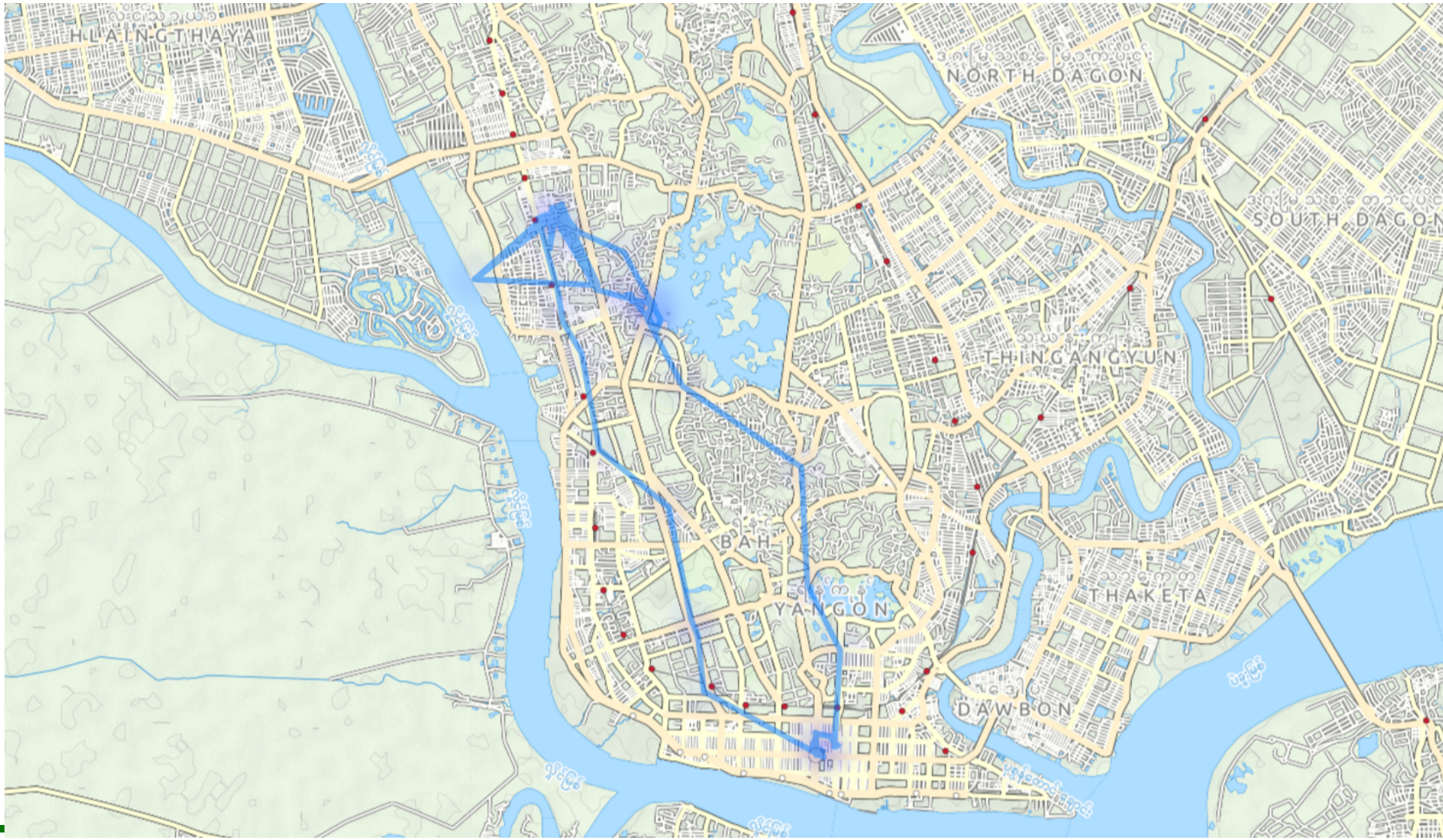
YANGON – Myanmar: MyMOBY



YANGON - Myanmar: MyMOBY



YANGON - Myanmar: MyMOBY



UNDERSTAND MORE: analysis of travel behaviour

- analyse and evaluate behavioural data, related to personal traits, attitudes, habits, travel behaviour, daily activities, etc., to develop further state-of-the-art theories (e.g. TPB, TIB, NAT, TTM, etc.), finding new variables influencing travel behaviour to improve current behavioural models

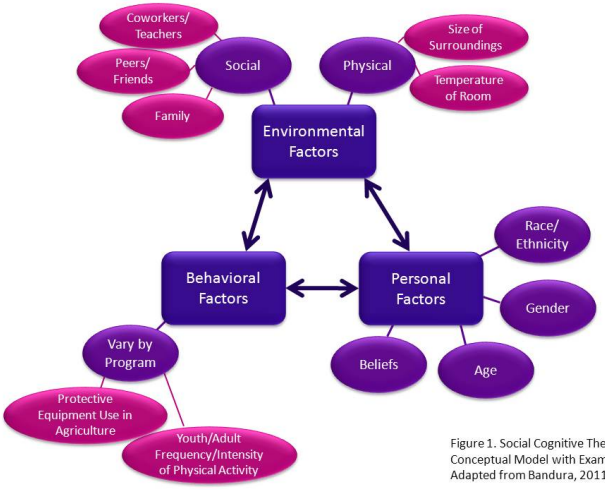
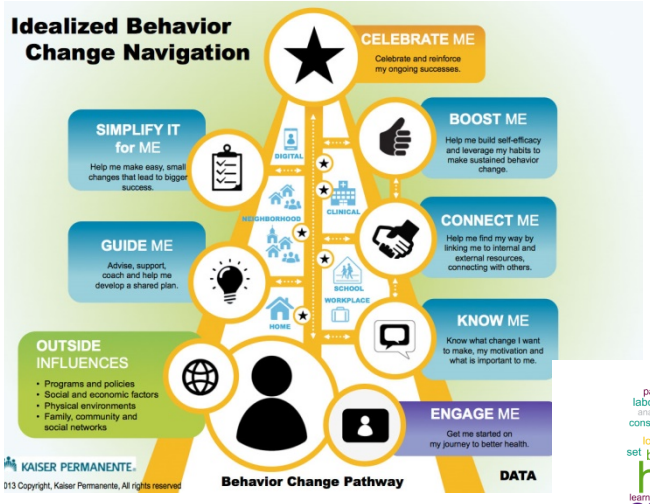
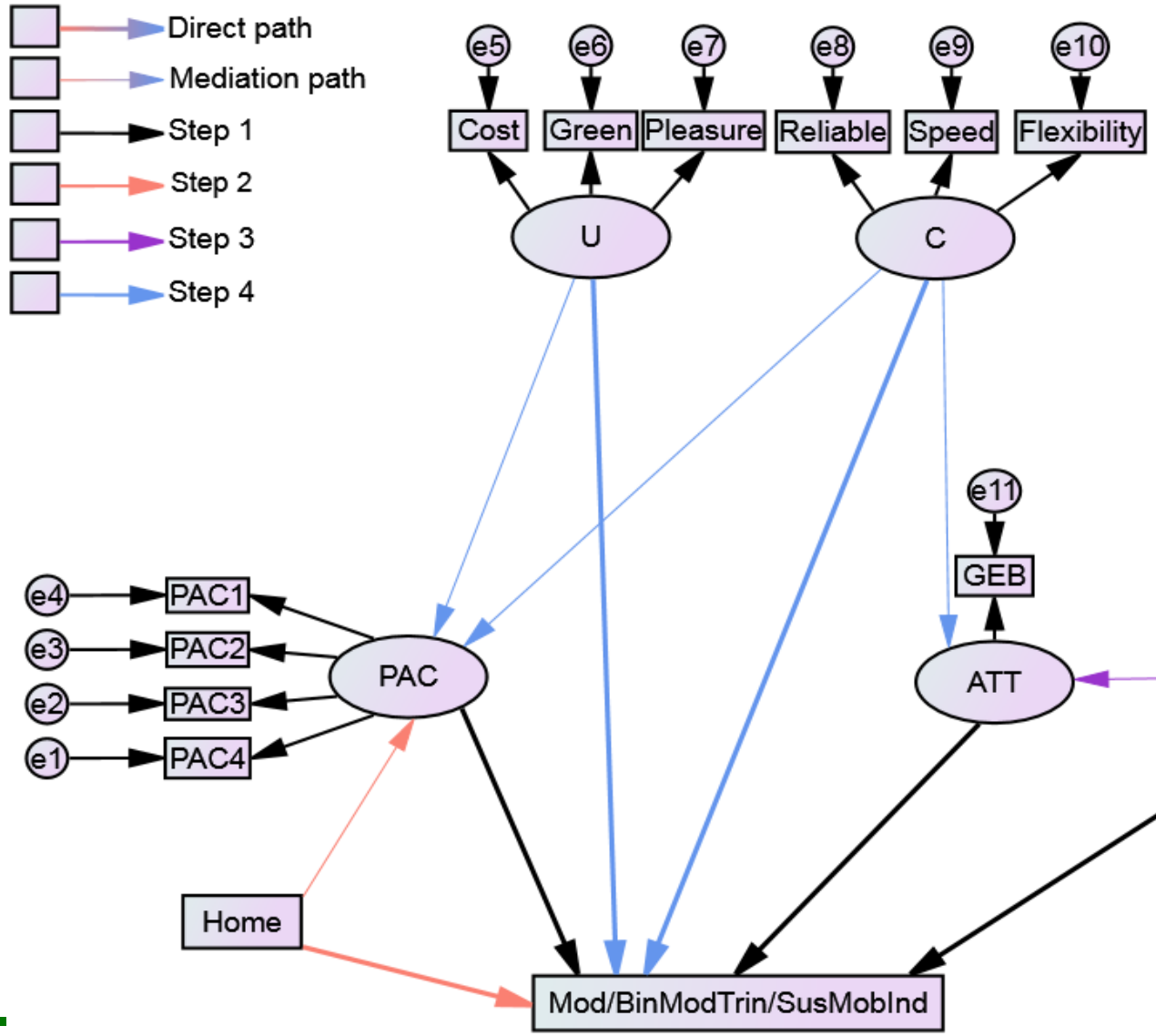


Figure 1. Social Cognitive Theory Conceptual Model with Examples. Adapted from Bandura, 2011.



UNDERSTAND MORE: model travel behaviour



Transport related values and their mediation by PAC and ATT:
U: Utilitarian
C: Convenience

Home: home localisation

Explaining factors of behaviour:
PAC: perceived accessibility
ATT: general attitude toward the environment
AFF: affect toward car-use

UNDERSTAND AND SPEAK MORE

- **Develop** a framework for collecting, analysing and extracting urban mobility information from several sources

through a mixed method, joining a qualitative and a quantitative approach

Speak and interact more

to support:

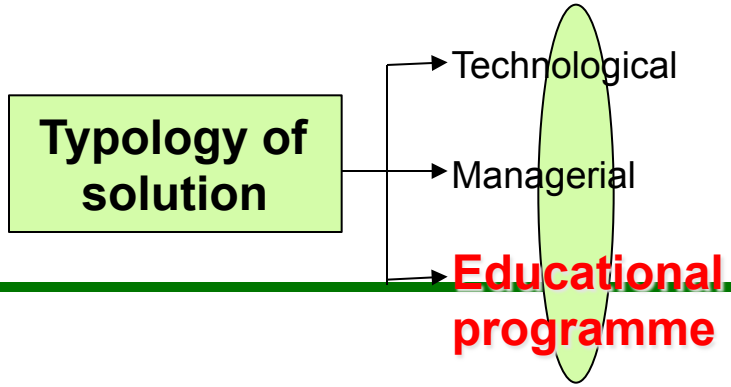
- planning and programming of public transport
- control of the quality of service
- managing mobility
- supplying new services for the customers

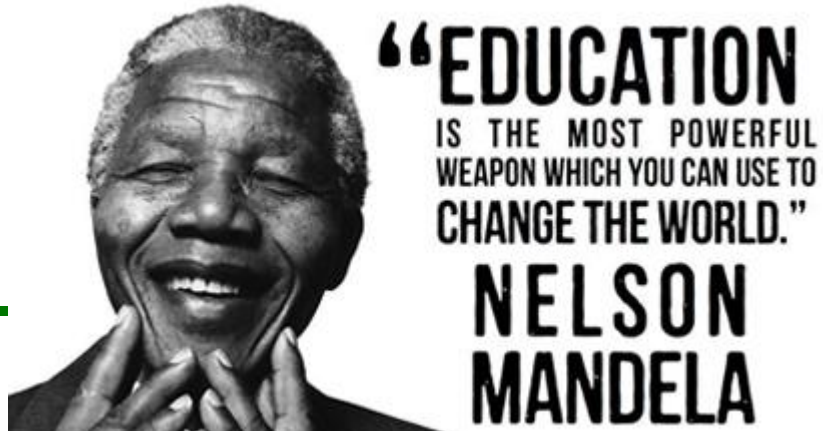
Understand more

EDUCATE MORE AND BETTER

- Tackle transport problems as a trans-disciplinary process and as an evolutionary one, which considers all the scientific, social, cultural, political and economical aspects
- How to make people involved and deliver successful solutions ?
  - Tailored communication

  - Tailored education child; young; adult; elderly people





THANKS FOR YOUR ATTENTION

CONTACT:
Cristina Pronello
Sorbonne Universités – UTC. Département Génie des systèmes urbains (GSU) & EA 7284 AVENUES
cristina.pronello@utc.fr