Issue 10 | December 2023

MASTER

Multiple ASpects TrajEctoRy management and analysis

Inside this issue

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant No 777695 Duration: March 1 2018 | December 31 2023

Content

Editorial

Highlights of events

Secondee feedback

Last but not least

Editorial

Welcome to the 10th issue of the MASTER newsletter!

The project lasted from March 2018 to December 2023 for a total of 6 years with the suspension of activities during 2 years of COVID, due to travel restrictions. We have executed almost 100 secondments months to and from international and non academic institutions. Of these 100 secondments, 83 are from Europe to International and non academic institutions. More than 40 staff members from consortium partners travelled. Of them, 12 are female, 18 Experienced researchers, 21 Early stage researchers and 1 technical profile, thus proving the good balance among the different profiles.

We have published 52 peer reviewed papers witnessing the high scientific productivity of the project interactions. These papers can be found in the website under “documents and publications” and Zenodo group under “master-h2020-msca-rise-project”.
We have organized a special issue on “Multiple-aspect analysis of semantic trajectories” in a very prestigious journal, IJGIS. References can be foun on the MASTER website.

Besides the 100 person months of secondments, the project activity focuses on many events: the DSM summer school held in Santorini in October 2022; the Dagstuhl seminar held online (during COVID) in January 2022, three MASTER workshops held in 2018, 2022, 2023 and one joint workshop MASTER and PRINT held in Florianopolis in November 2019.
In addition to the partners participation in events organised outside the project we reached a total of about 20.000 persons.

The project has been assisted by Prof. Bettina Berendt, our Independent Ethics Advisor, who has guided us in reflecting on the potential ethical implications arising from the management and analysis of multiple aspects of trajectories. However, Bettina’s contributions extend far beyond this role. She actively engaged in project activities, demonstrating a unique blend of expertise and empathy.

MASTER has been an incredible journey, spanning over 2000 days together as a consortium! Throughout this journey, we’ve experienced numerous highs, as well as a few challenges (such as the COVID period). In all this journey the partners, the IEA and all secondees maintained a remarkably strong connection, supporting each other and diligently working towards our project objectives and results.
I want to take a moment to express my true appreciation to each and every one of MASTER partners and secondees. Thank you for dedicating your time and energy to MASTER. The outstanding project results we’ve achieved are a testament to your hard work and dedication. Without a doubt, you are the best consortium ever!

I extend my gratitude to Michela Rial, who joined and supported us during challenging times and remained committed to navigating us through the complexities of RISE management.

A special mention goes to Beatrice Rapisarda for her invaluable support to MASTER infusing our communications and dissemination efforts with creative intelligence. From designing and creating our newsletter, to designing the graphics and web sites of all our events. Additionally, her participation as a secondee has enriched the consortium with her wealth of experience.

I am also in debt to all ISTI staff for their prompt support during the many challenges we had to face.

In this issue of the newsletter, we choose to highlight the project events and the feedback from the secondees.

Chiara Renso, MASTER Project Coordinator

You can download this and previous issues of the newsletter from the MASTER web site:
http://www.master-project-h2020.eu

Highlights of events

DAGSTUHL

Mobility data is one of the fastest growing types of data, thanks to the increasing number of mobile devices approaching the population of the globe. The collection, storage and analysis of spatio-temporal data representing trajectories of moving objects is one of the topics that received major attention in the field of data analytics. The more semantic information is collected from various sources, the richer is movement data. This enriched mobility data is typically referred to as semantic trajectories. The analysis of such trajectories can produce powerful results in domains such as transportation, security, tourism, health, environment and even policy design. The recent COVID-19 outbreak shed a light on the importance of collecting mobility data for public health. However, at the same time, the more mobility data is enriched with semantics, the larger the risks of violating the privacy of users and of possible unethical uses of these data analysis results. Aspects of Computational Ethics include privacy, but they go beyond this, towards a more general vision of ethical gathering, processing, uses of data and the results of data analyses. How ethics interrelates with mobility data analysis is an emerging issue. This Dagstuhl Seminar, organised by Chiara Renso, Bettina Berendt and Stan Matwin aimed at bringing together researchers from different disciplines from Computer Science, Mobility Analysis and Ethics to trace the path from a technical vision of mobility Analysis to an also ethics-based approach to the field.

Due to the COVID critical situation the seminar has been held online from January, 9 to January 12, 2022.

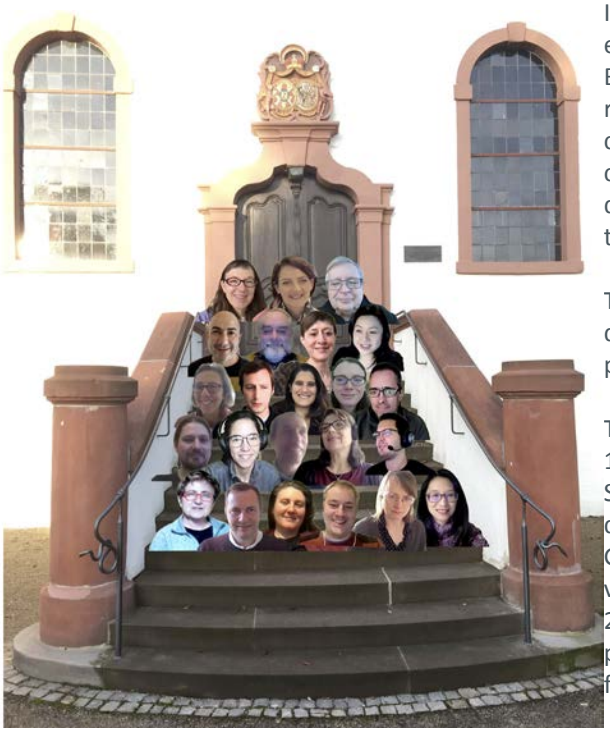
The three-day seminar was structured into three main modules: (1) round-table presentations in which each participant presented him/her self with a question about Mobility and Ethics that represented his/her interest and an object to visualise this interest or serve as a starting point for further discussion; (2) three tutorials on "technical", "ethical" and "legal" aspects of mobility data; (3) the working groups to discuss the main topics of interest that emerged during phases (1) and (2).

The presented tutorials were:

– **Location privacy: an overview** by Sébastien Gambs (Université du Québec à Montréal (UQAM), Canada);

– **Mobility data analysis: ethical issues** by Geoffrey Rockwell (University of Alberta, Canada);

– **Connected vehicles and mobility data,** work done by the EDPB by Peter Kraus (European Data Protection Board, Brussels, Belgium).



Dagstuhl Seminar

DSM SUMMER SCHOOL

The MASTER summer school held in October 2022 was named Data Science of Mobility (DSM) to stress the need to explore and adapt data science techniques for mobility data.

All the information is available at the school web site http://master-school.isti.cnr.it/

The school received a total of 49 attendees among which 22 PhD students and 5 from industries therefore building a networking activity with the non-academic sector. One PhD student received a travel grant of 500 euro and a free registration with the intention to support extra EU students. The participants came from 10 different countries: USA, Italy, Greece, Germany, The Netherlands, Denmark, Belgium, France, Brazil, UK. This heterogeneity has represented a great value and a concrete possibility to establish new connections above all for PhD students who are at the beginning of their research career.

The program was structured into 5 days with keynotes mini courses and panel.

The **two keynotes**:

1) Entanglement of Distance and Semantic Constraints for PoI (Sequence) Recommendation by Prof. Goce Trajcevski from Iowa State University (USA);

2) Planning the path: an aviation perspective by Prof. George Vouros from University of Piraeus (Greece).

Then there were three practical **hands-on mini courses** held by MASTER partners from UPRC and CNR.

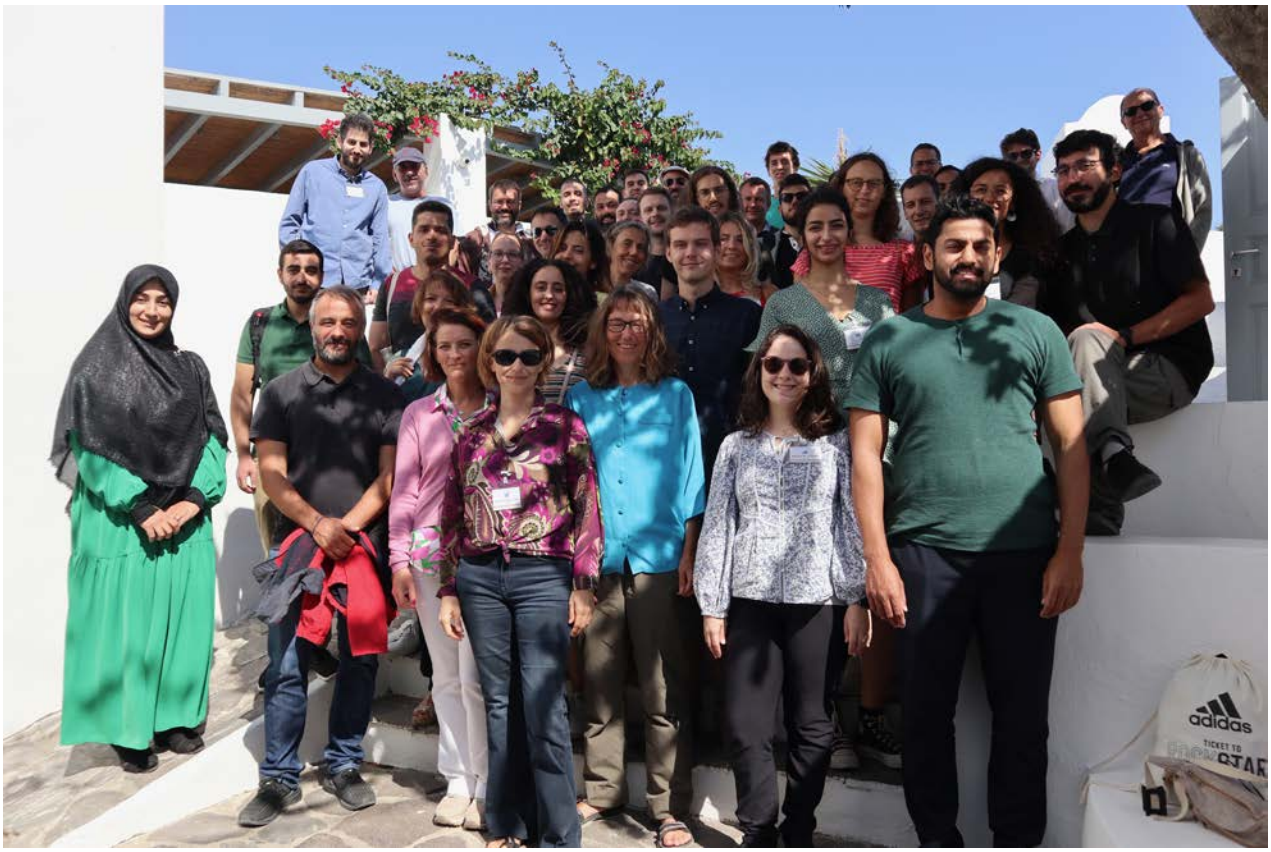
The first mini course, **Learning from our movements – Big Mobility Data Analytics**, was held by Prof. Panagiotis Tampakis from University of Southern Denmark (Denmark) and Yannis Theodoridis from University of Piraeus (Greece). The aim was to address the following questions. From raw location recordings to mobility patterns – how can we exploit the ubiquitous GPS technology in order to get knowledge about our movement behavior? Which are the most representative examples of patterns that can be mined from humans' mobility datasets?

In the course, issues and solutions on Big Mobility Data Analytics (BMDA) have been overviewed, including acquisition, storage, processing, and mining aspects. Use cases from urban, maritime, and/or aviation domains have been presented.

The second mini-course, **Human Mobility Analysis and Simulation**, was held by Dr. Luca Pappalardo from ISTI CNR (Italy) and it focused on a Python library to analyze mobility data. Despite the increasing importance of human mobility analysis for many scientific and industrial domains, a view on state of the art cannot avoid noticing that there is no statistical software that can support scientists and practitioners with all the aspects of mobility data analysis. Hence, the mini-course presented an overview of both analytical principles and modeling principles of human mobility through scikit-mobility, a Python library to analyze mobility data and simulate human mobility habits. scikit-mobility is efficient and easy to use as it extends pandas, a popular Python library for data analysis. The mini-course showed how to use the library for many practical tasks, from visualizing trajectories to generating synthetic data, from analyzing the statistical patterns of trajectories to assessing the privacy risk related to the analysis of mobility data sets.

The third mini-course, **Deep Learning for Mobility**, was taught by Dr. Franco Maria Nardini and Dr. Salvatore Trani from ISTI CNR (Italy). The course was a practical introduction to machine learning with focus on Deep Learning (DL). The first part introduced the methodological aspects of DL, and discussed the features, advantages, and disadvantages of different DL solutions. The second part included a hands-on session discussing best practices for a successful DL workflow development on a real-world example of mobility analysis. Attendees could learn how to exploit some of the most popular and powerful libraries, such as scikit-learn and Keras.

A stimulating **panel** took place the last day. The topic was on **Emerging issues on mobility data science** organized by our Independent Ethical Advisor Prof. Berendt from Technische Universität Berlin & Weizenbaum Institute (Germany) and KU Leuven (Belgium) and moderated by Prof. Tserpes from HUA (Greece). The panelists were: Dr. Thierry Chevalier from AKKODIS (France), coordinator of the H2020 project MOBIDATALAB (http://www.mobidatalab.eu) who brought the industrial and practical point of view in the issue of semantically enriched mobility data; Prof. Mahmoud Sakr from Free University of Brussels (Belgium), one of the creators of MOBILITYDB, an open source geospatial trajectory data management & analysis platform, who presented his “database oriented” vision of the future of mobility data; Dr. Franco Maria Nardini from ISTI-CNR (Italy) and Dr. Luca Pappalardo from ISTI-CNR (Italy).



DSM summer school

The audience participated actively and there was a very interesting discussion.

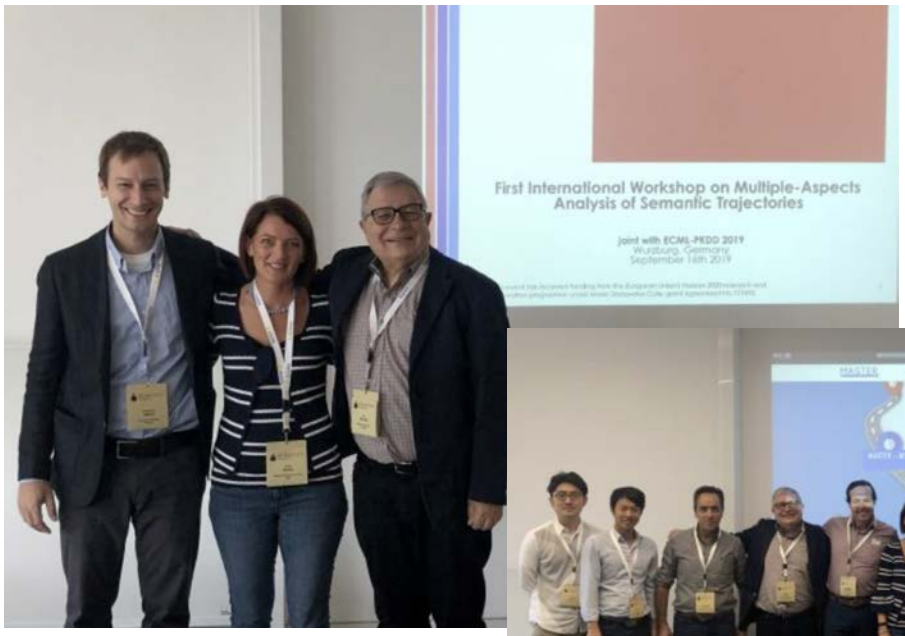
As a side note we highlight that one of the MASTER Summer school participated in the **MOBIDATALAB Datathon** activity and won the first prize (https://mobidatalab.eu/global-fusion-team-triumphs-innovative-approach-to-disability-data-at-mobidatalab-datathon-2023/) . This is a proof of the successful cross fertilization between projects and the impact of the training of easly stage researchers attendees of the school.

Pictures taken during the event are available at the web page:
http://www.master-project-h2020.eu/dsm-summer-school-in-santorini/

WORKSHOPS

FIRST MASTER WORKSHOP IN WURZBURG

On September 16, 2019 we had our First MASTER workshop. The event has been held in conjunction with **ECML-PKDD** conference in Wurzburg, Germany. The main conference received an unexpected high number of participants this year, thus favouring a very good attendance to our Workshop. The program of the workshop with link to submitted version of papers is available here: http://www.master-project-h2020.eu/workshop-master-2019/



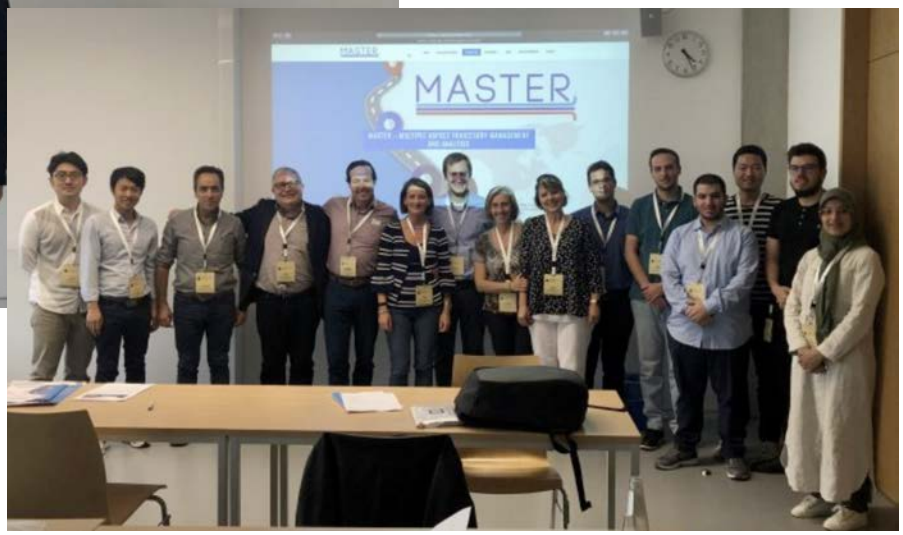
We are very honoured to host the keynote talk by Prof. Yannis Theodoridis.
We had very good attendance and discussion with MASTER partners and external authors and attendees. More pictures here: http://www.master-project-h2020.eu/first-master-workshop-in-wurzburg/

MASTER-PRINT WORKSHOP

The First MASTER – PRINT workshop has been held at the **Federal University of Santa Catarina** (UFSC), in Florianopolis (Brasil), in November 2019. The PRINT project is an internationalisation project ongoing at UFSC that has several intersections with MASTER topics and partnerships.
We took the opportunity that 5 secondments were ongoing at UFSC (3 from CNR and 2 from HUA) to meet all together with local researchers and share experiences and results to drive our next collaborations. The workshop took two days, the 11 and 12 of November 2019. You can find the pictures, program and the slides here: http://www.master-project-h2020.eu/first-master-print-workshop-held-at-ufsc/

SECOND WORKSHOP IN VENICE: MASTER MEETS MOBILITY INDUSTRIES

On May 13th 2022 we held the Second MASTER workshop. The event has been organised by our partner Ca' Foscari University of Venice by Alessandra Raffaetà in the room Aula Magna Silvio Trentin at Ca' Dolfin, in the historical centre of Venice.



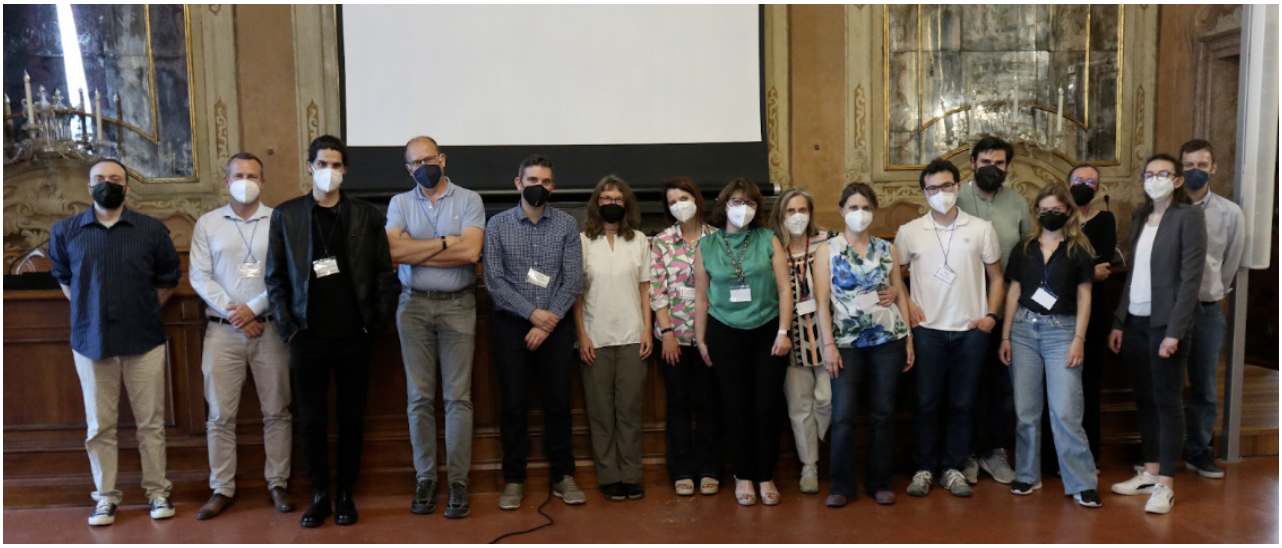
First MASTER workshop in Wurzburg

The title of the workshop was **"MASTER meets Mobility Industries"** where the objective was to find links with the industrial world of mobility. Companies ACTV Venice, BusForFun and Mindicity kindly agreed to give a presentation, introducing their companies, the data they manage, and the analysis problems they are facing.
In addition, we invited two European projects related to mobility data, MOBIDATALAB (Thierry Chevalier from AKKA, France) and VesselAI (Spiros Mouzakitis from NTUA, Greece).
MASTER Partners – Chiara Renso from CNR, Alessandra Raffaetà and Giulia Rovinelli from UNIVE, Konstantinos Tserpes from HUA, Nikos Pelekis from UPRC, Karine Zeitouni from UVSQ – presented their latest results and the research activities in the project.
The Independent Ethical Advisor, Prof. Bettina Berendt, closed the meeting presenting the experience of the Dagstuhl Seminar and the ethical challenges in this domain.
http://www.master-project-h2020.eu/second-master-workshop-in-venice/

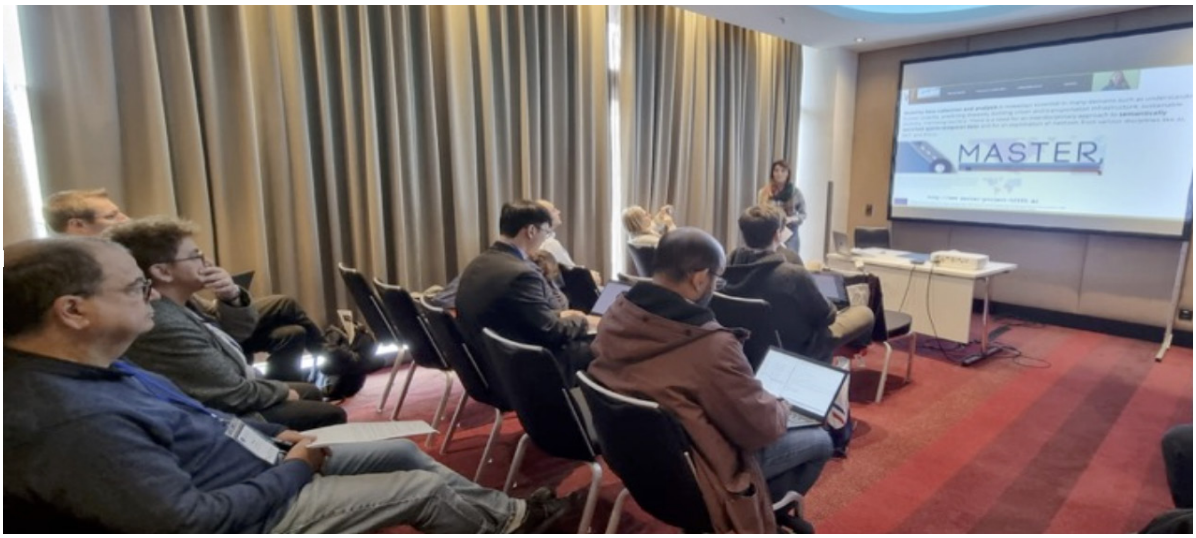
THIRD WORKSHOP EMODE

On November 13th, 2023 we held the Final Workshop of the project as the 1st ACM SIGSPATIAL International Workshop on **Methods for Enriched Mobility Data**: Emerging issues and Ethical perspectives 2023 (EMODE23) joint with **SIGSPATIAL conference 2023** in Hamburg, (Germany). The event has been successful with 6 papers accepted and presented on site and online triggering many useful discussions.
We have been very proud to host an invited talk on Spatial Fairness by Prof. Dimtris Sacharidis from Free University Brussels.
http://www.master-project-h2020.eu/emod-final-master-workshop/

MASTER-PRINT Workshop



Second workshop in Venice MASTER meets Mobility Industries



Third workshop EMODE

Secondees feedbacks
from interviews

Secondees have reported their secondment as a significant experience, both in terms of scientific opportunities for their research career perspectives, but also for the human point of view! Thanks to our hosting institutions, our secondees always found a friendly, supportive and stimulating environment allowing them to enlarge their experience being immersed in different environments, languages and lifestyles.

Below is the tag cloud of the “three words that summarized” the secondments according to secondees, who also expressed the aspects that they appreciated the most, together with their “take home” message:

“The opportunity to learn a different culture”.

The multi-disciplinary collaboration and the ‘holistic’ way of thinking.

“Being in a new working environment, which allows you to meet new people and learn new things, and opens your mind for new ideas”

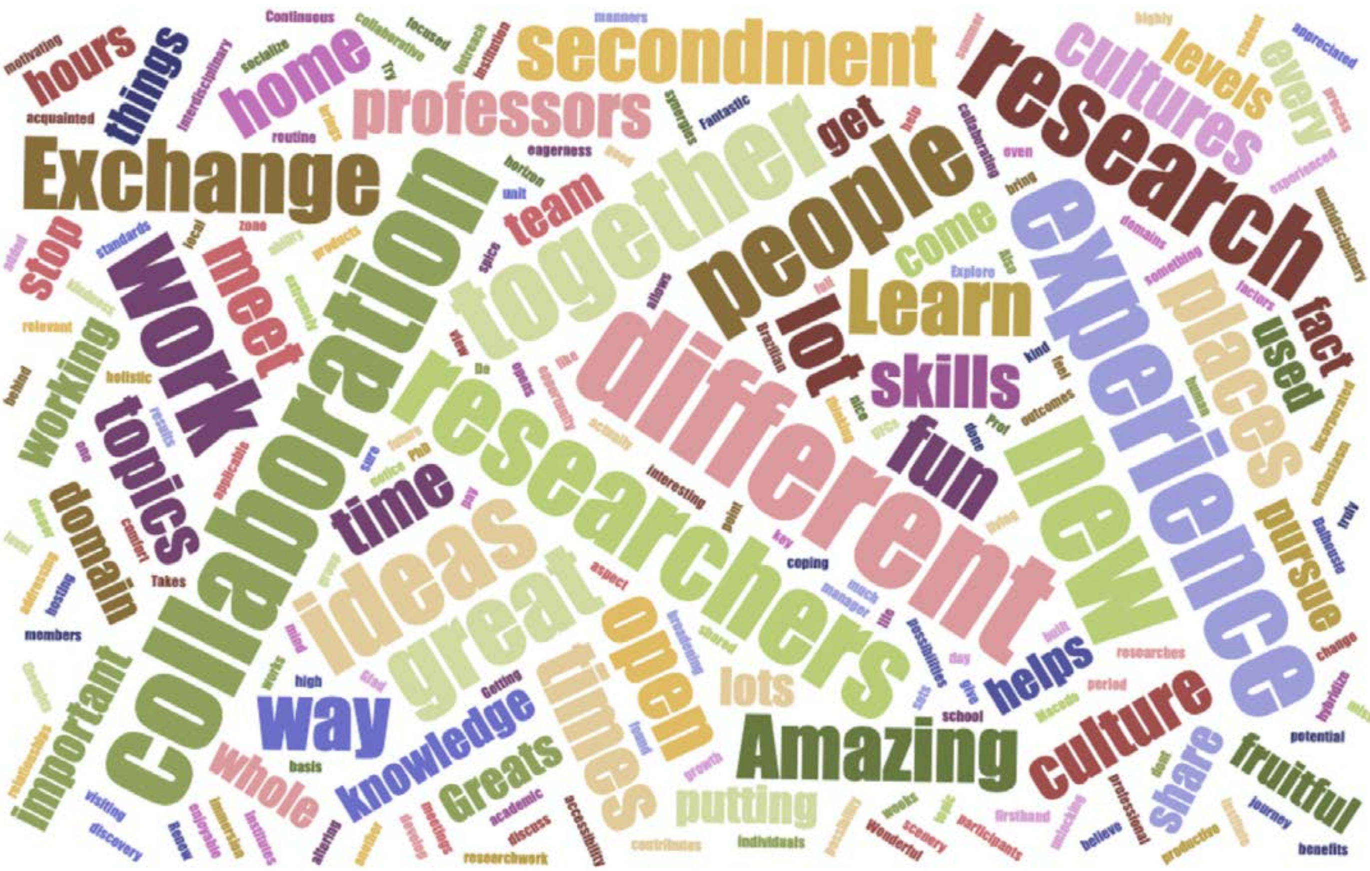
The ability to collaborate with scientists from other universities, learn from their experience
Experiences like this are the spice of life.

Secondments are always enjoyable and productive experiences.

I appreciate the discovery of other cultures, manners, and the different work methods they have.

Getting to understand another culture and one of its academic institutes

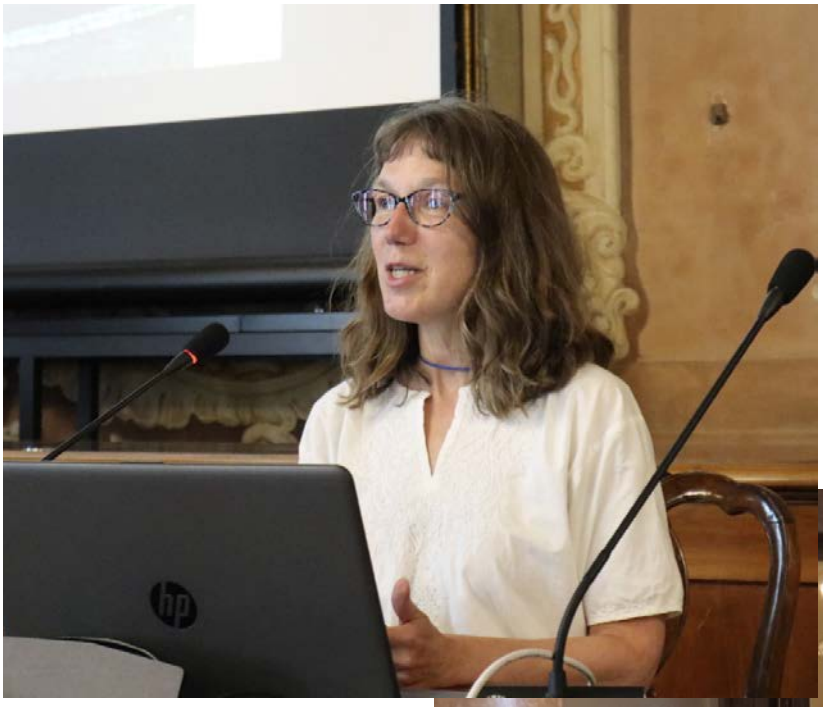
Among the critical issues many secondees have highlighted the very low co financing amount of the EC for secondments (i.e. 2000 euros) that is - for some destinations - only sufficient to cover the flight ticket thus putting a huge financial load on the sending institution that not always can cover these amounts.
Another critical issue has been reported as the expensive and long VISA procedures.

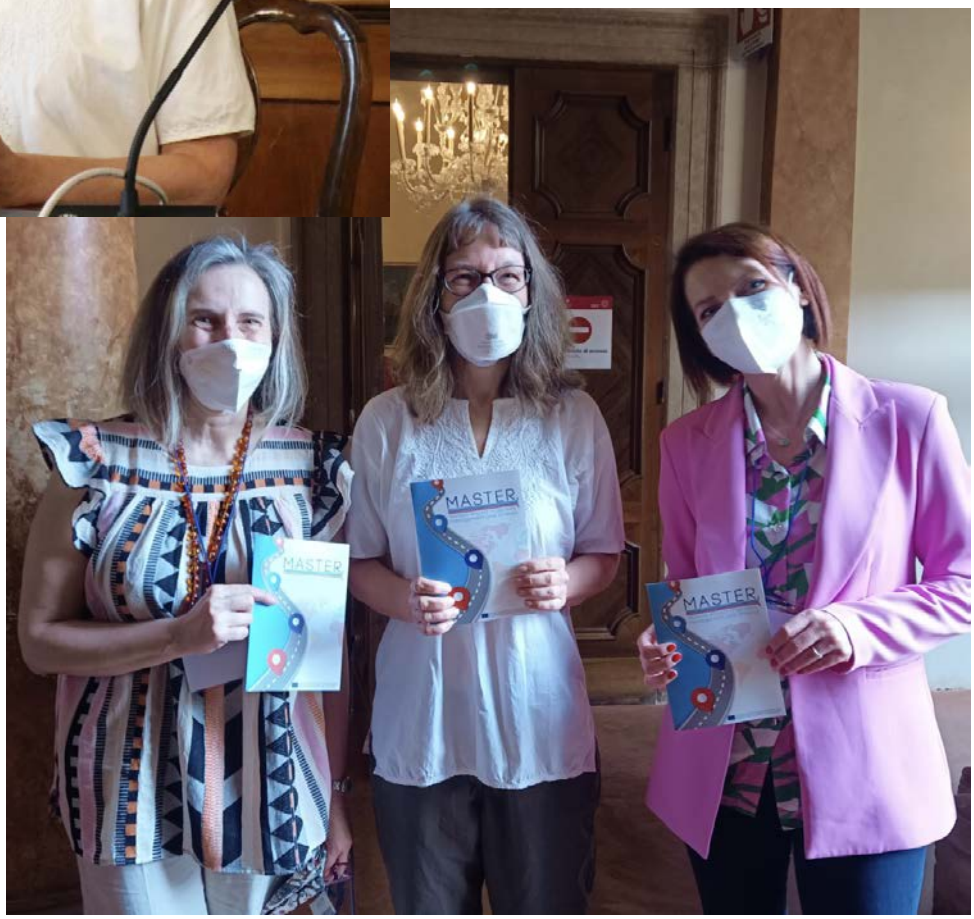


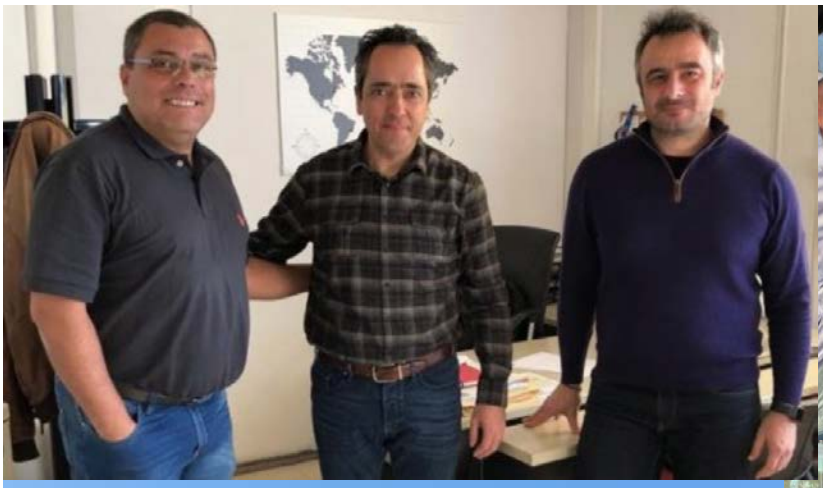
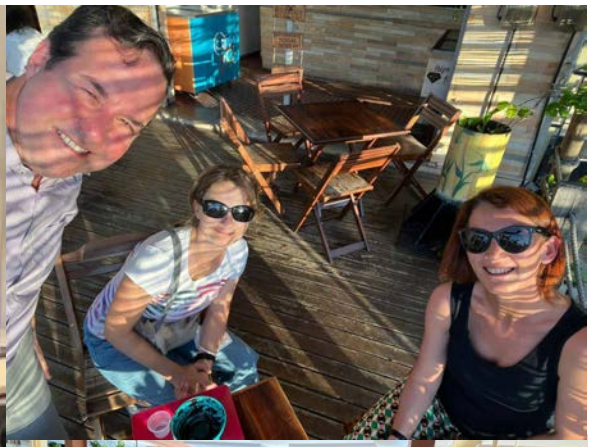
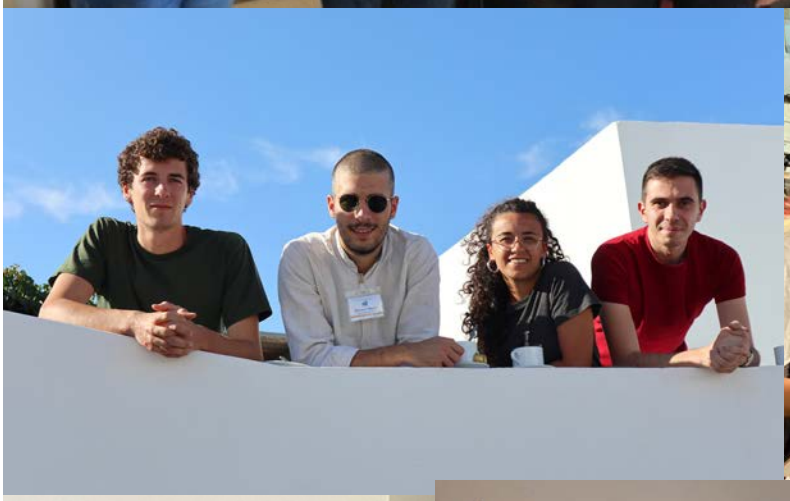
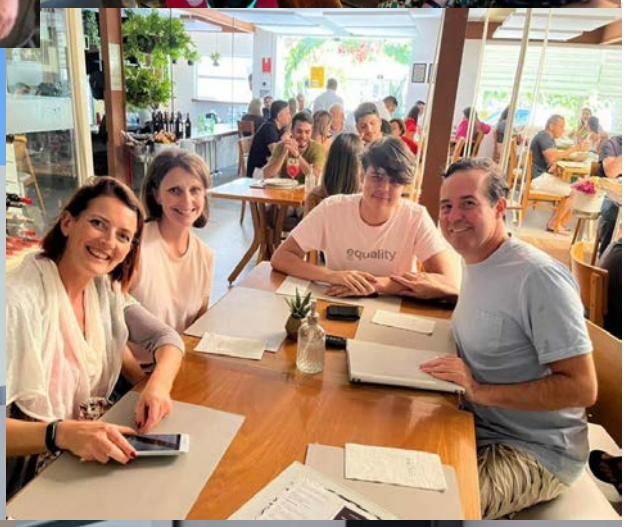
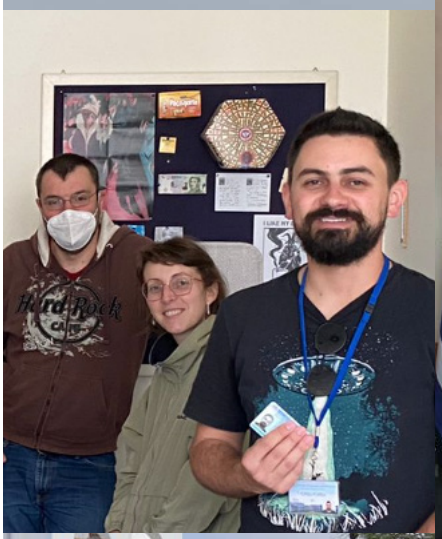
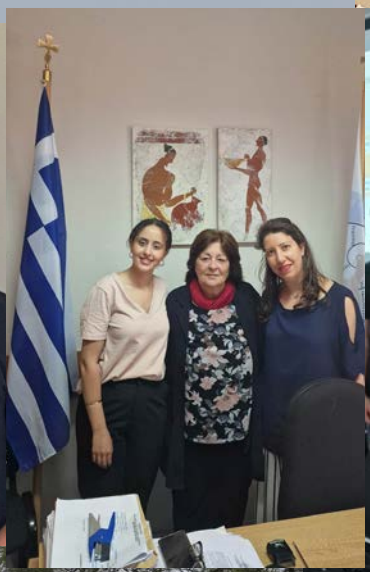
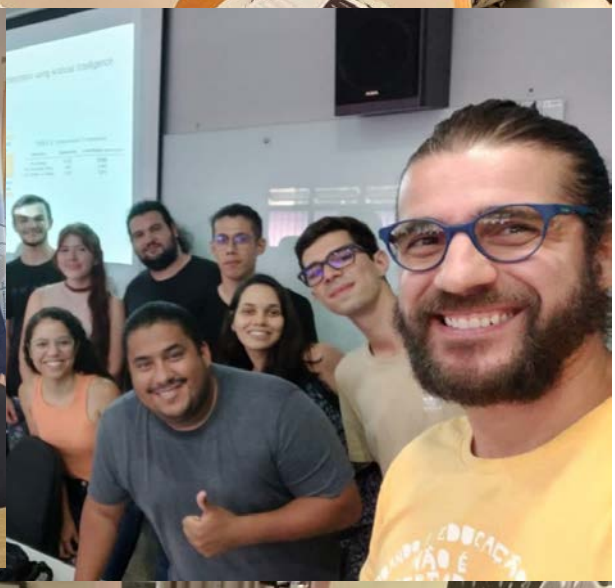
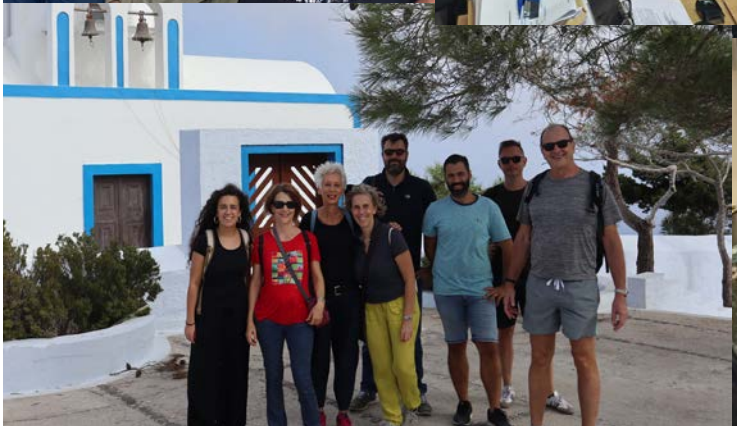
Last but for sure not least...

our IEA!

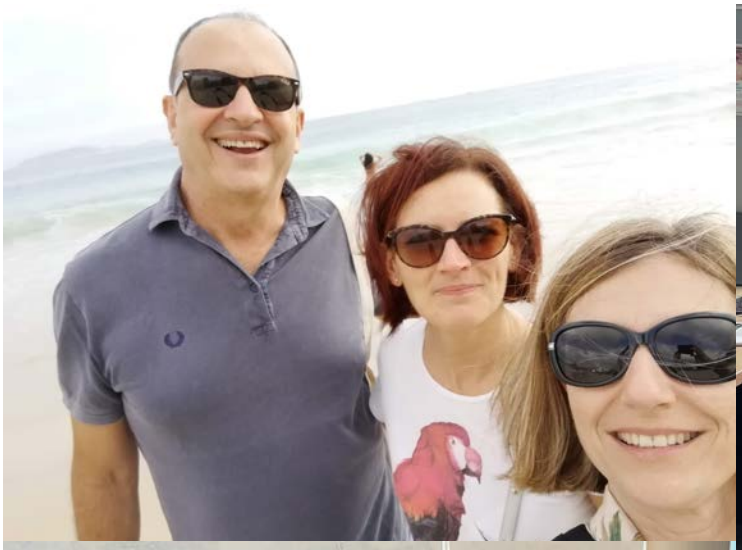
Throughout the entire project duration, MASTER has received support from **Prof. Bettina Berendt**, serving as the Independent Ethics Advisor. Prof. Berendt's contribution to the project has been invaluable, extending beyond raising awareness among secondees about the potential ethical implications of their research and overseeing the project activities. She actively engaged in project initiatives, co-organizing and participating in various events such as Dagstuhl, the DSM Summer school, workshops, and meetings. We are grateful for her guidance on the complex interplay between Ethics and mobility data, and we appreciate her proactive and consistently positive attitude.

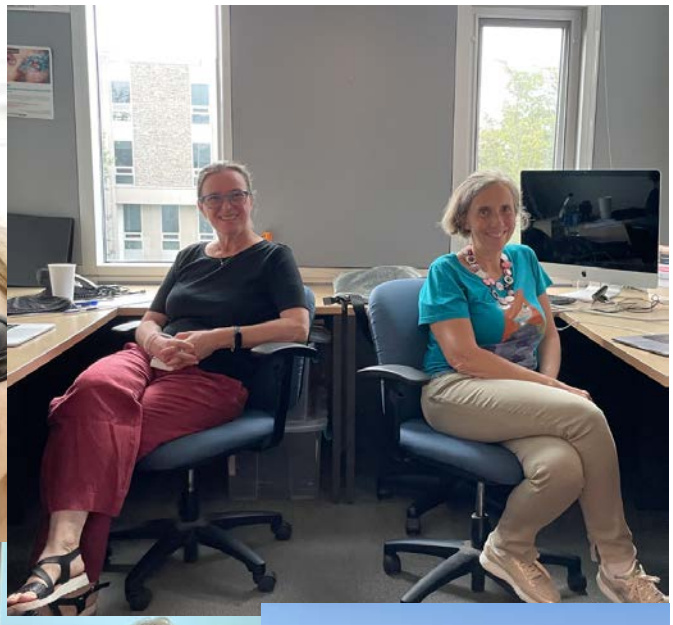


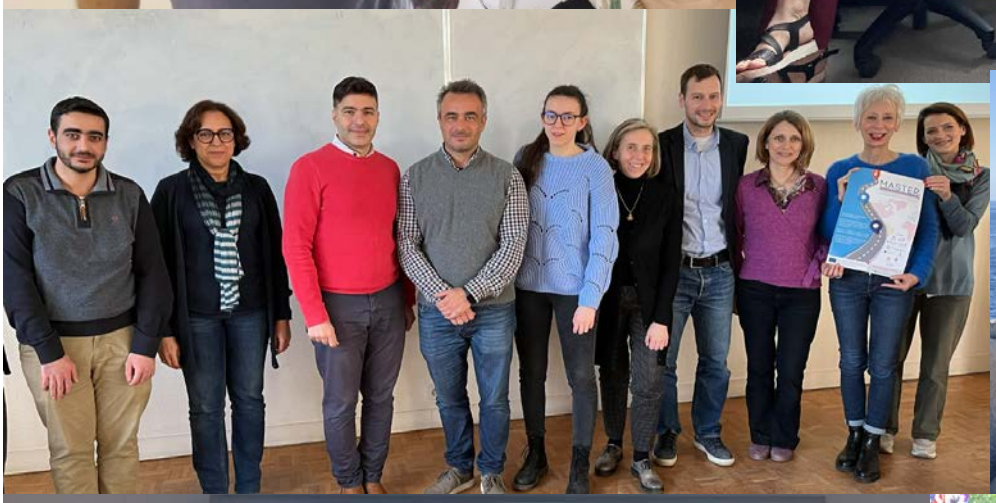


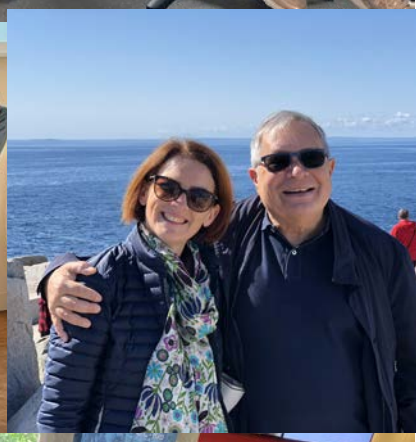




Quality





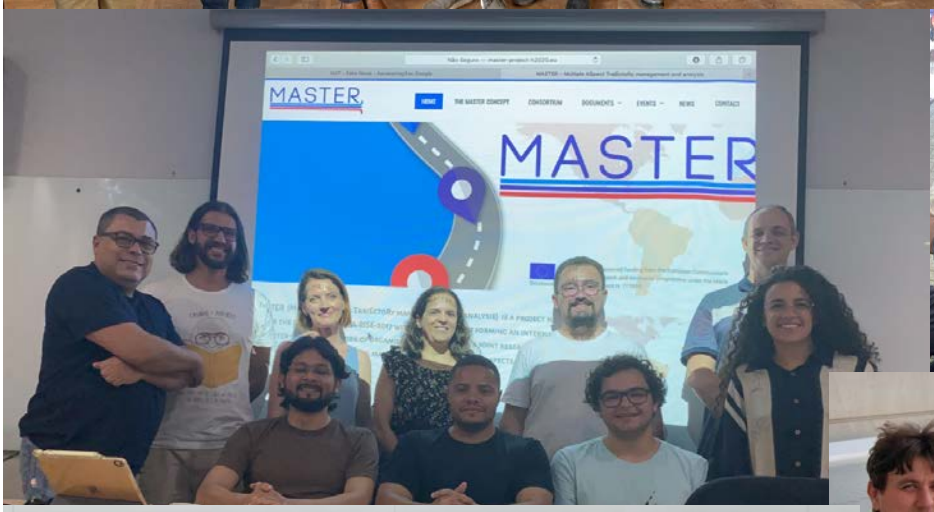
COFFEE

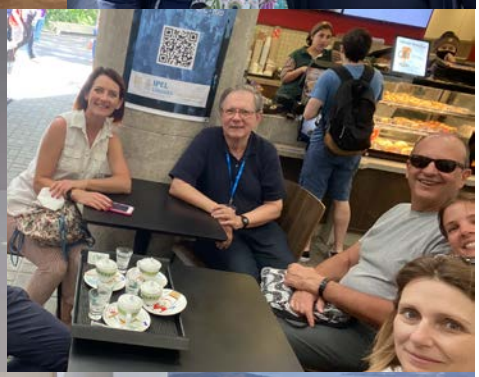


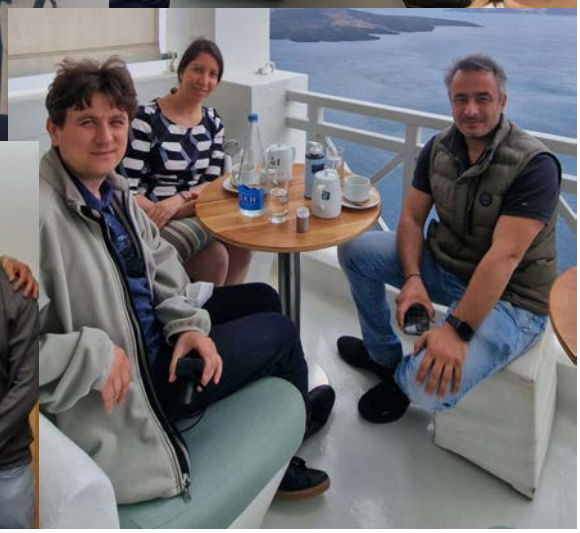







MASTER
MASTER





This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant No 777695
Duration: March 1 2018 | December 31 2023

Copyright notice

Privacy statement
The personal data (names, email addresses…) and the other information entered in MASTER Newsletter will be treated according with the provision set out in Legislative Degree 196/2003 (known as Privacy Code) and subsequently integration and amendment.

Coordinator of the project: Chiara Renso | chiara.renso@isti.cnr.it

MASTER Newsletter is not for sale but it is distributed for purposes of study and research and published online at http://www.master-project-h2020.eu