CLIMATE CHANGE, SUSTAINABILITY AND CITIES

(MOBILE BIG) DATA PERSPECTIVE

TUULI TOIVONEN

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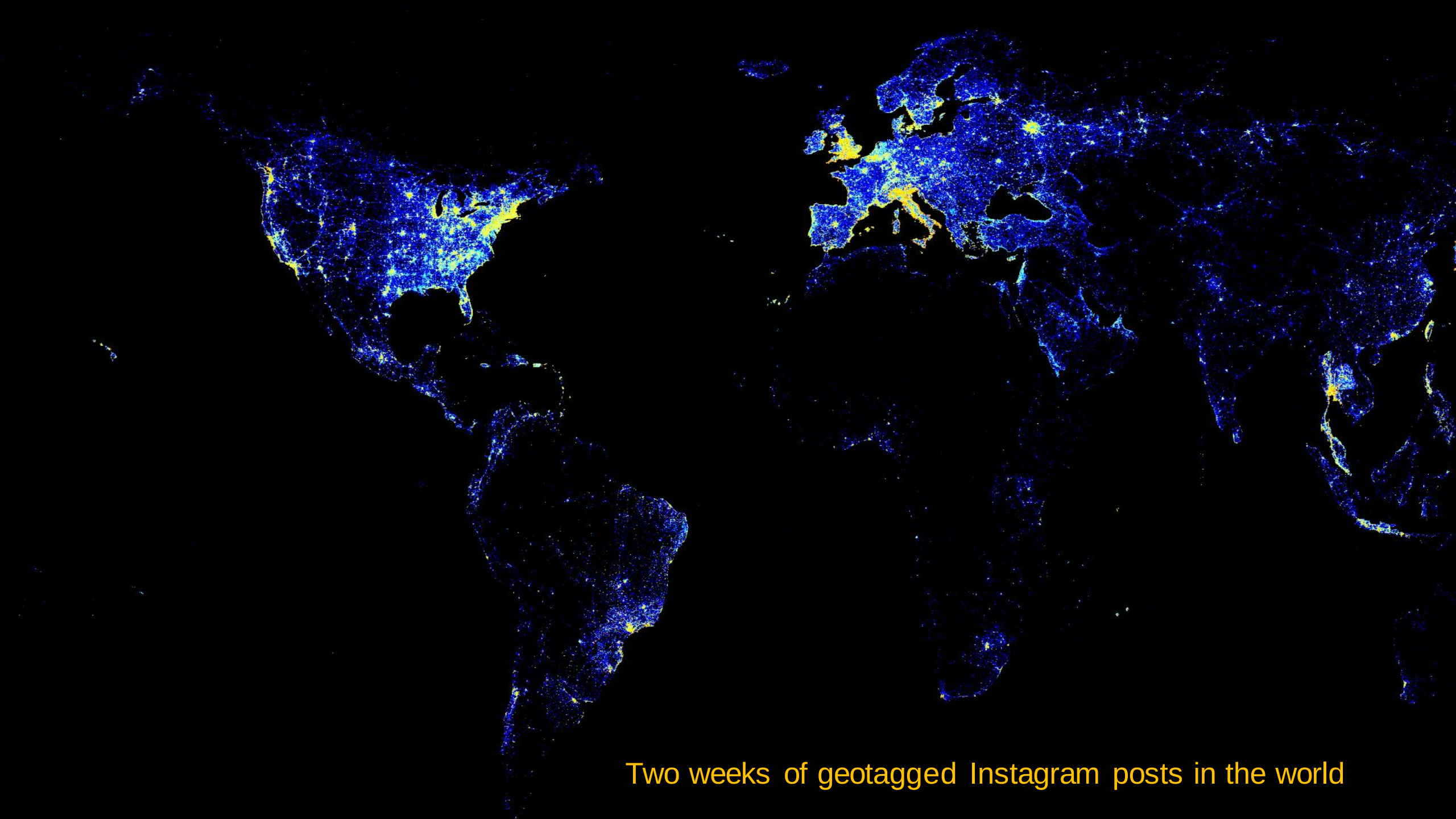
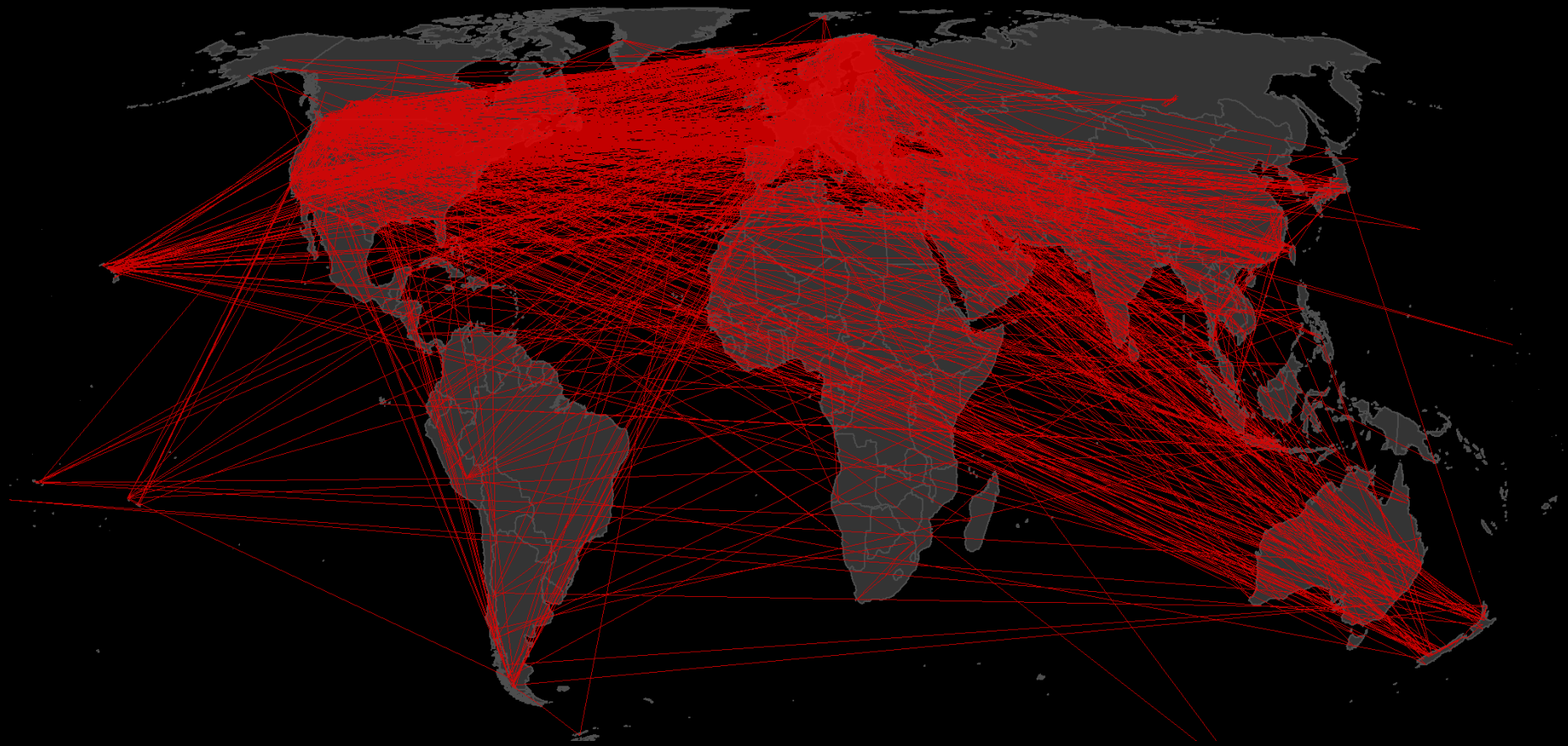
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

DIGITAL GEOGRAPHY LAB

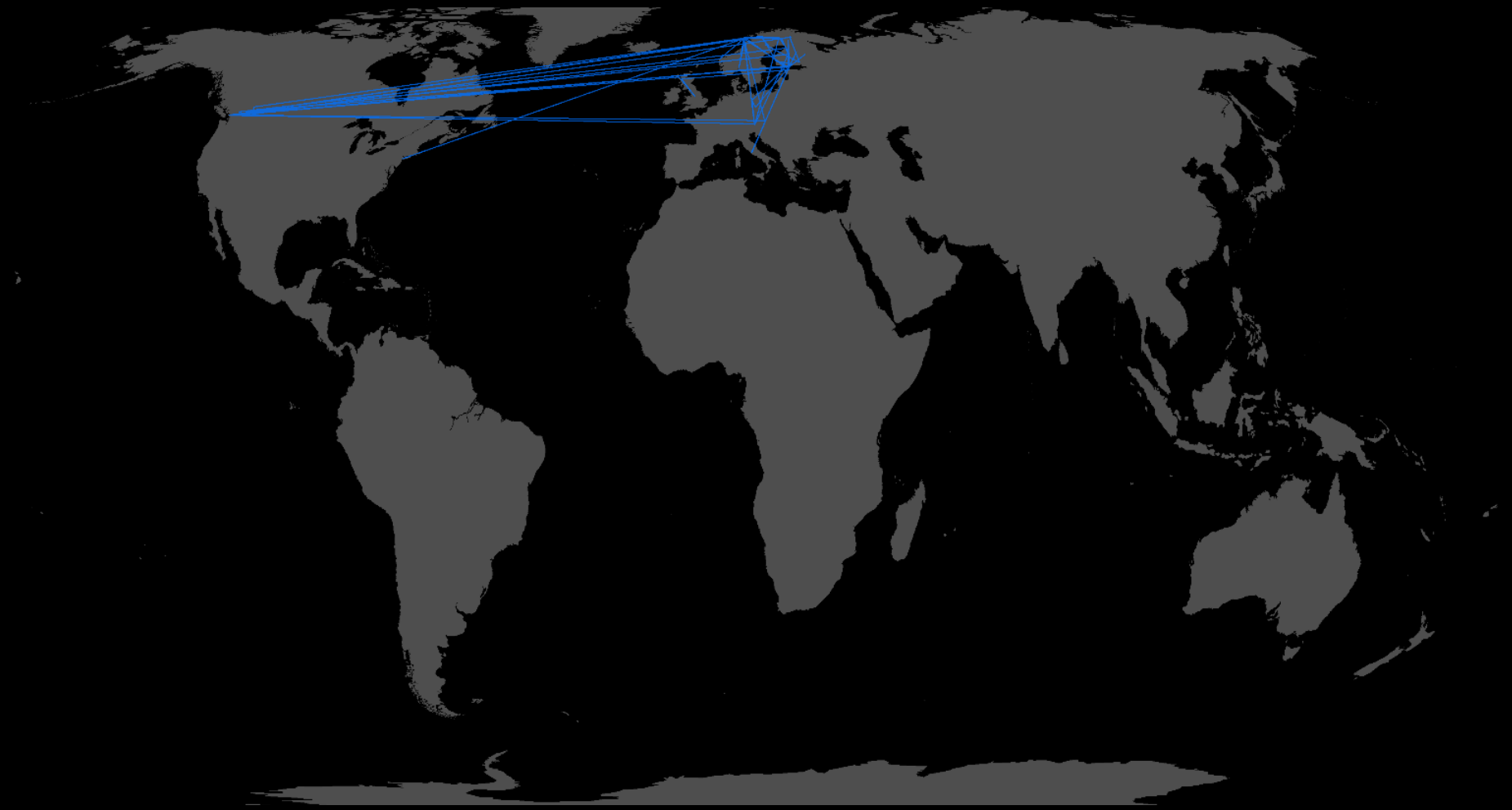

Two weeks of geotagged Instagram posts in the world

GLOBAL MOBILITY PATTERNS



Toivonen, T., Heikinheimo, V., Fink, C., Hausmann, A., Hiippala, T., Järv, O., Tenkanen, H., & Di Minin, E. (2019). Social media data for conservation science: A methodological overview. *Biological Conservation*, *233*, 298-315. https://doi.org/10.1016/j.biocon.2019.01.023

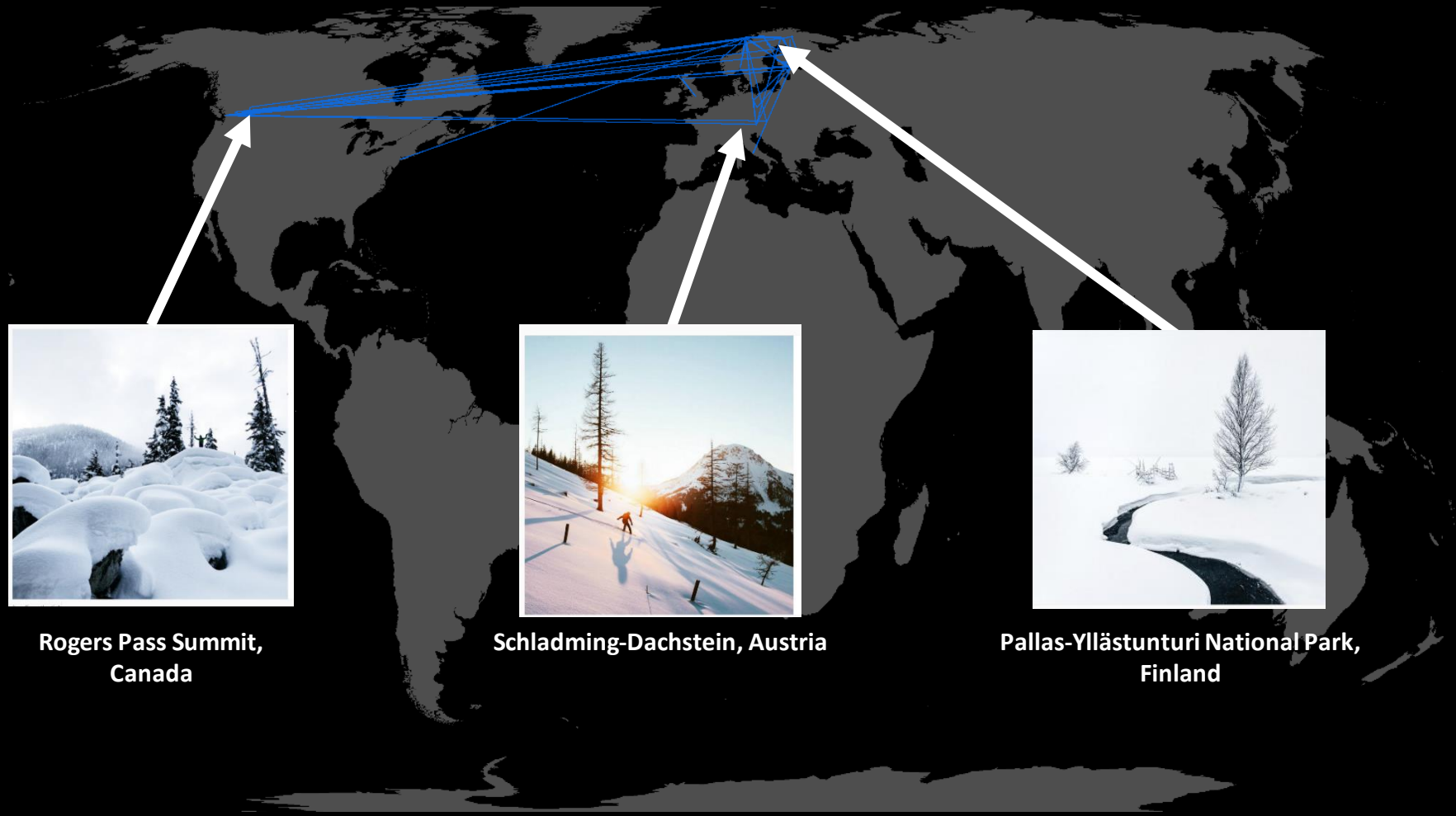
INDIVIDUAL ACTIVITY SPACES



Toivonen, T., Heikinheimo, V., Fink, C., Hausmann, A., Hiippala, T., Järv, O., Tenkanen, H., & Di Minin, E. (2019). Social media data for conservation science: A methodological overview. *Biological Conservation*, *233*, 298-315. https://doi.org/10.1016/j.biocon.2019.01.023

Posts from a Finnish Instagram-user. 107 posts in total.

PREFERENCES / OPINIONS / SENTIMENTS



Rogers Pass Summit, Canada

Schladming-Dachstein, Austria

Pallas-Yllästunturi National Park, Finland

Toivonen, T., Heikinheimo, V., Fink, C., Hausmann, A., Hiippala, T., Järv, O., Tenkanen, H., & Di Minin, E. (2019). Social media data for conservation science: A methodological overview. *Biological Conservation*, *233*, 298-315. https://doi.org/10.1016/j.biocon.2019.01.023

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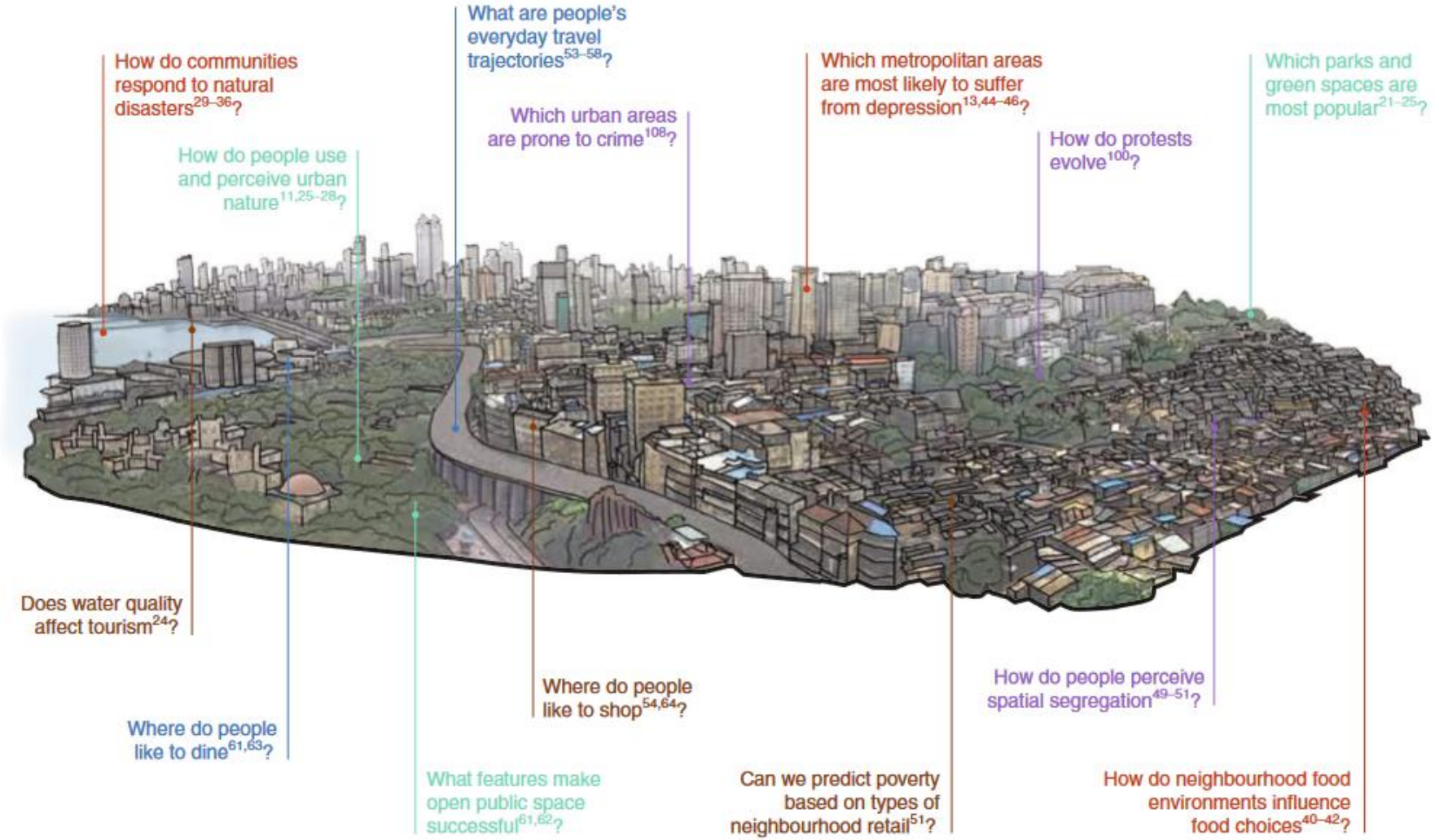


Fig. 1 | The wide range of emerging opportunities for urban-sustainability research provided by big data from social media. Evidence points to the promise of social-media data (SMD) for addressing key questions in five established domains of sustainability research: environmental sustainability (questions in green), public health (questions in orange), social equity (questions in violet), mobility (questions in blue), and economic development (questions in red). Large-scale, publicly available SMD on how people navigate, perceive, and respond to man-made and natural landscapes allows the investigation of human–environmental relationships in greater depth. SMD provide researchers and decision-makers with fresh insights into what makes open public spaces successful (refs [61,62]), what travel trajectories people pursue every day (refs [53–58]), how communities respond to natural disasters (refs [29–36]), which metropolitan areas are more prone to depression (refs [13,44–46]), and how neighbourhood environments influence food choices (refs [40–42]), among other consequential topics for sustainability planning discussed in the text. Image credit: Taylor Drake.

Ilieva & McPhearson (2018)

Social-media data for urban sustainability. ***Nature Sustainability*****,** **https://doi.org/10.1038/s41893-018-0153**

TAL GEOGRAPHY LAB

68% OF THE WORLD POPULATION PROJECTED TO LIVE IN URBAN AREAS BY 2050

UN 2018: https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

CITIES ARE IN KEY POSITION WHEN FIGHTING THE CLIMATE CHANGE

- “Climate change is a global phenomenon that largely impacts urban life. Rising global temperatures causes sea levels to rise, increases the number of extreme weather events such as floods, droughts and storms, and increases the spread of tropical diseases. All these have costly impacts on cities' basic services, infrastructure, housing, human livelihoods and health.
- At the same time, cities are a key contributor to climate change, as urban activities are major sources of greenhouse gas emissions. Estimates suggest that cities are responsible for 75 percent of global CO2 emissions, with transport and buildings being among the largest contributors.”

UNEP https://www.unep.org/explore-topics/resource-efficiency/what-we-do/cities/cities-and-climate-change

TOWARDS 24-HOUR SOCIETY

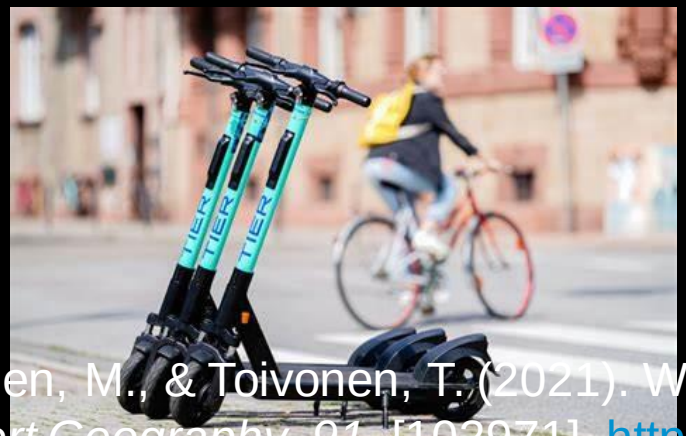
Järv, O., Tenkanen, H. T. O., Salonen, M. P., Ahas, R., & Toivonen, T. K. (2018). Dynamic cities: Location-based accessibility modelling as a function of time. *Applied Geography*, *95*, 101-110. https://doi.org/10.1016/j.apgeog.2018.04.009

TOWARDS 24-HOUR SOCIETY

TOWARDS MULTILOCAL LIVING AND HYBRID WORK

Raun, J., Järv, O., Okkonen, P. O., Rantanen, M., Hyyryläinen, T., Ryynänen, T., & Toivonen, T. (2022). New avenues for second home tourism research using big data: prospects and challenges. *Current Issues in Tourism*, *26*(6), 90–902. https://doi.org/10.1080/13683500.2022.2138282

TOWARDS NEW MOBILITY NEEDS AND MOBILITY OPTIONS



Willberg, E., Salonen, M., & Toivonen, T. (2021). What do trip data reveal about bike-sharing system users? *Journal of Transport Geography, 91*, [102971]. https://doi.org/10.1016/j.jtrangeo.2021.102971

TOWARDS GREENER & HEALTHIER CITIES, FOR PEOPLE AND THE PLANET

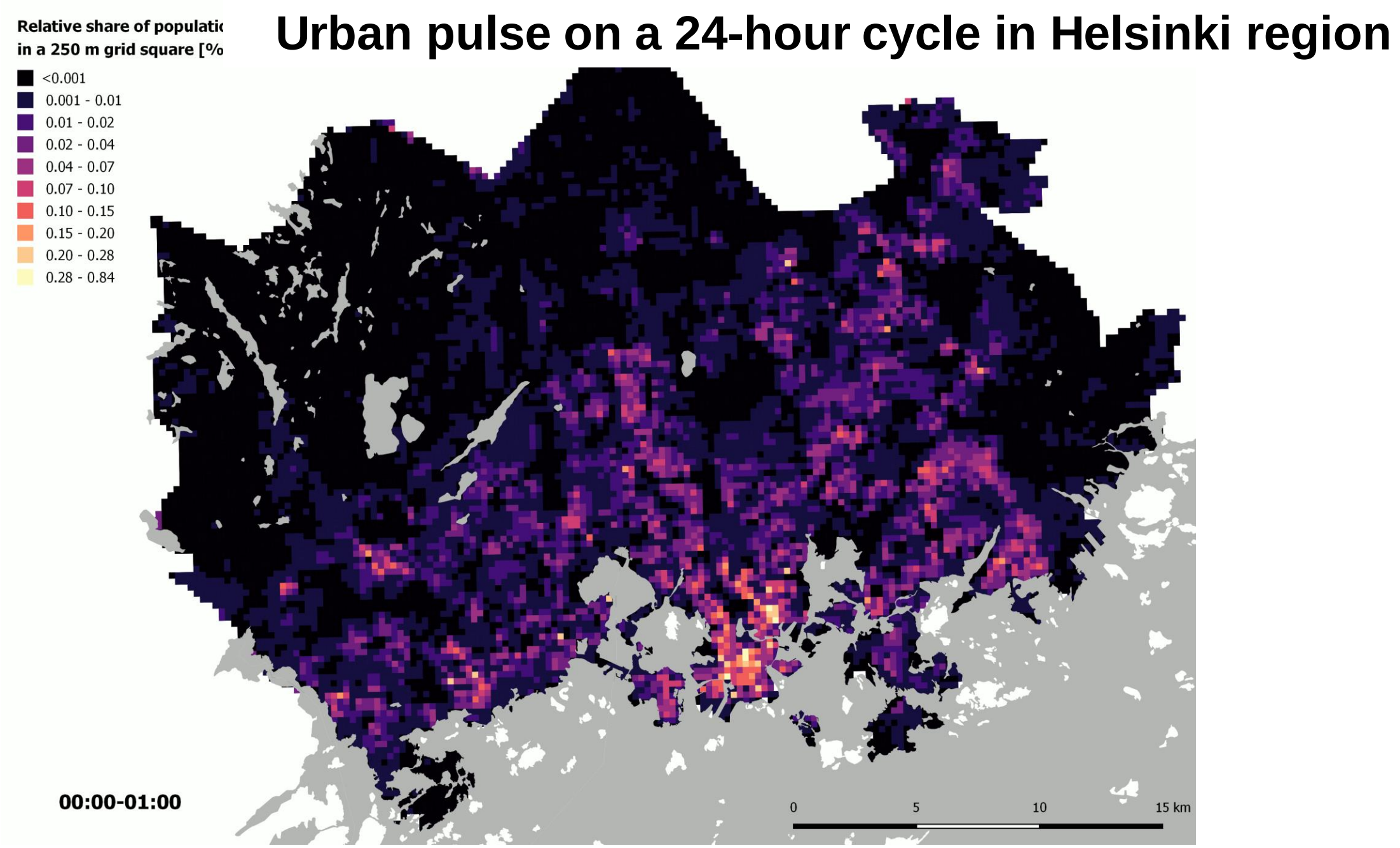
Poom, A., Willberg, E., & Toivonen, T. (2021). Environmental exposure during travel: A research review and suggestions forward. *Health & Place*, *70*, [102584]. https://doi.org/10.1016/j.healthplace.2021.102584

TOWARDS EQUITABLE AND ACCESSIBLE CITIES

Willberg, E., Fink, C., & Toivonen, T. (2023). The 15-minute city for all? – Measuring individual and temporal variations in walking accessibility. *Journal of Transport Geography*, *106*, [1032521]. https://doi.org/10.1016/j.jtrangeo.2022.103521

TOWARDS MORE SUSTAINABLE CITIES

Urban pulse on a 24-hour cycle in Helsinki region



Bergroth, C., Järv, O., Tenkanen, H., Manninen, M., & Toivonen, T. (2022). A 24-hour population distribution dataset based on mobile phone data from Helsinki Metropolitan Area, Finland. *Scientific data* , *9*, [39]. https://doi.org/10.1038/s41597-021-01113-4

npj | urban sustainability

www.nature.com/npjUrbanSustain

PERSPECTIVE OPEN

Check for updates

Harnessing sensing systems towards urban sustainability transformation

Adrienne Grêt-Regamey[1✉], Michal Switalski[1], Nora Fagerholm[2], Silviya Korpilo[3,4], Sirkku Juhola[3,4], Marketta Kyttä[5], Niina Käyhkö[2], Timon McPhearson[6,7,8], Markus Nollert[9], Tiina Rinne[5], Niko Soininen[10], Tuuli Toivonen[3,11], Aleksi Räsänen[3,4], Elias Willberg[3,11] and Christopher M. Raymond[3,4,12,13]

Recent years have seen a massive development of geospatial sensing systems informing the use of space. However, rarely do these sensing systems inform transformation towards urban sustainability. Drawing on four global urban case examples, we conceptualize how passive and active sensing systems should be harnessed to secure an inclusive, sustainable and resilient urban transformation. We derive principles for stakeholders highlighting the need for an iterative dialogue along a sensing loop, new modes of governance enabling direct feeding of sensed information, an account for data biases in the sensing processes and a commitment to high ethical standards, including open access data sharing.

npj Urban Sustainability (2021)1:40 ; https://doi.org/10.1038/s42949-021-00042-w

INTRODUCTION

Rapid urban growth and related pressures on the global environment are challenging the governance and planning of cities[1–3]. Recent frameworks suggest various levers to bring about triggering transformation[21]. For example, geographic information observatories now provide the potential to combine data about human preferences and behaviour data with biophysical data streams such as traffic counters, public transit, weather stations,

LAB

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PERSPECTIVE OPEN

Harnessing sensing systems towards urban sustainal transformation

Adrienne Grêt-Regamey[1✉], Michal Switalski[1], Nora Fagerholm[2], Silviya Korpilo[3,4], Sirkku Juhola[3,4], M
Niina Käyhkö[2], Timon McPhearson[6,7,8], Markus Nollert[9], Tiina Rinne[5], Niko Soininen[10], Tuuli Toivonen[3,
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INTRODUCTION

Rapid urban growth and related pressures on the global environment are challenging the governance and planning of cities[1–3]. Recent frameworks suggest various levers to bring about urban transformation towards sustainability[4–9]. However, urban planners and decision-makers struggle to implement the transformation processes in complex, real-world settings[9,10]. Effectively directing urban development towards more inclusive, resilient and sustainable urban systems[11,12] requires multi-dimensional and radical changes[13,14]. Latest debates have pointed to the oversight of the 'inner world' of sustainability in these systemic views of transformation, including the emotions, thoughts, identities and beliefs of individuals driving human behaviour, otherwise referred to as a 'deep leverage point'[15–17]. At the same time, there is a proliferation of data generated by massive ubiquitous sensing

triggering transformation[21]. For examp
observatories now provide the poten
human preferences and behaviour
streams such as traffic counters, pub
news portals and air quality mon
building technologies increasingly i
everyday objects[23], and digital twins
real-time data sources to allow
integrated sensing systems can help
tive of places, regions or the en
observation, experimentation and
processes and structures forming the city, and their change

Here, we investigate the different forms of sensing systems and their role in urban sustainability transformation. We conceptualize the interactions between various types of sensing systems and

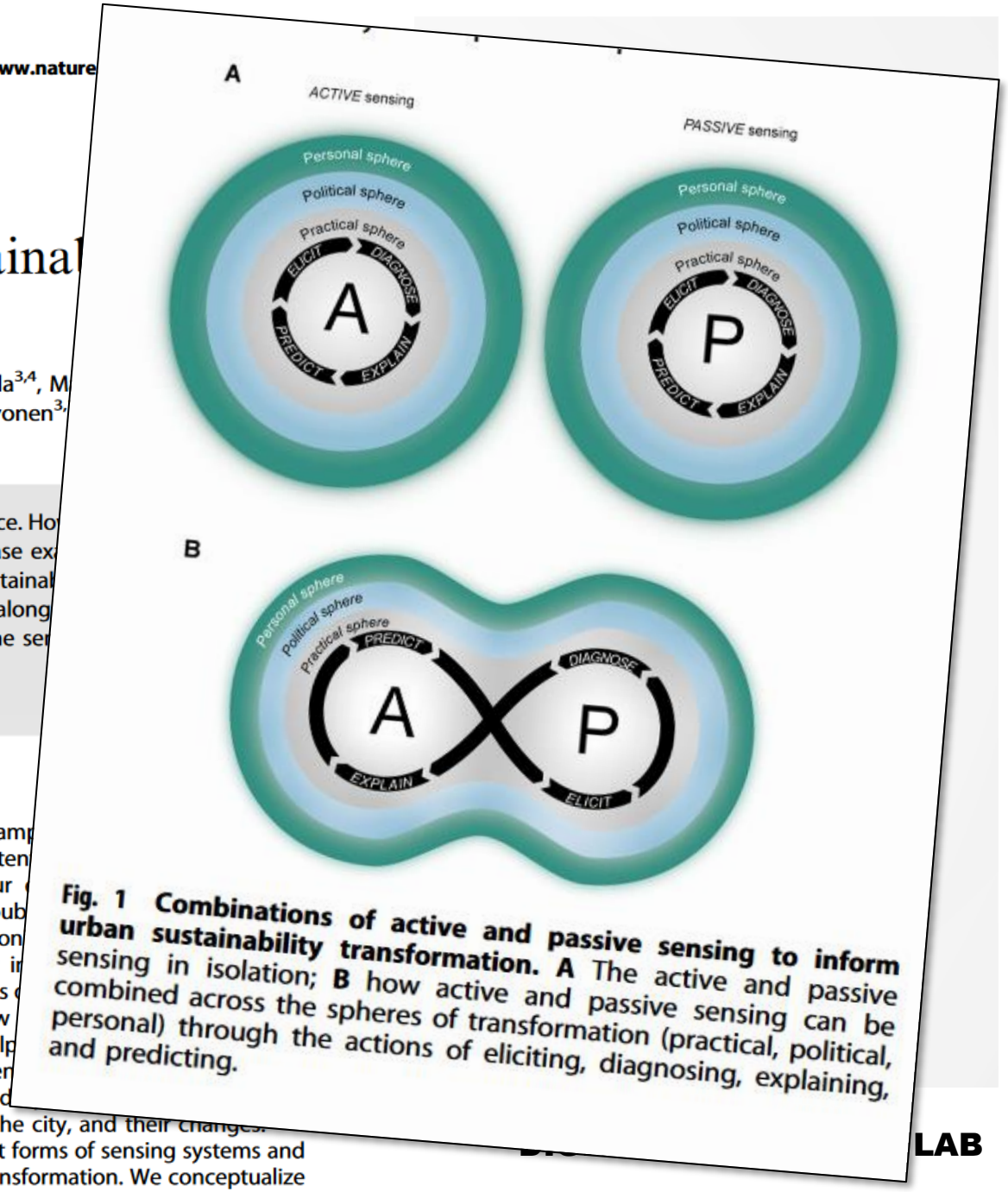
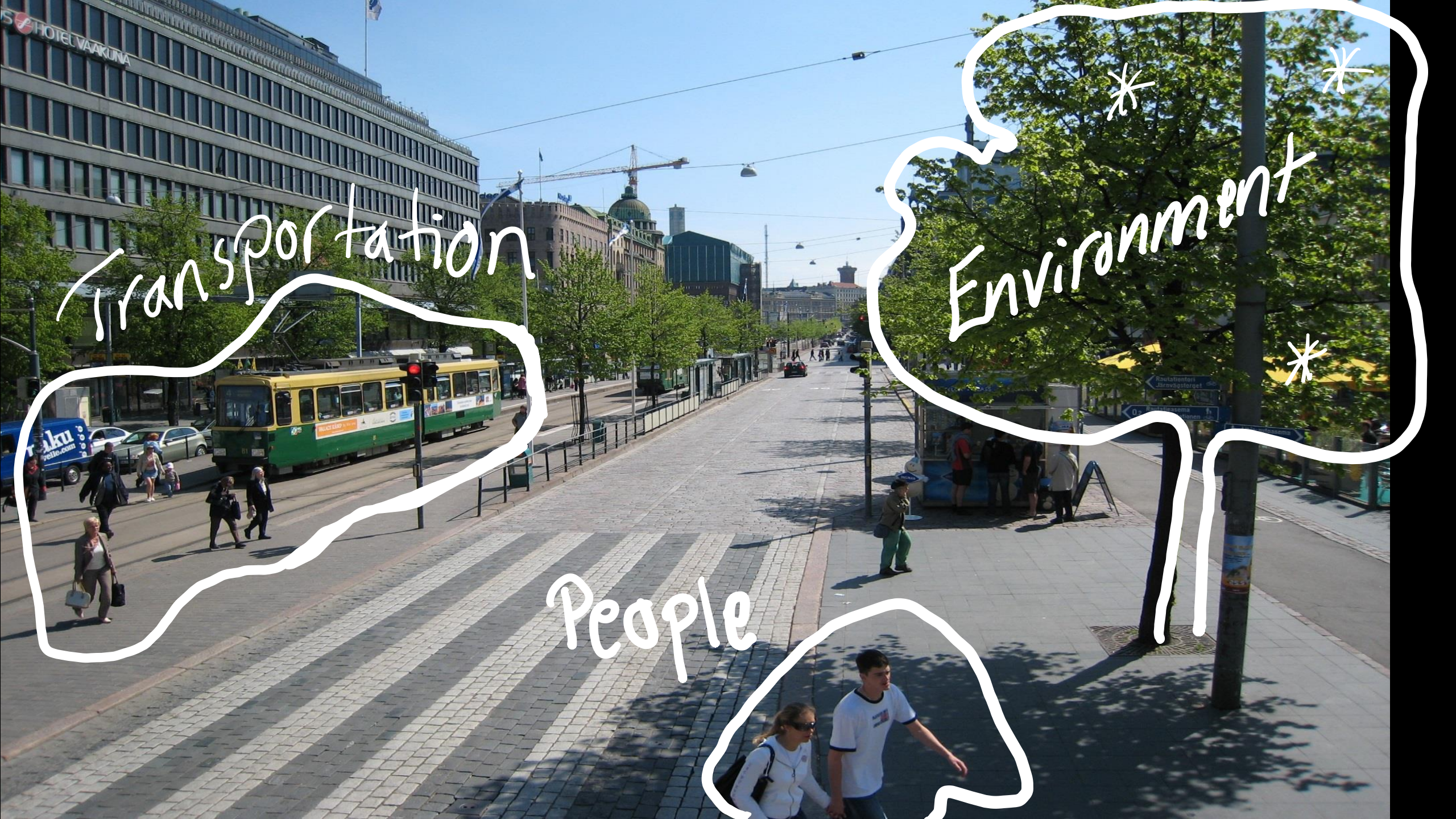


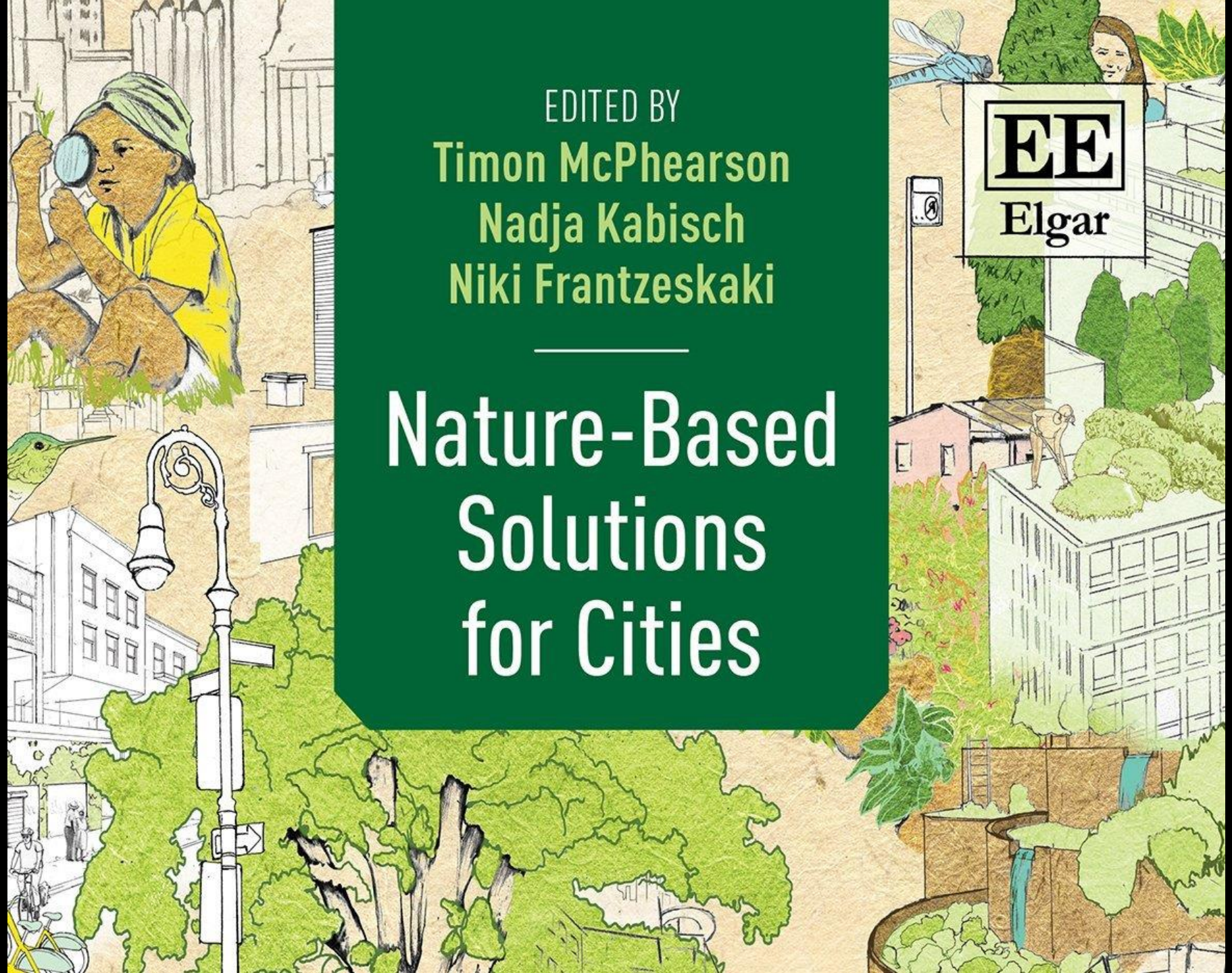
Fig. 1 Combinations of active and passive sensing to inform urban sustainability transformation. A The active and passive sensing in isolation; **B** how active and passive sensing can be combined across the spheres of transformation (practical, political, personal) through the actions of eliciting, diagnosing, explaining, and predicting.

LAB

Do people use the urban environment as planners assume?

Who is impacted by climate change, where and when?


Transportation
Enviranment
People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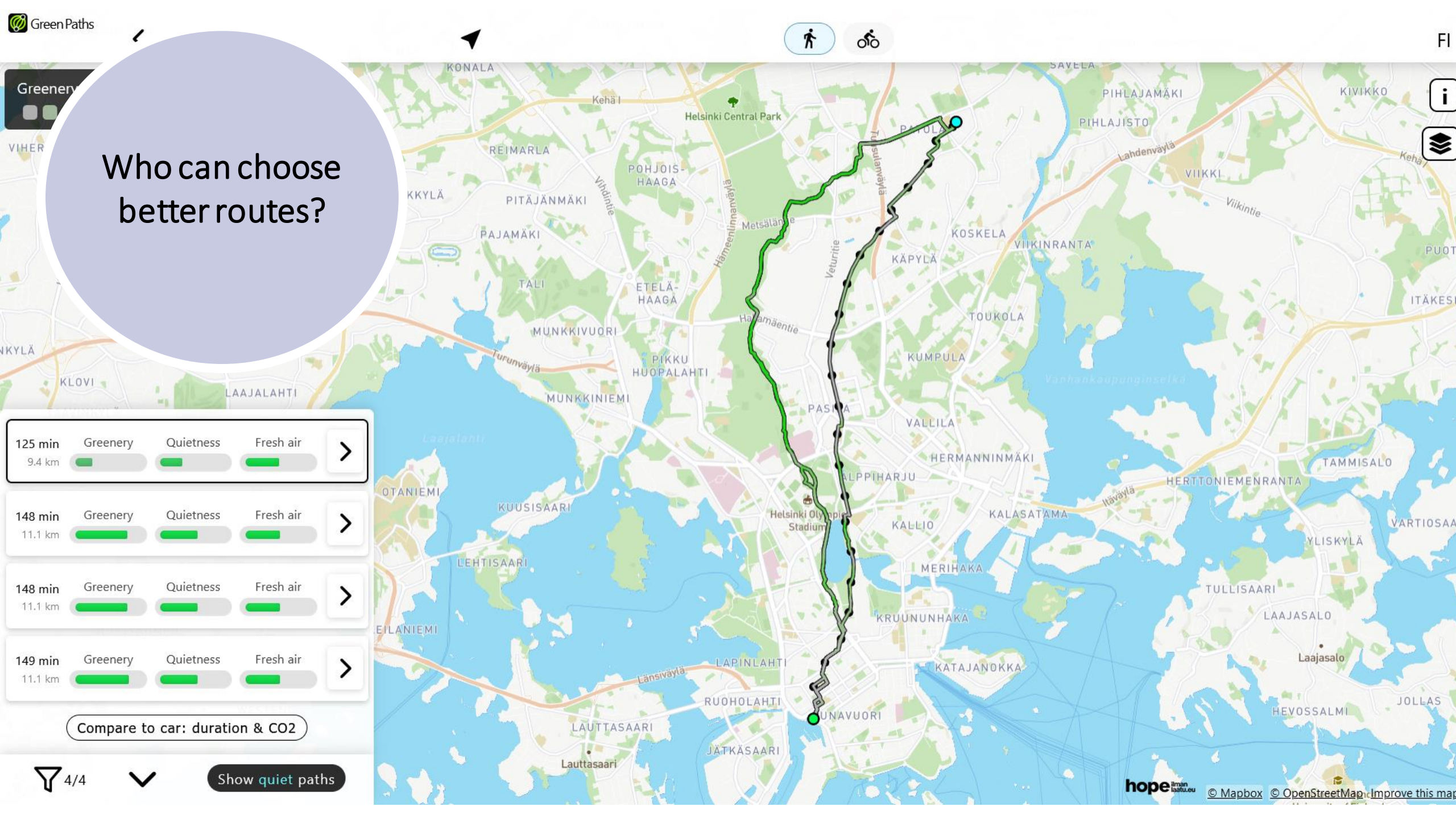
Timon McPhearson
Nadja Kabisch
Niki Frantzeskaki
Nature-Based Solutions for Cities
EE
Elgar


Green Paths
FI
Who can choose better routes?
125 min
9.4 km
Greenery
Quietness
Fresh air
148 min
11.1 km
Greenery
Quietness
Fresh air
148 min
11.1 km
Greenery
Quietness
Fresh air
149 min
11.1 km
Greenery
Quietness
Fresh air
Compare to car: duration & CO2
4/4
Show quiet paths
Helsinki Central Park
KONALA
REIMARLA
POHJOIS-HAAGA
PITÄJÄNMÄKI
PAJAMÄKI
TALI
ETELÄ-HAAGA
MUNKKIVUORI
PIKKU HUOPALAHTI
MUNKKINIEMI
LAAJALAHTI
KLOVI
OTANIEMI
KUUSISAARI
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EILANIEMI
LAUTTASAARI
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KÄPYLÄ
TOUKOLA
KUMPULA
VALLILA
HERMANNINMÄKI
KALLIO
KALASATAMA
MERIHAKA
KRUUNUNHAKA
KATAJANOKKA
TULLISAARI
LAAJASALO
Laajasalo
YLISKYLÄ
HERTTONIEMENRANTA
TAMMISALO
HEVOSSALMI
JOLLAS
Lahdenväylä
Viikintie
Länsiväylä
Itäväylä
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Improve this map

Who has access to good environment during daily mobilities?

GREENTRAVEL PROJECT 2023-2027

Willberg *et al.*
International Journal of Health Geographics (2023) 22:5
https://doi.org/10.1186/s12942-023-00326-7

International Journal of Health Geographics

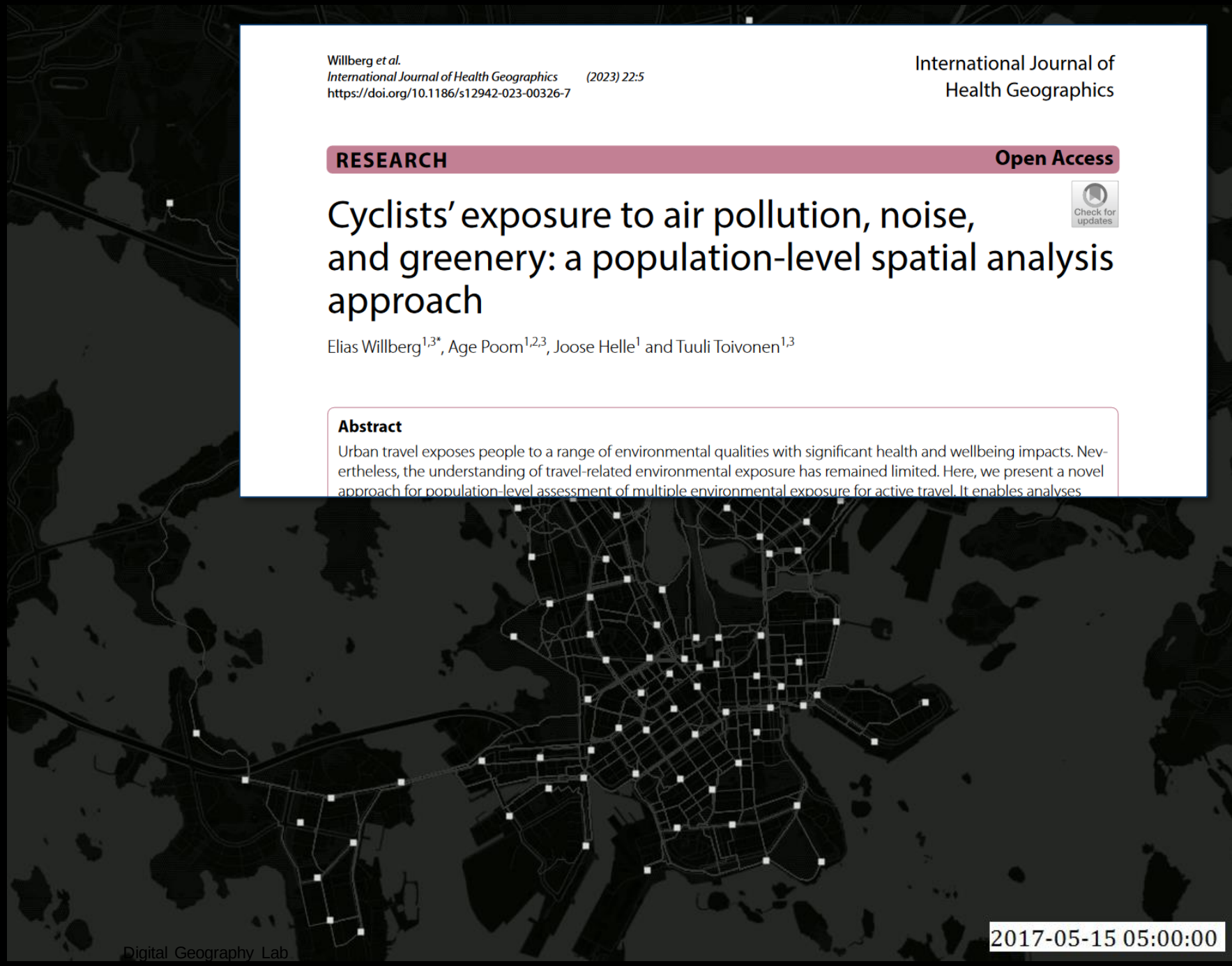
RESEARCH Open Access

Cyclists' exposure to air pollution, noise, and greenery: a population-level spatial analysis approach

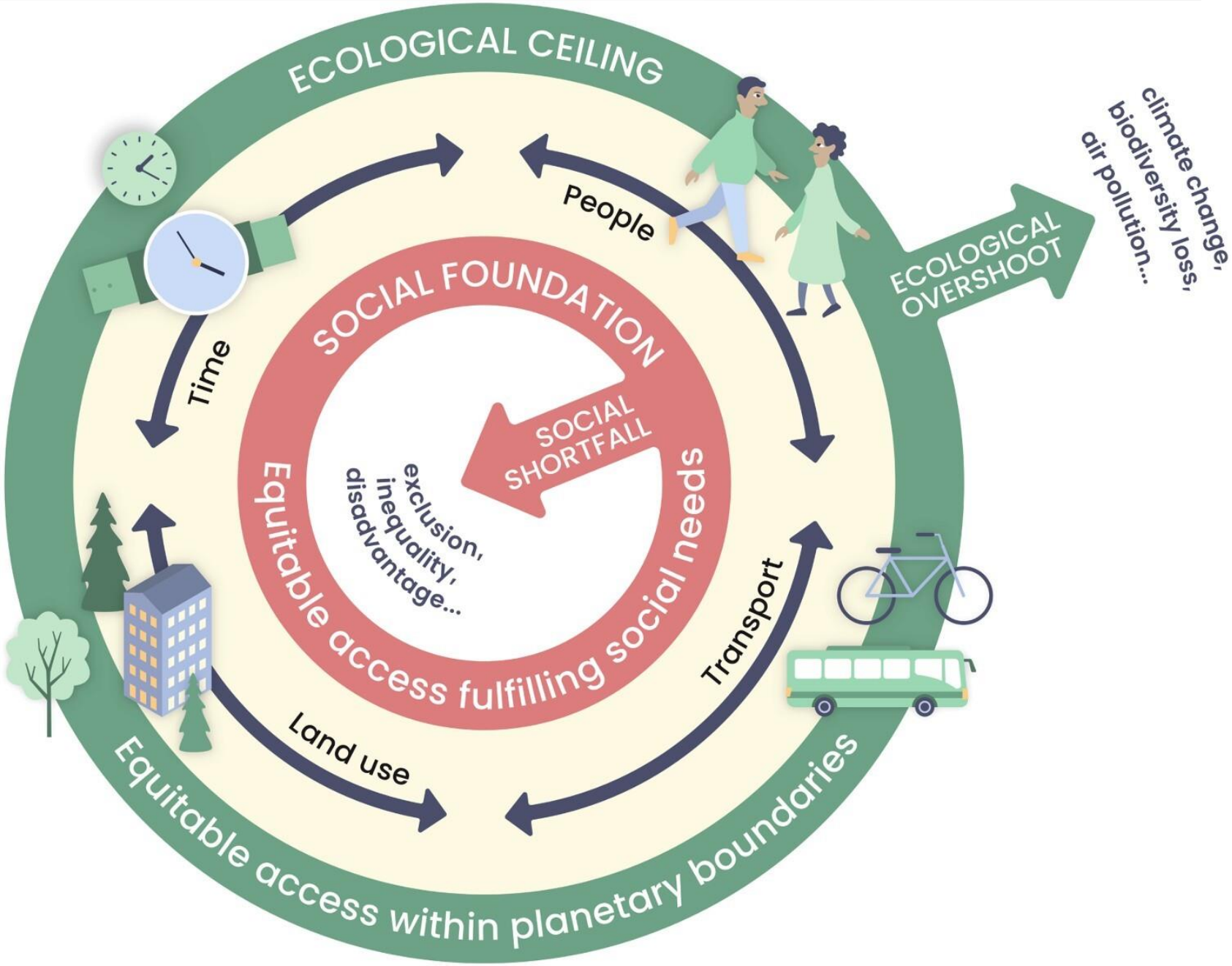
Elias Willberg[1,3*], Age Poom[1,2,3], Joose Helle[1] and Tuuli Toivonen[1,3]

Abstract

Urban travel exposes people to a range of environmental qualities with significant health and wellbeing impacts. Nevertheless, the understanding of travel-related environmental exposure has remained limited. Here, we present a novel approach for population-level assessment of multiple environmental exposure for active travel. It enables analyses



Willberg, E., Tenkanen, H., Miller, H. J., Pereira, R. H. M., & Toivonen, T. (2023). Measuring just accessibility within planetary boundaries. *Transport Reviews*, [https://doi.org/10.1080/01441647.2023.2240958]. https://doi.org/10.1080/01441647.2023.2240958



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Helsinki

SUOMEN KULTTUURIRAHASTO

HiDATA
HELSINKI CENTRE FOR DATA SCIENCE

FCAI Finnish Center for Artificial Intelligence
REAL AI FOR REAL PEOPLE IN THE REAL WORLD

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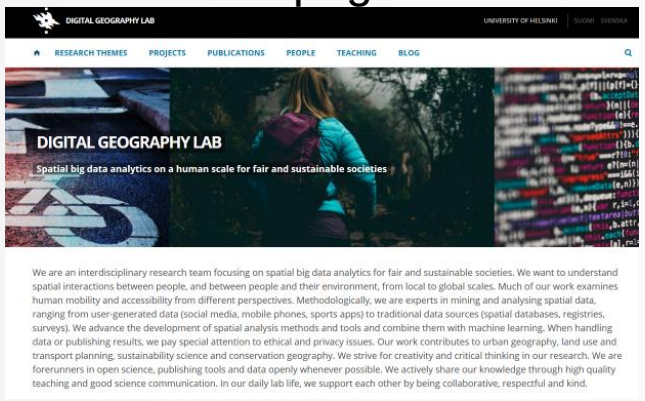
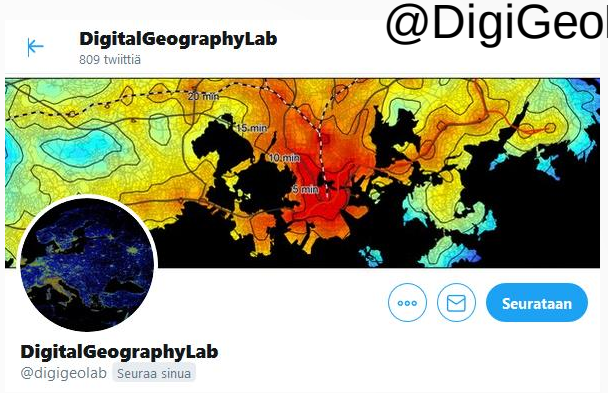
HOW TO FOLLOW OUR WORK?

Web pages

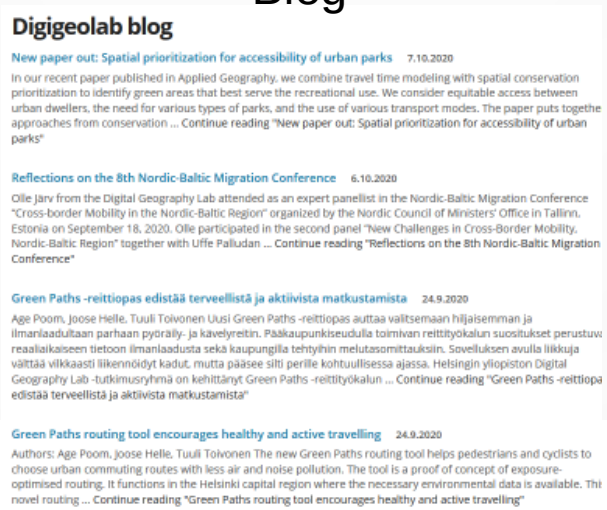


http://www.helsinki.fi/digital-geography

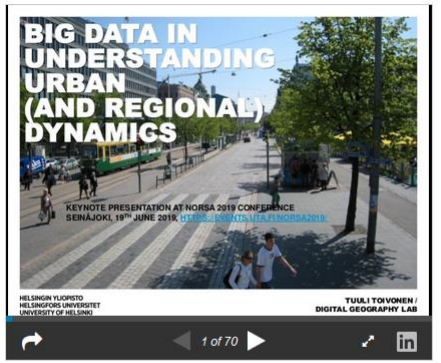
@DigiGeoLab, @TuuliToivonen



Blog



Presentations



NoRSA 2019 Keynote: Tuuli Toivonen – Big Data for Analysin Dynamics from University of Helsinki / Digital Geography La

CLIMATE CHANGE, SUSTAINABILITY AND CITIES

PERSPECTIVE OF DATA AND PEOPLE

TIMON MCPHEARSON &
TUULI TOIVONEN

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