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## ERC Work Program 2025 Webinar

Geographic environments, daily activities and stress:

A study on the space-time fragmentation  
of exposure patterns

*July 23rd, 2024*

Camille Perchoux Ph.D.



Funded by  
the European Union



European Research Council  
Established by the European Commission

The FragMent project was funded by the European Union, under the Horizon European Research Council (ERC) Starting grant program. Grant Agreement No. 101040492

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# Bio

Antibes, France  
***Sciences***



1987  
Cannes,  
France  
***Me***

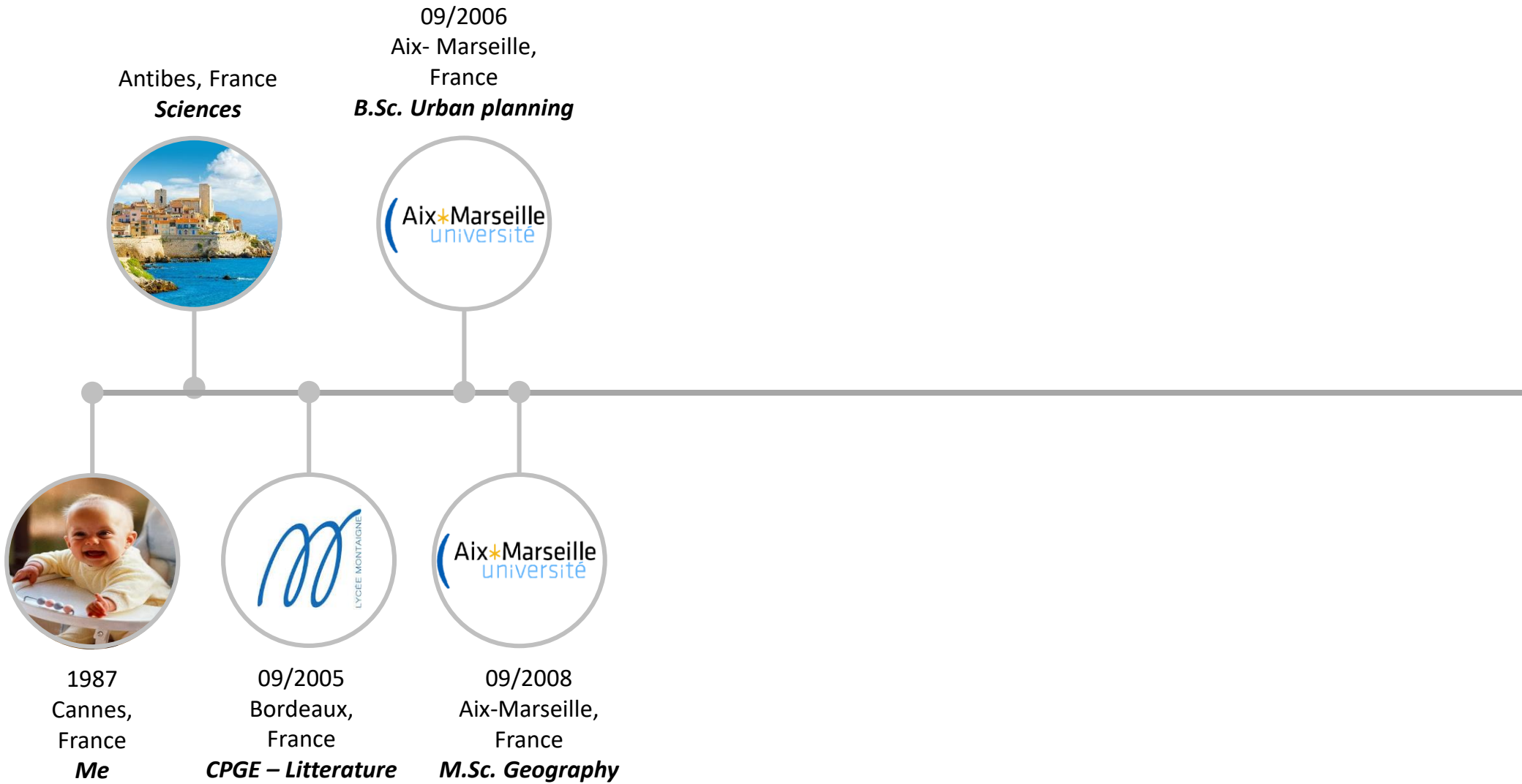
Antibes, France  
**Sciences**

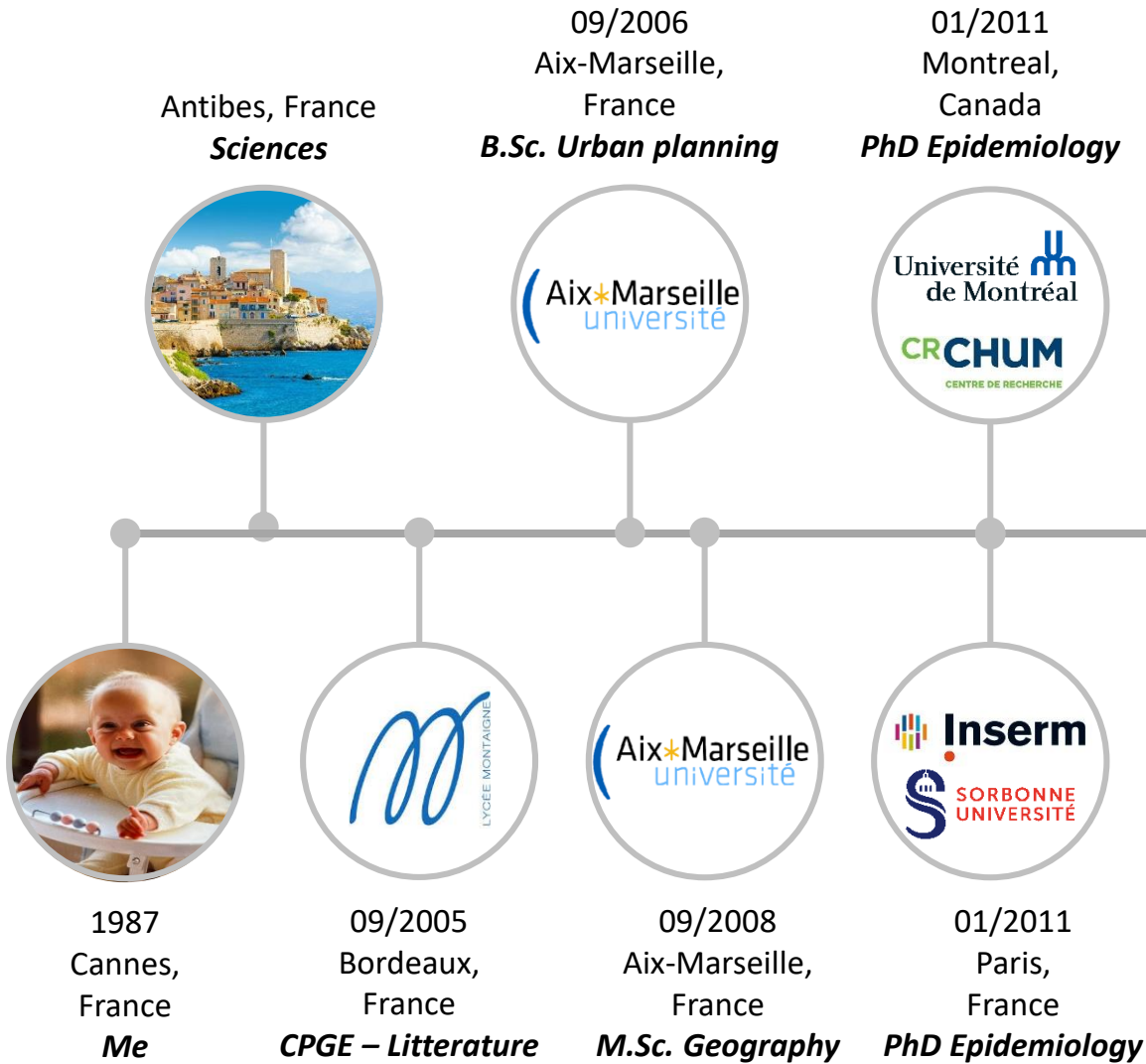


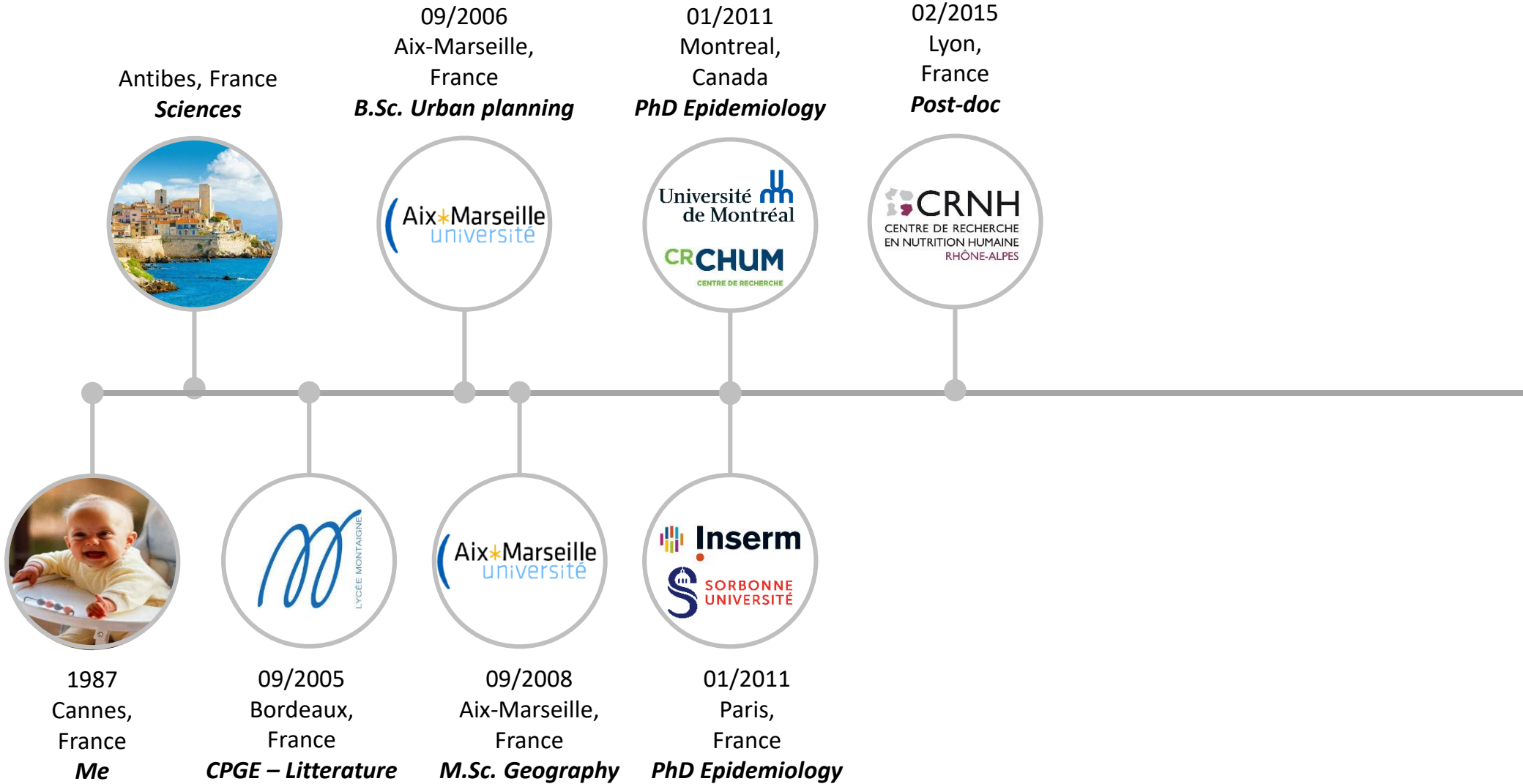
1987  
Cannes,  
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**Me**

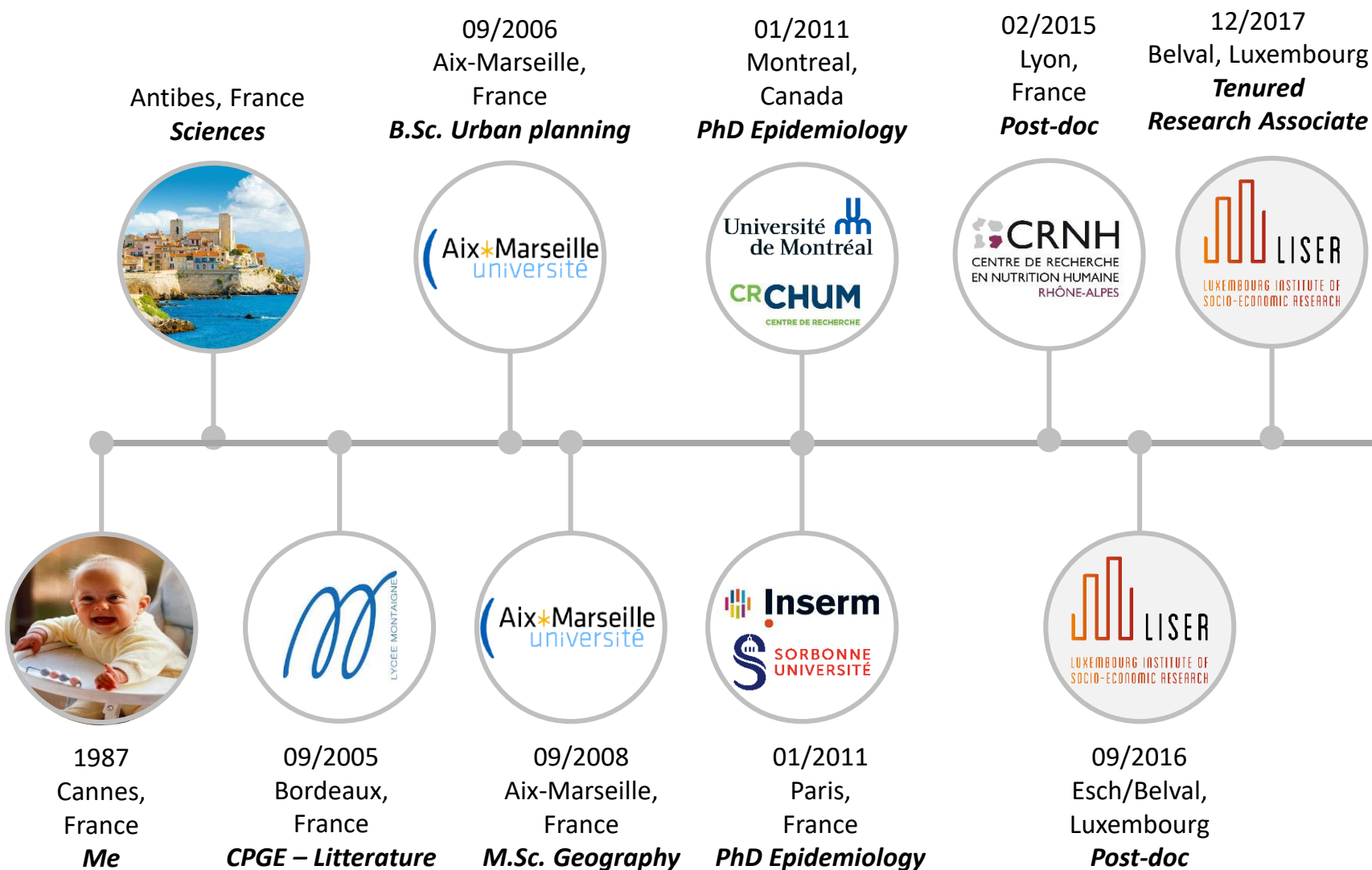


09/2005  
Bordeaux,  
France  
**CPGE – Litterature**

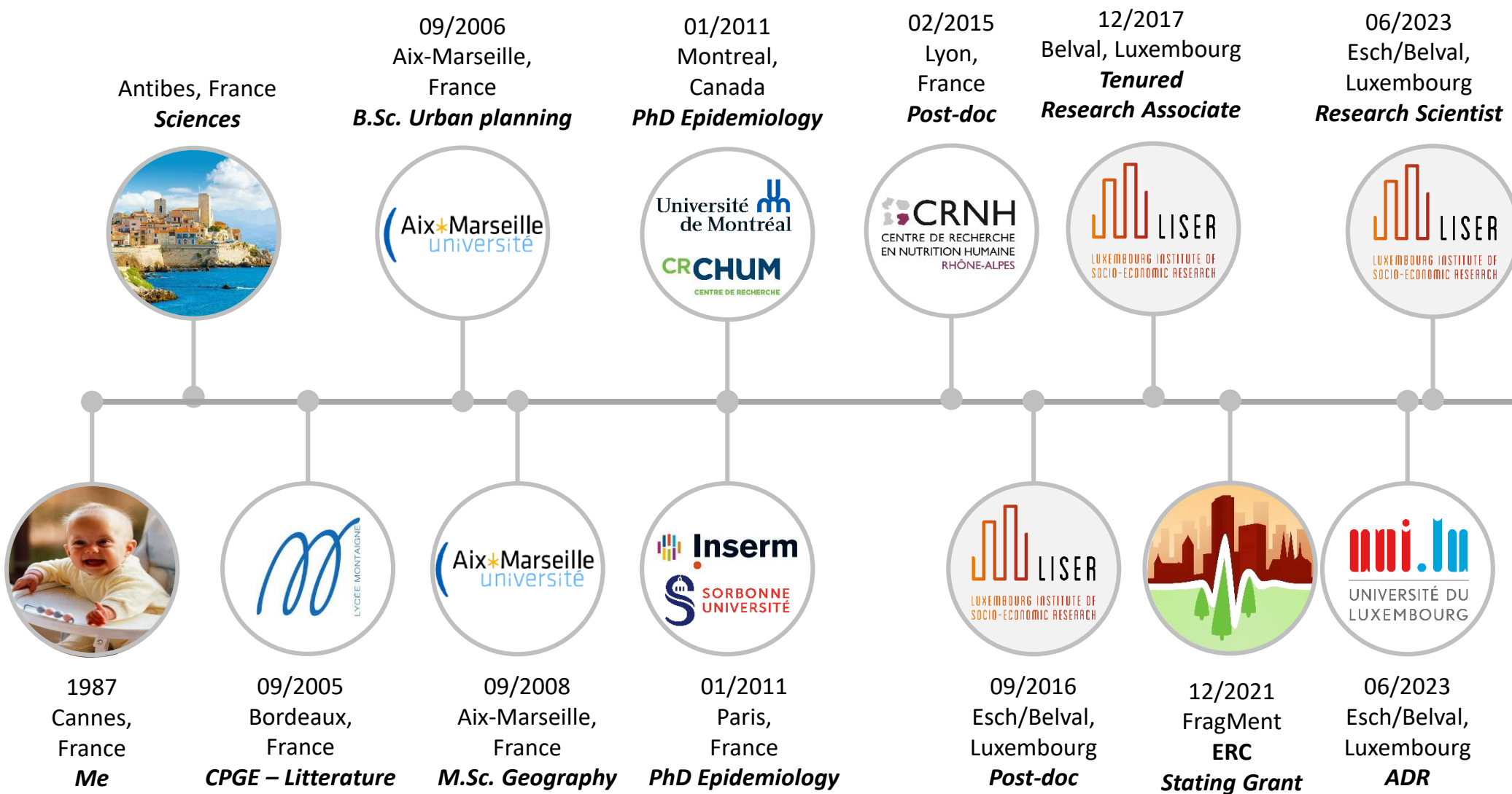






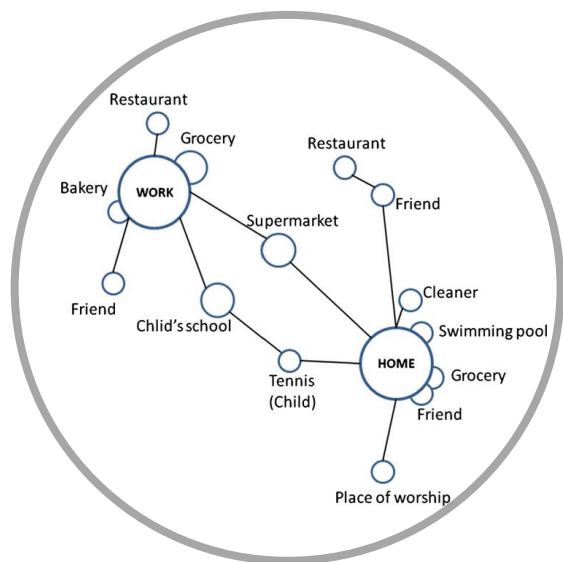




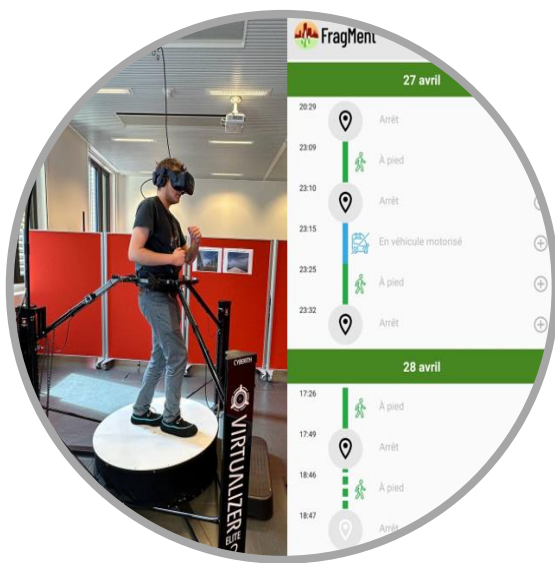


# My research - Methodologies

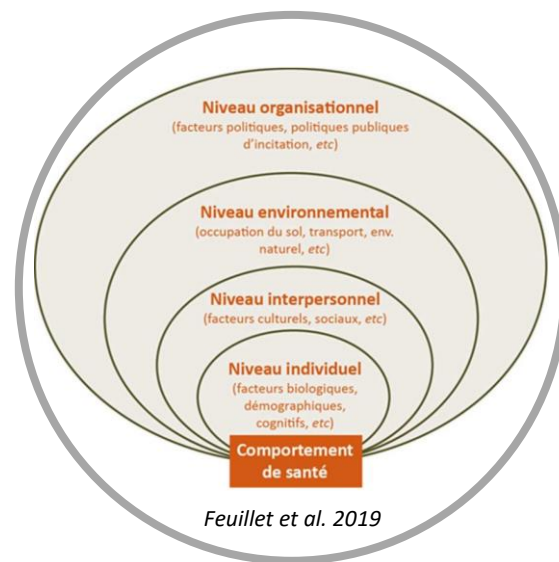
## Understanding how urban environments and places influence population health



Environmental exposure assessment accounting for daily mobilities

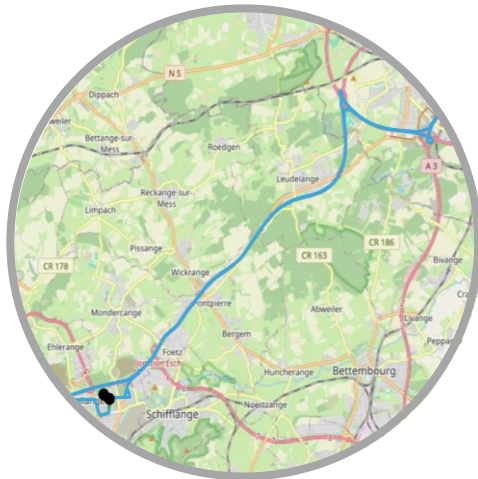


New developments in Exposure & Risk assessment



A socio-ecological approach of health determinants

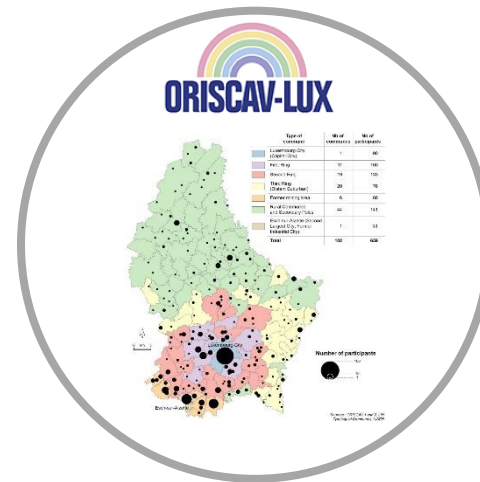
# My research – Research themes



Mobility and activity patterns



Environmental determinants of physical activity and sedentary behaviors  
\*Image : Roe & McCay 2021



Time-varying neighborhood effects on cardio-metabolic health  
FNR CORE MET'HOOD 2020-2023



Geographic environments, daily activities and Stress  
ERC StG FragMent 2021-2027

*Social inequalities in health*



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and stress:

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# Why stress ?



## STRESS & DISEASES

90%

STRESS IS A RISK  
FACTOR OF 90%  
OF DISEASES OF  
VARIOUS ORIGIN



CARDIOVASCULAR

RESPIRATORY



PSYCHOLOGICAL

GASTROINTESTINAL



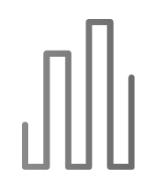
IMMUNE

COGNITIVE



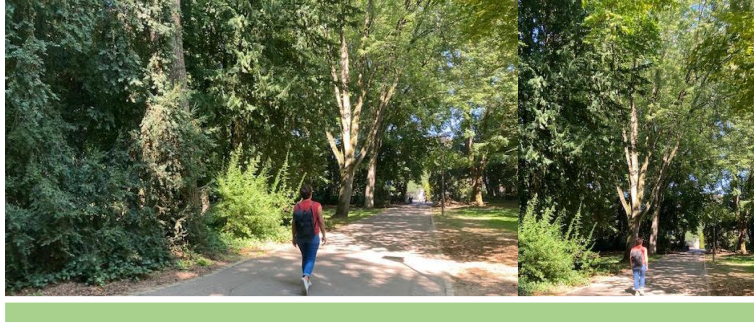
WHAT  
ABOUT  
YOUR  
HEALTH?





# Stress throughout the day

IMAGINE





8:00 am



1:00 pm

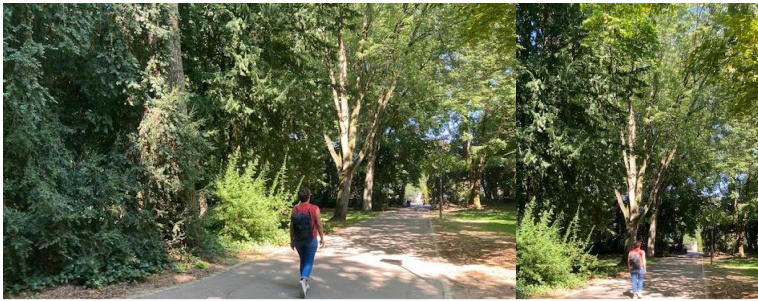
6:00 pm

  Urban stressors



# Stress throughout the day

IMAGINE



8:00 am

1:00 pm

6:00 pm

WHAT IF...

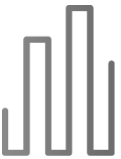


8:00 am

9:00 am

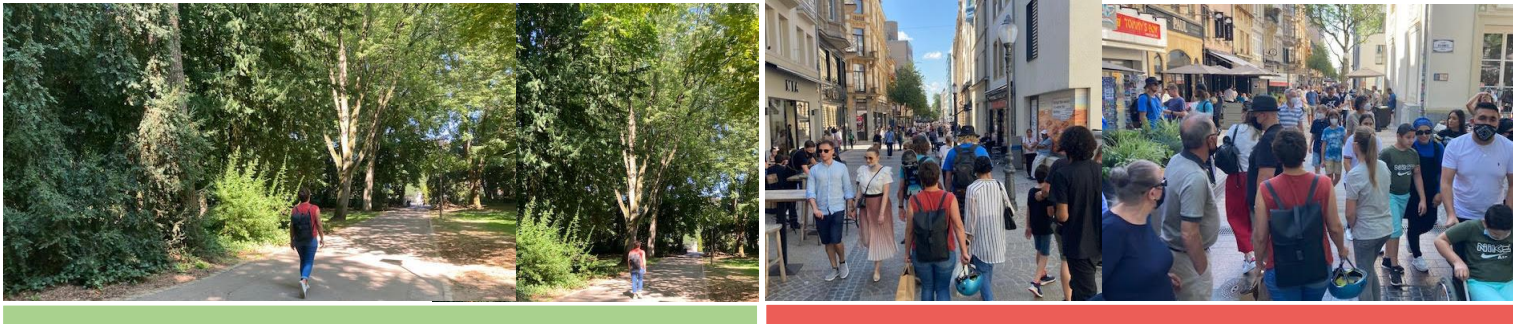
6:00 pm





# Stress throughout the day

IMAGINE



8:00 am

1:00 pm

6:00 pm

WHAT IF...



8:00 am

9:00 am

6:00 pm

OR IF...



8:00 am

8:45 am

11:00 am

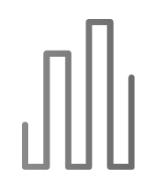
3:00 pm

5:00 pm

6:00 pm

Urban stressors





# The FragMent projet



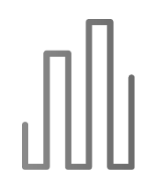
## What is FragMent ?

Project FragMent wants to understand the impacts **neighborhood environments** and **daily activities** have on the **stress levels** of Luxembourg residents.



## Who is behind FragMent?

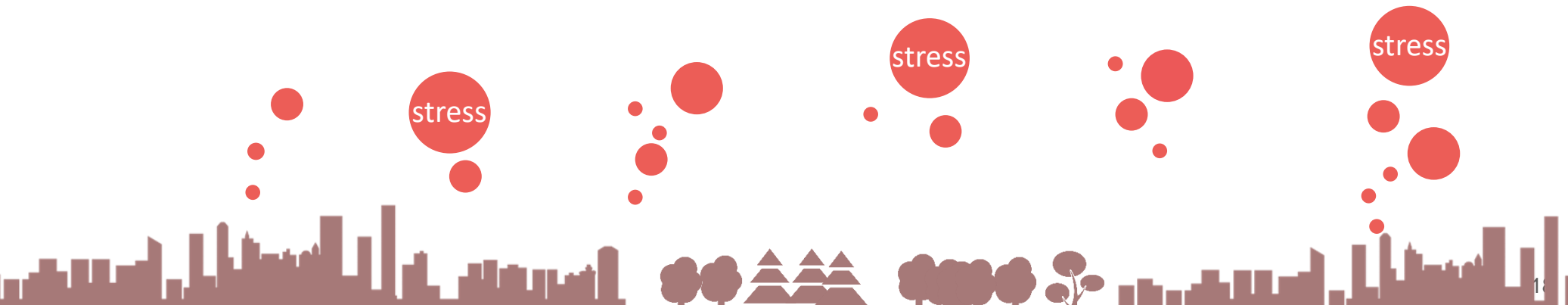
This study is led by the **Luxembourg Institute of Socio-Economic Research (LISER)**. Funded by the **European Union**, the project brings together experts in epidemiology, psychology, geography, health, data science, and mobility.



# Aim of FragMent

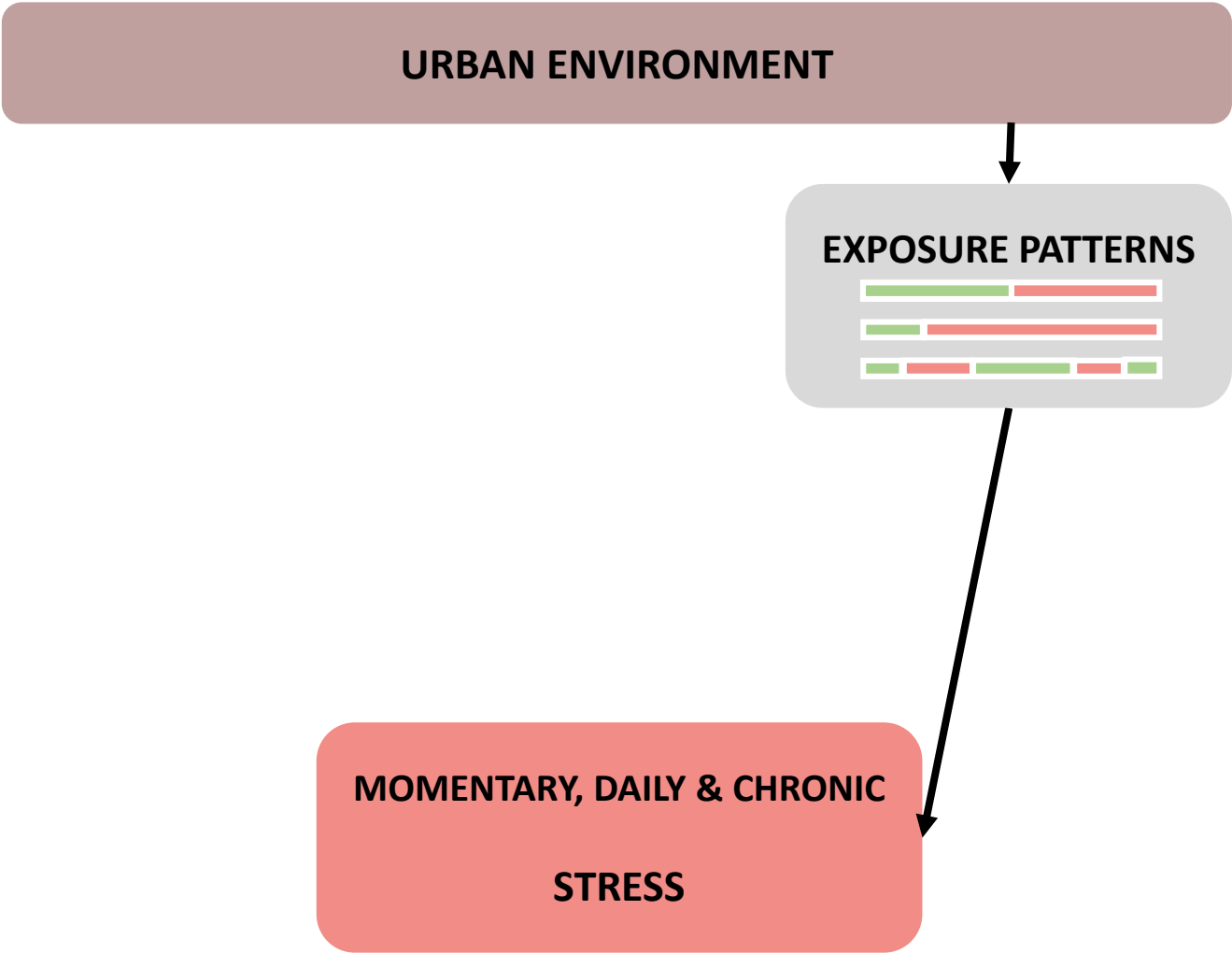
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Evaluate the extent to which the  
**spatial and temporal fragmentation of exposures**  
to **environments** in daily life influences **stress**,  
and **social inequalities in stress**





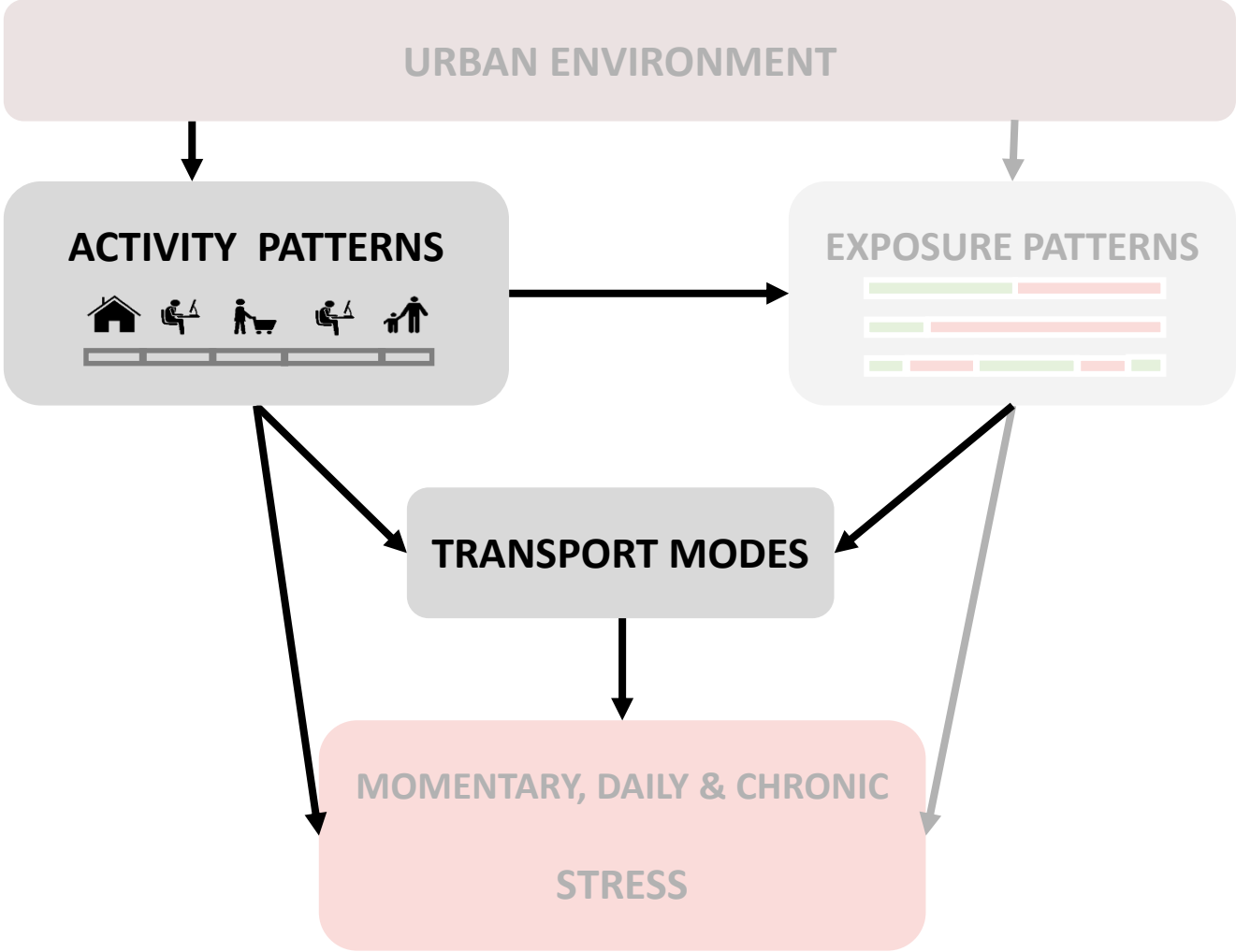
# Objectives and hypotheses



*Objectives 1 & 2*



# Objectives and hypotheses

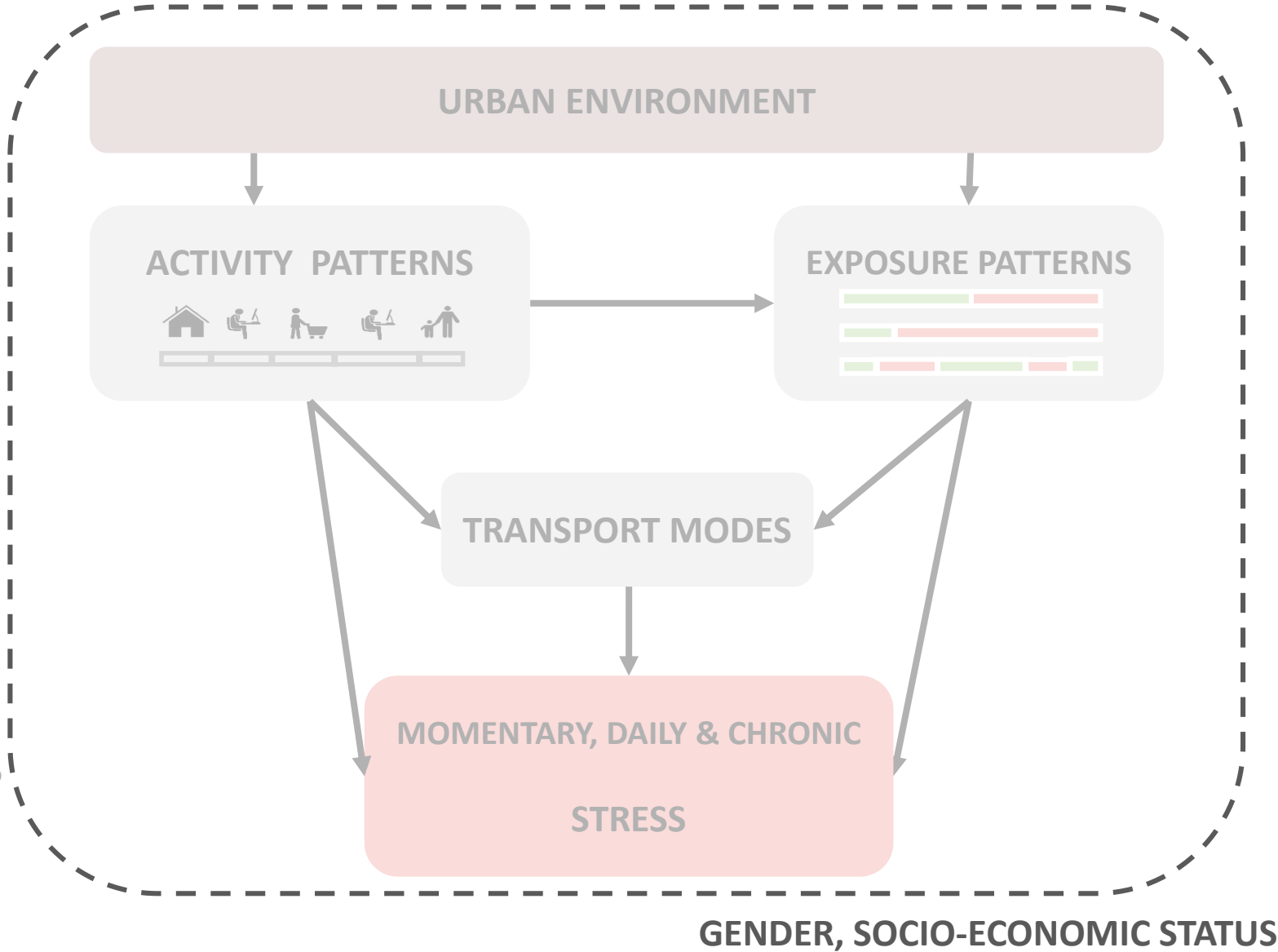


*Objectives 1 & 2*

*Objective 3*



# Objectives and hypotheses



*Objectives 1 & 2*

*Objective 3*

*Objective 4*

# Three complementary methods



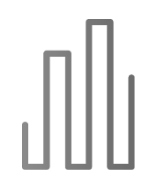
Participatory & **qualitative**  
**Research !**



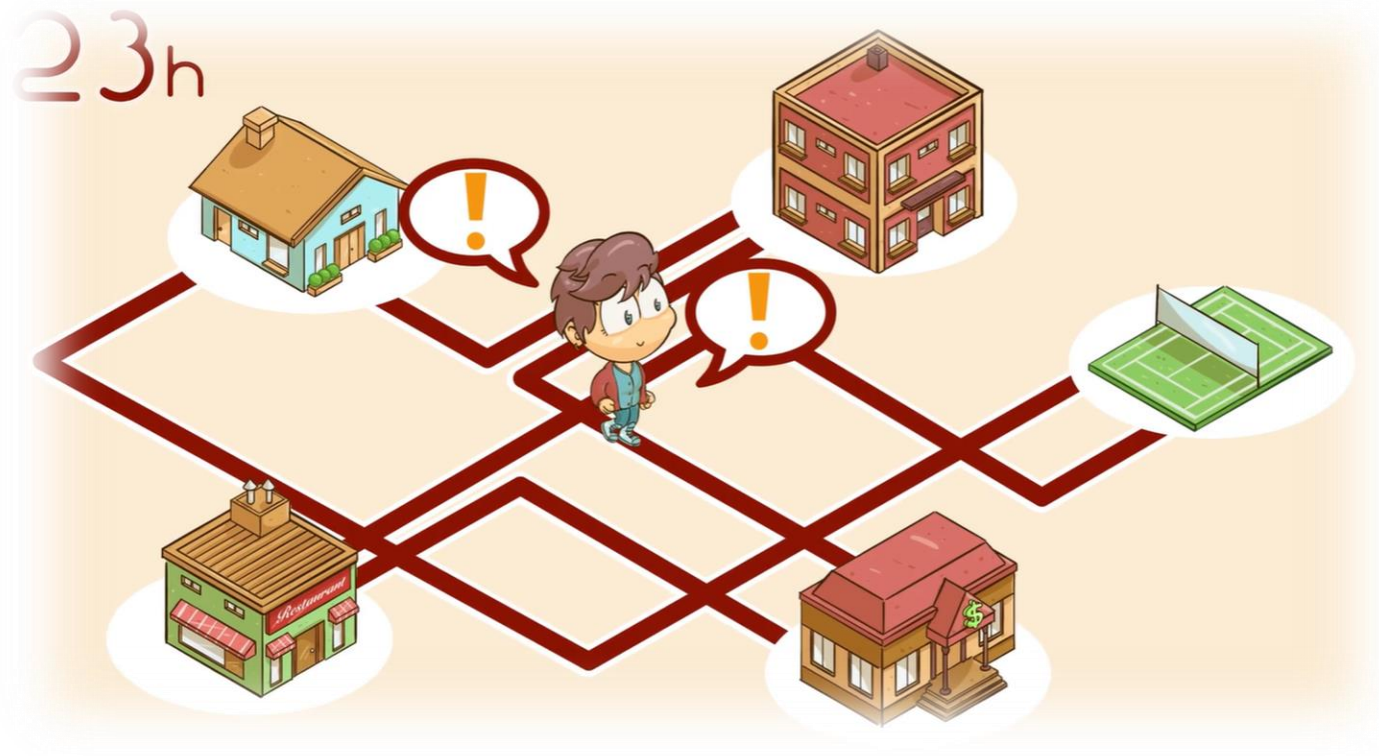
A **national survey**:  
Your voice matters more  
than you think !



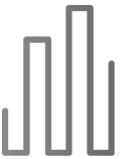
**Virtual** lab experiments !



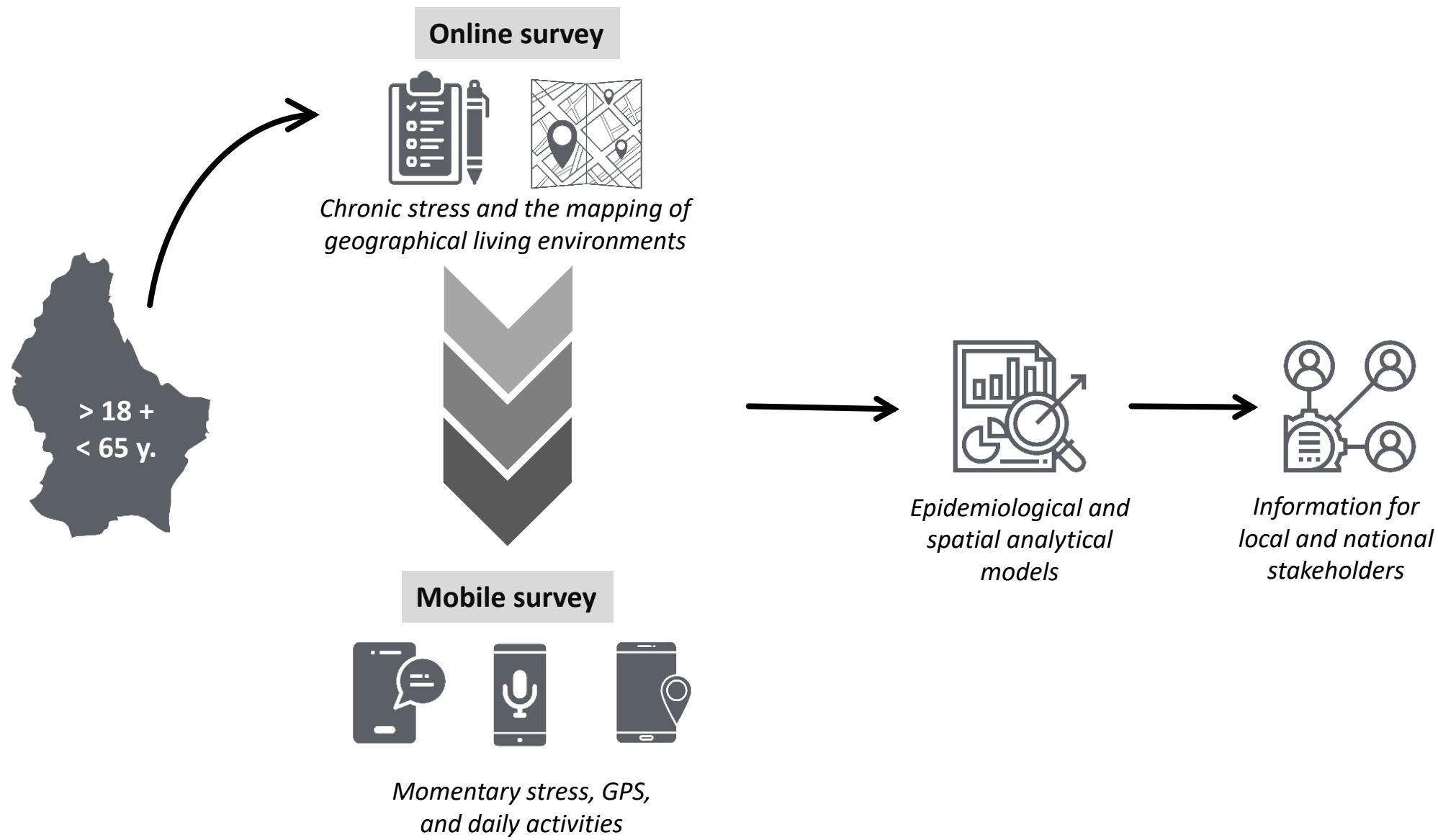
# The FragMent survey



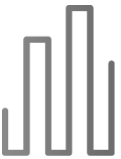
Use interactive map-based questionnaires and an app to help understand the causes of stress in our everyday environments.



# The FragMent survey





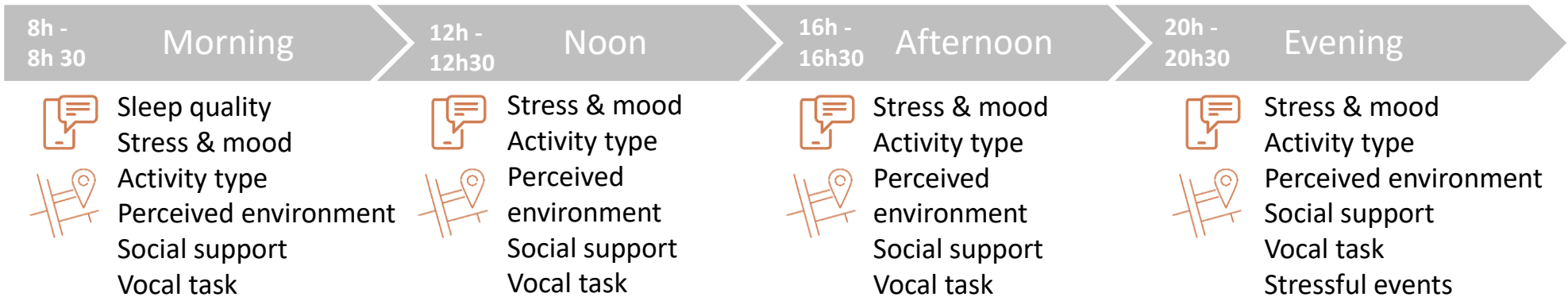


# Geographical ecological momentary assessment



Repeated sampling throughout the day of participants' experiences and behaviors, in situ and in real time.

*(Shiffman et al., 2008)*



- **WHERE & WHEN** stress is experienced (+ **GPS**)
- **WHAT**: What domain of activity ?
- **WHITH WHOM** : with whom are you interaction ?
- **WHY**: What perceived environmental factors matter ?



# FragMent mobile survey: examples of core questions

## Measuring perceived stress in daily life environments

The image displays three sequential screenshots of the FragMent mobile application interface, all showing the 'evening survey (A)'.

**Screenshot 1: Stress Level**  
The question is 'How stressed are you now?'. It features a horizontal slider with a green dot positioned at 50. The scale ranges from 0 (labeled 'Not at all') to 100 (labeled 'Very stressed').

**Screenshot 2: Current Activity**  
The question is 'What are you currently doing?'. It lists ten activities, each with a radio button for selection:

- Work/study
- Transportation (car, train, bus, bicycle, walking ...)
- Shopping
- Sports
- Leisure activities
- Household chores
- Family care activities
- Self-care activities
- Eating
- Rest

**Screenshot 3: Surrounding Environment**  
The question is 'Which aspects of your surrounding environment are you currently enjoying?'. It includes the instruction 'Check all that apply' and a list of environmental factors, each with a checkbox:

- Green spaces (park, forest, vegetation)
- Blue spaces (river, lake, fountain, waterbodies...)
- Smells
- Sounds
- Building architecture
- Open space, view
- Weather
- None of them

Each screenshot shows a navigation bar at the bottom with 'PRÉCÉDENT' and 'SUIVANT' buttons, and a footer indicating 'Propulsé par Eco Emo Tracker'.

# FragMent mobile survey: mobility data

A precise characterization of mobility patterns and transport modes

15:53

FragMent

Données GPS

Activé

Latitude

49.503948697820306°

Longitude

5.946654444560409°

Heure

2024-04-23 10:53:23

Altitude

407.0m

Précision

23.0m

Direction

Ouest Nord-Ouest (286.5°)

Vitesse

1.8m/s

Nb de satellites

0/0

Activité

f (96%)

Hdop

3.4

Vdop

2.2

Pdop

4.2

Propulsé par Eco Emo Tracker

18:38

FragMent

27 avril

20:29

Arrêt

23:09

À pied

23:10

Arrêt

23:15

En véhicule motorisé

23:25

À pied

23:32

Arrêt

28 avril

17:26

À pied

17:49

Arrêt

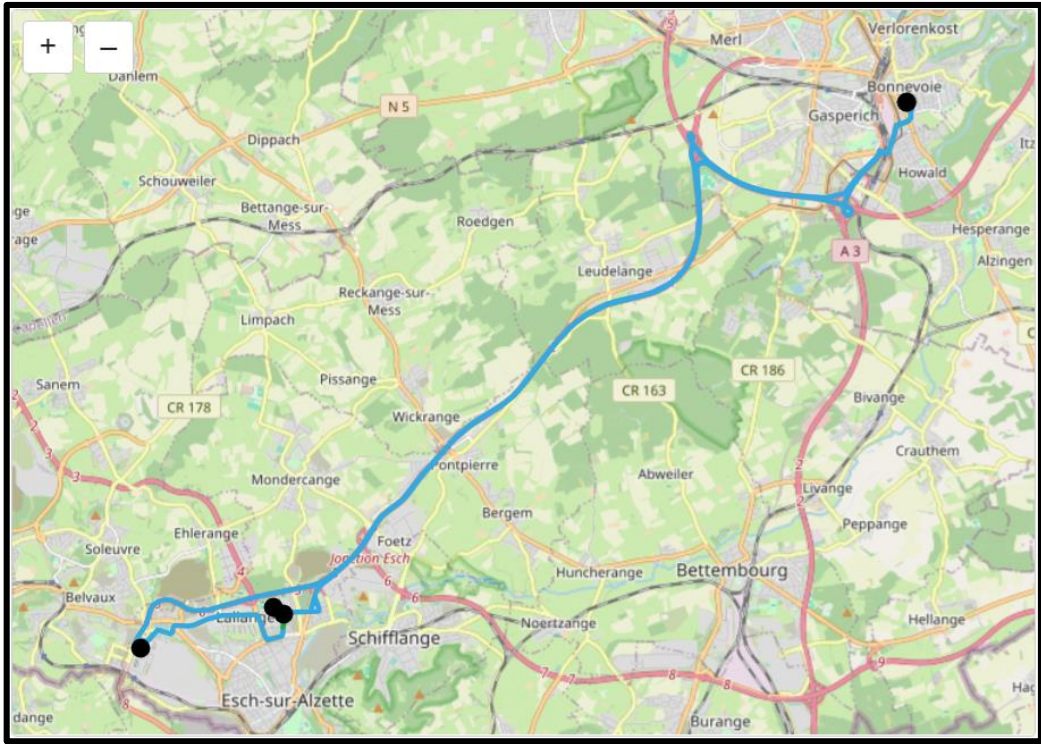
18:46

À pied

18:47

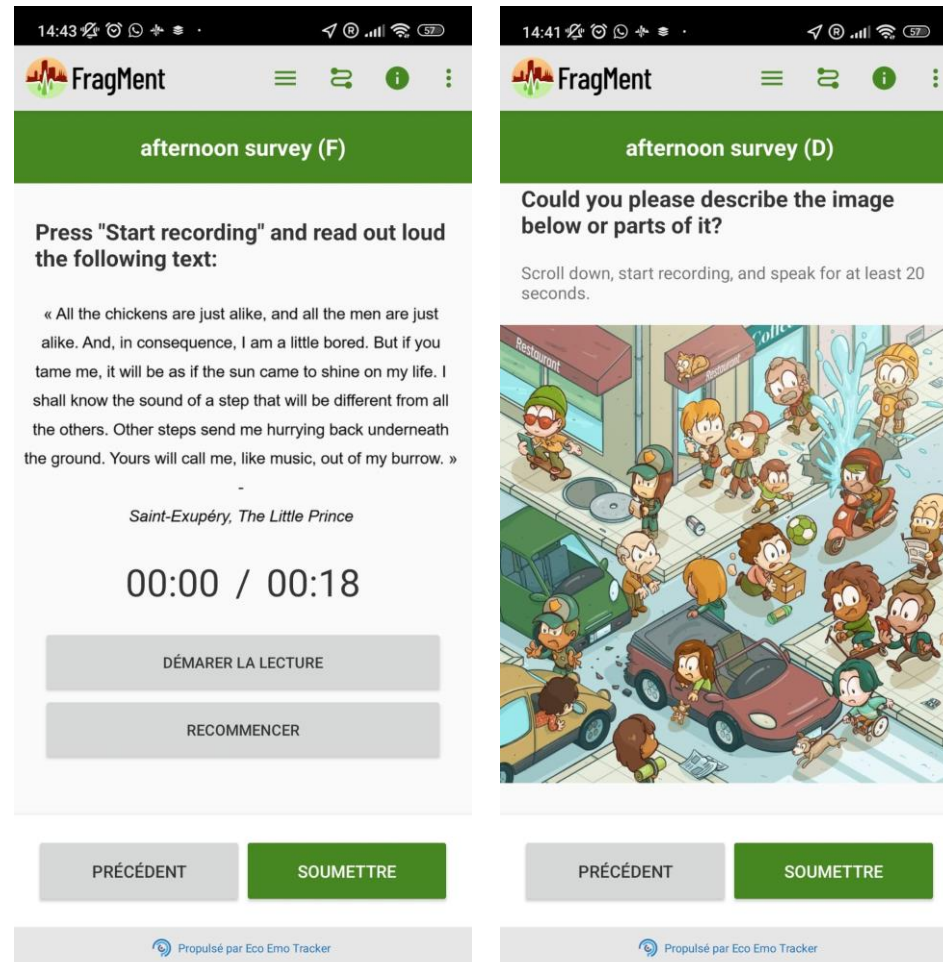
Arrêt

Propulsé par Eco Emo Tracker



# FragMent mobile survey: vocal tasks

A measurement of physiological stress via the voice !



# Virtual reality experiments to study stress

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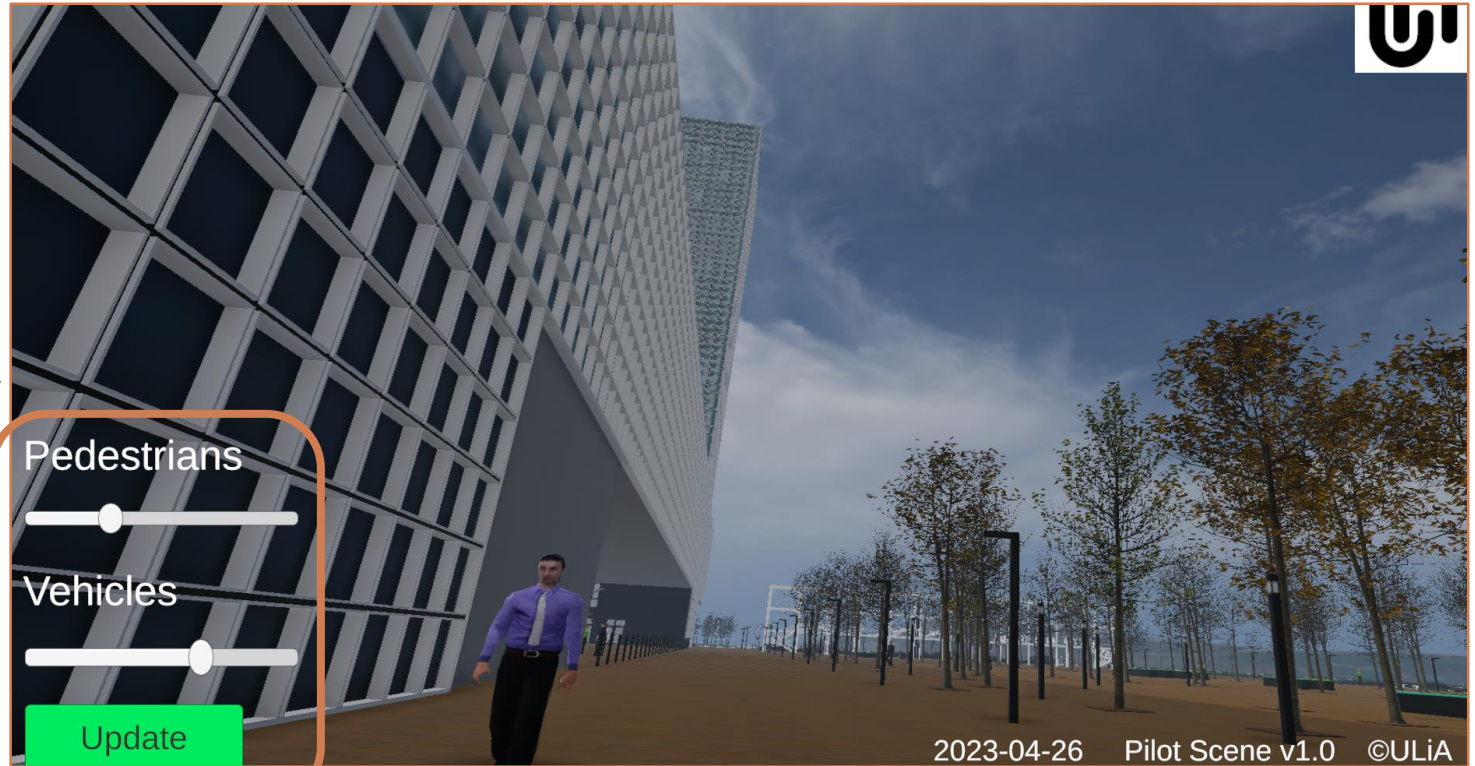




# Why controlled virtual experimentation?



**Virtual reality experimentation** makes it possible to **systematically manipulate** and **test controlled virtual environments**, while maintaining a **high level of realism** to ensure strong **ecological validity**. (Birenboim, 2021)



Manipulate and evaluate the attributable part to each factor



# Stress measurements in VR

Real-time  
physiological data  
(HR, ST, EDA)



**Empathica E4**

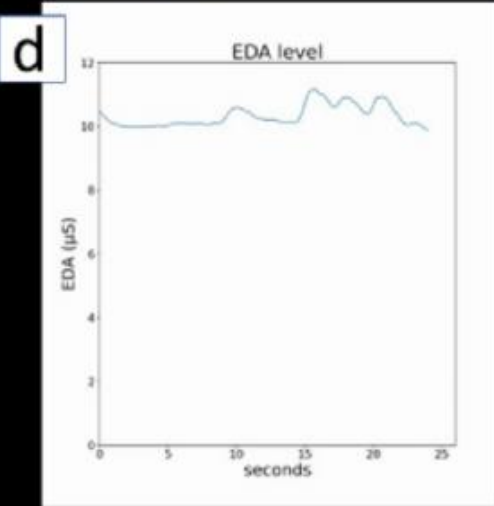
*Other biosensors to be tested (EEG)*

Psychological  
stress



**How stressed are you?**  
*1 ("Not at all stressed out")*  
**to**  
*4 ("Very stressed out") scale*

# Experimental setting: combining IVEs with biosensors



**Source:** Birenboim, A., Ben-Nun Bloom, P., Levit, H., & Omer, I. (2021). The study of walking, walkability and wellbeing in immersive virtual environments. *International journal of environmental research and public health*, 18(2), 364.

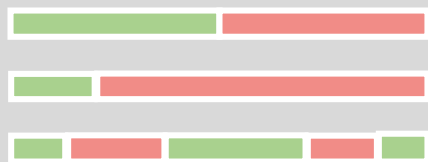




# Expected results

## A new analytical framework for neighborhood effects on health

**Acknowledgement of  
the « meaning of time »**



**Better assessment of  
social inequalities in stress**



## Robust evidence on environmental stressors in daily life

**Advances in risk  
assessment**



**New knowledge on  
environmental stressors**



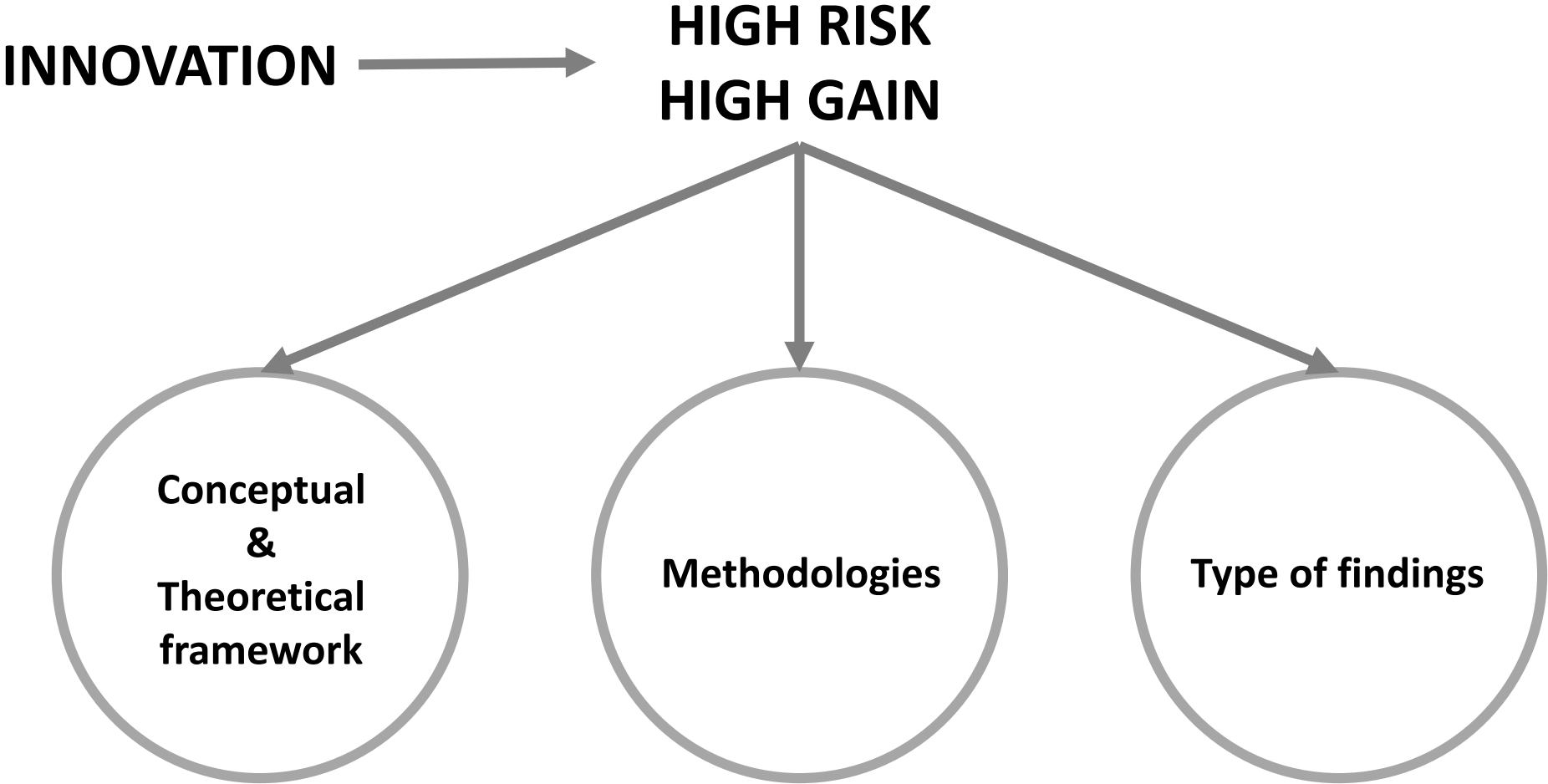
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# Preparing your ERC proposal: general considerations, timeline, and more...



# Innovation is key

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# FragMent innovation points

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- **A new conceptual framework...**
  - bridge geography & epidemiology
  - disentangle the « notion of time » in place and health research
  - better understanding of social inequities in neighborhood effects on stress
- **Use of VR technologies...**
  - while walking in virtual environments
  - in combinaison with biosensors
  - a newly « validated » experimental setting
- **Use of vocal biomarkers in real-life environments**
  - First study to use vocal biomarkers linked to environmental stressors
  - First study to use vocal biomarkers with a GEMA study design
  - Longitudinal study with vocal biomarkers of stress (15 days)
- **New knowledge from different methodologies on environmental stressors**



# You DO NOT NEED to master everything

---

## **My background & core expertise**

- Geography and public health epidemiology
- Accounting for daily mobility in neighborhood and health research
- Methods: map-based questionnaires, GPS, GIS, spatial and epidemiological models

## **BEFORE THE ERC**

## **What I had never investigated**

- Stress
- Focus groups methodology
- Virtual reality
- Experimental research
- Vocal biomarkers
- Data collection campaign



# You DO NOT NEED to master everything

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## **BEFORE THE ERC**

### **What I had never investigated**

- Stress
- Focus groups methodology
- Virtual reality
- Experimental research
- Vocal biomarkers
- Data collection campaign

### **What I had already investigated**

- Numerous health outcomes
- Space-time exposure measurements
- Transport and daily mobility tools & analyses
- Social inequalities in health
- Longitudinal & cross-sectional study designs
- Intersectorial/participatory workshops



# You should capitalize on complementary expertises



*And show tracks of past/ongoing collaborations  
to increase the feasibility of your project !*



# Integrating colleagues with complementary expertise

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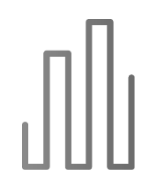
**PhD  
Co-supervision**

**Visitings**

**Steering committee**

**...**





# Preparing well in advance

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**January 2020:** Initial discussions on the general idea (i.e., fragmentation in health)

- Read every abstract of ERC funded projects

**Spring 2020:** Creation of a LISER support committee (meeting every month)

- Conceptual framework
- Short writing exercises (objectives, rational, etc.)
- General discussions on innovation from different disciplines

**Autumn 2020:** Mentoring by an external researcher (ERC grantee)

**Winter 2020:** First draft B2

- Listen to every video on the ERC website
- Create checkboxes and verify this is in your document
- B2 reviewed by Luxinnovation, mentor, head of department, colleagues

**Spring 2021:** B2 Final draft 3-4 weeks before the submission – start of B1



# Oral: practice, practice, practice

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**2**  
**mock Interviews**  
**with interdisciplinary panels**

**15**  
**mock Interviews**  
**with colleagues**

**40-page**  
**document referencing all**  
**questions & answers**



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European Research Council  
Established by the European Commission



# FragMent

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FragMent Project



Projet\_fragment



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