

# Understanding the Role of Contrasted Urban Environments on Healthy Aging: An International Study of Daily Mobility and Active Living Using Wearable Sensors Across cohorts

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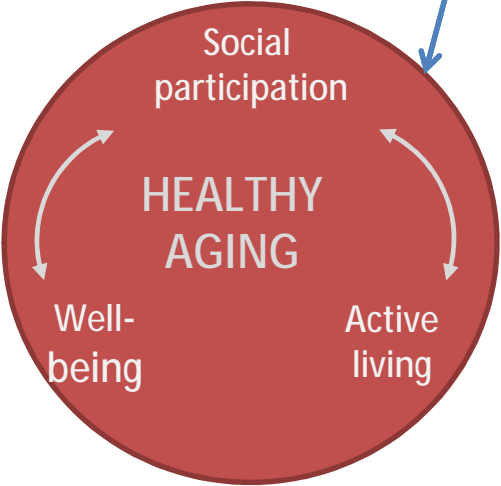
# Context

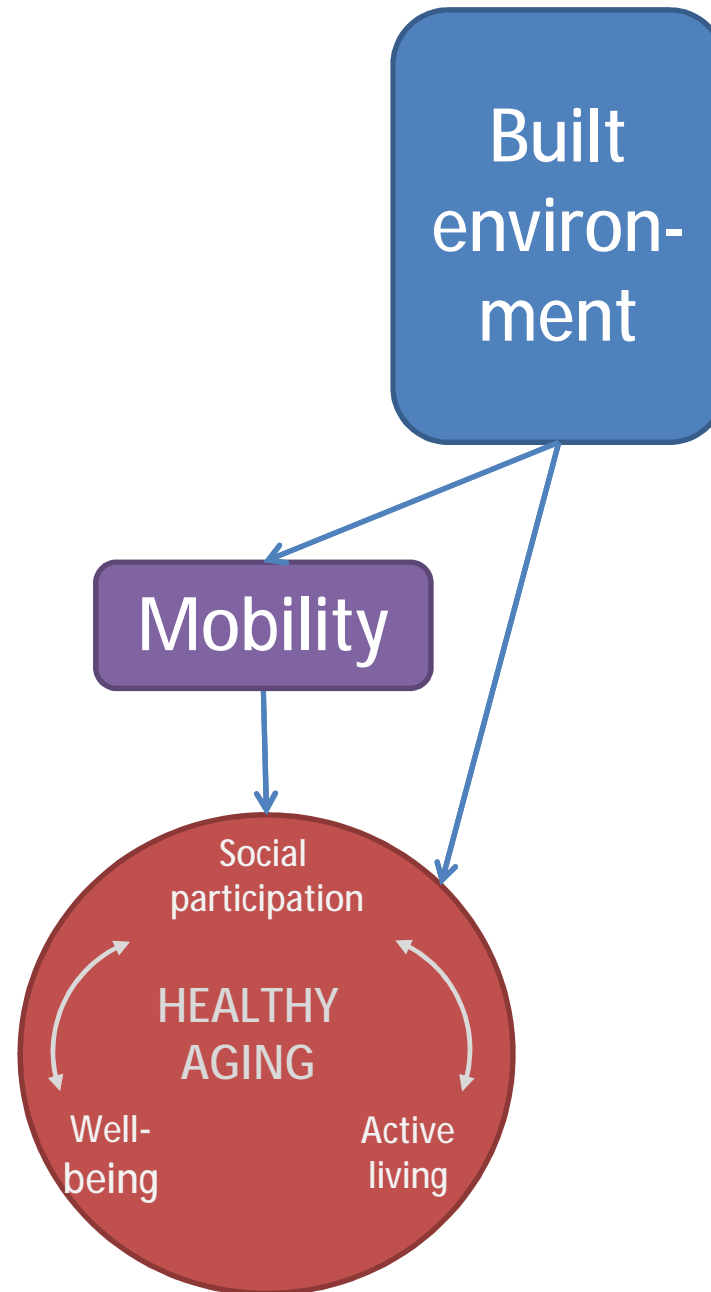
- Increasing number of studies on role of built and social environments on health, but:
  - Not so many studies targeting older adults
  - Lacking full consideration of daily mobility and social networks
- In context of:
  - Increasing 'mobile' and car-dependent world
  - Increasing aging populations and urban dwellers

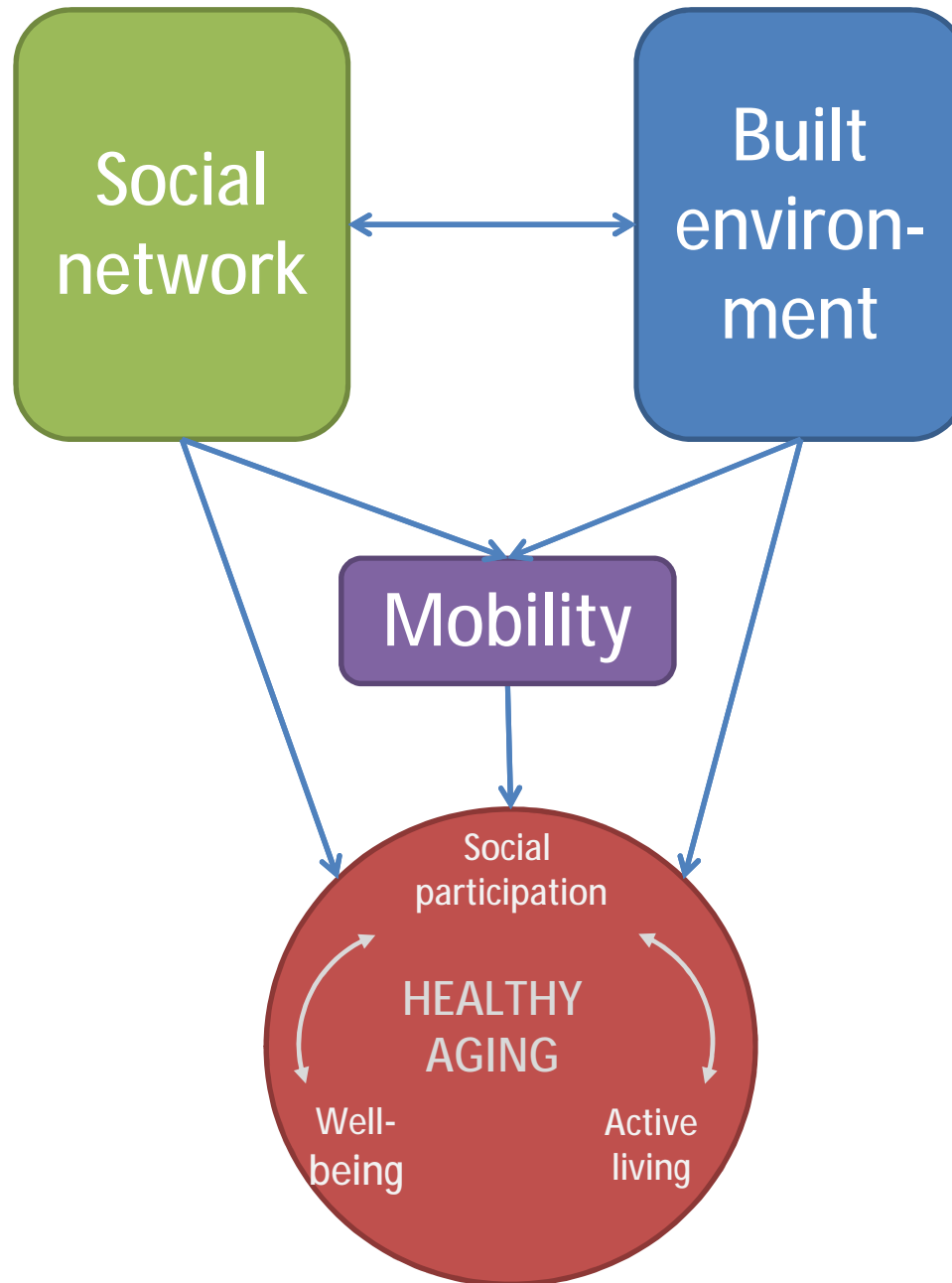
# Objectives of CURHA Project

- Develop and apply an innovative research protocol to better understand how urban environments influence healthy aging
  - Active living – active mobility
  - Social participation
  - Well being
- With objective measures of:
  - Daily mobility patterns
  - Individuals' social networks

Built environment





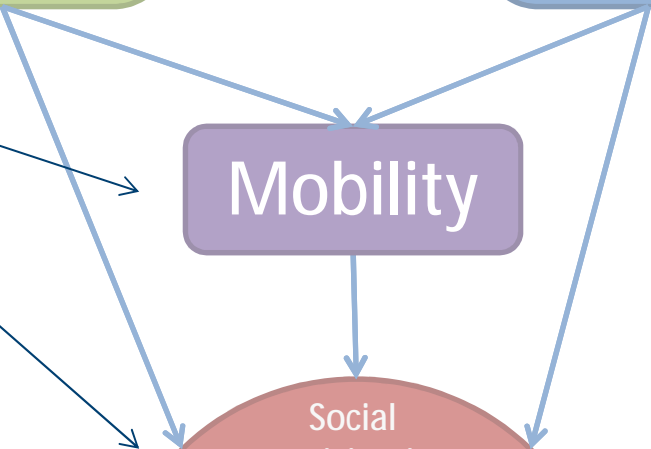
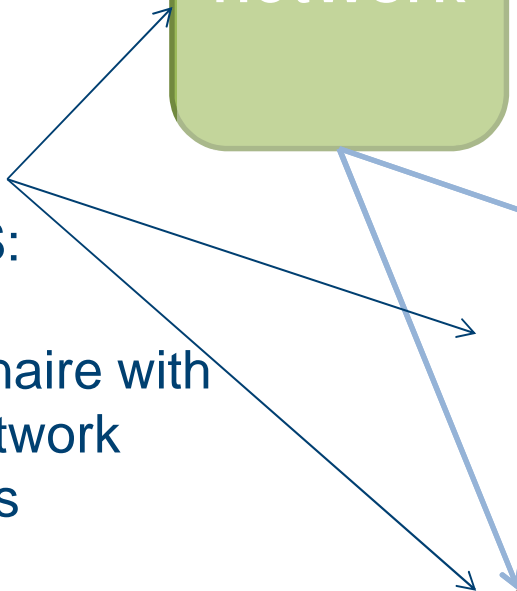
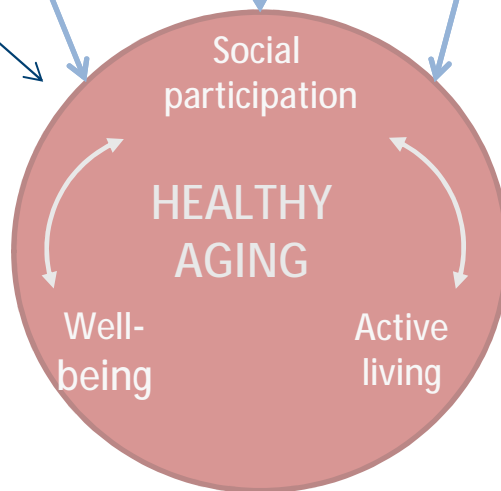
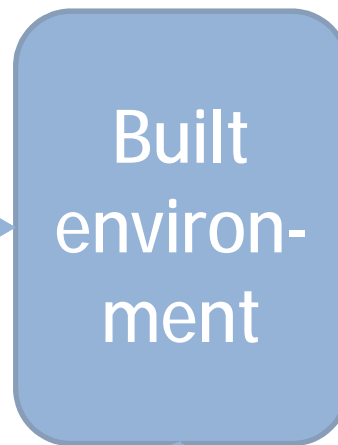


# Methods

- Innovative mixed-method data collection protocol using
  - Interactive map-based questionnaires
  - Wearable sensors
  - Qualitative assessments
- Bringing together three interdisciplinary research teams from Canada, France & Luxembourg
- A shared protocol for comparability and pooling capacity



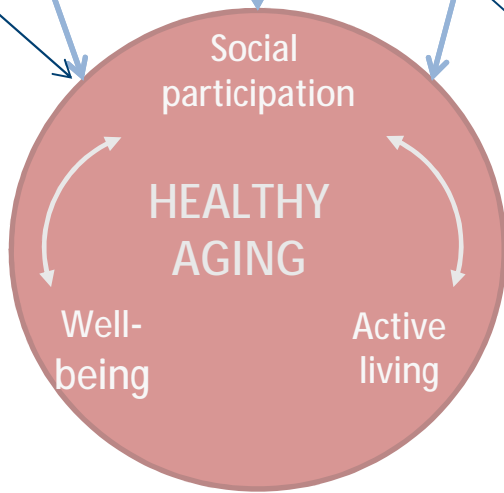
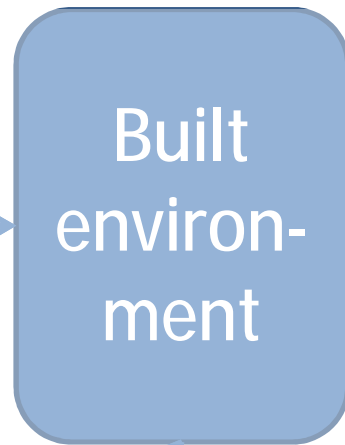
VERITAS:  
Spatial  
questionnaire with  
social network  
capacities



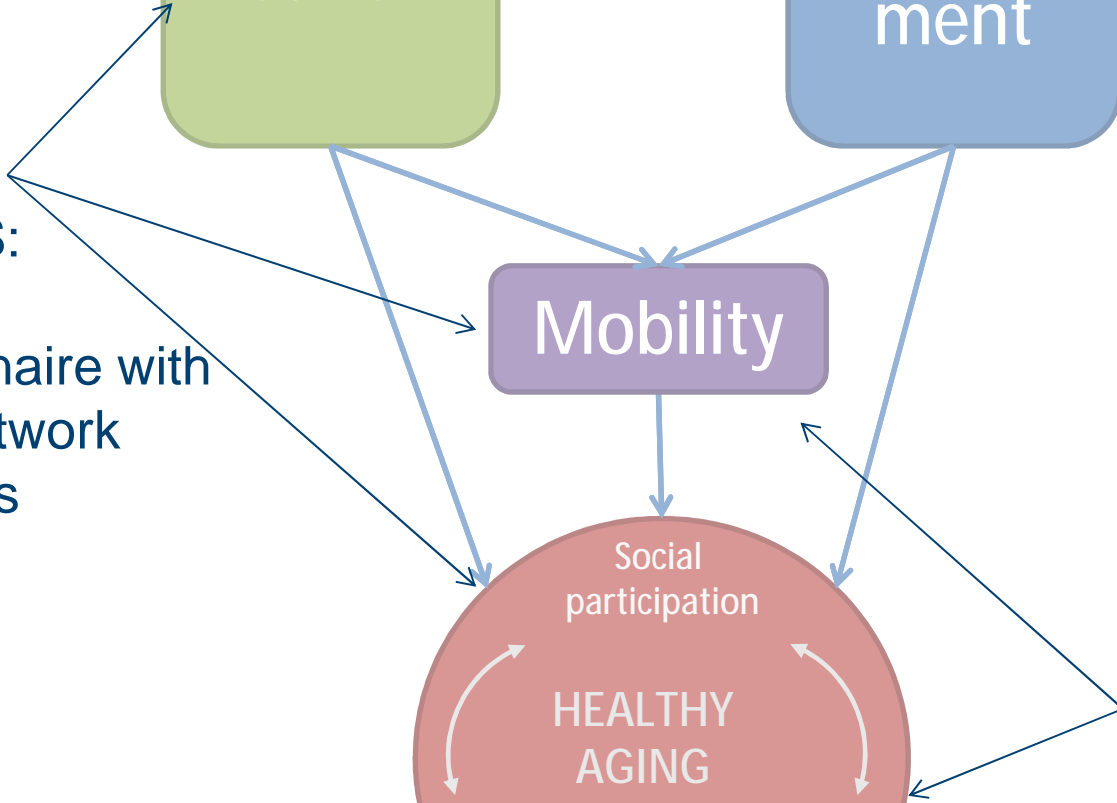


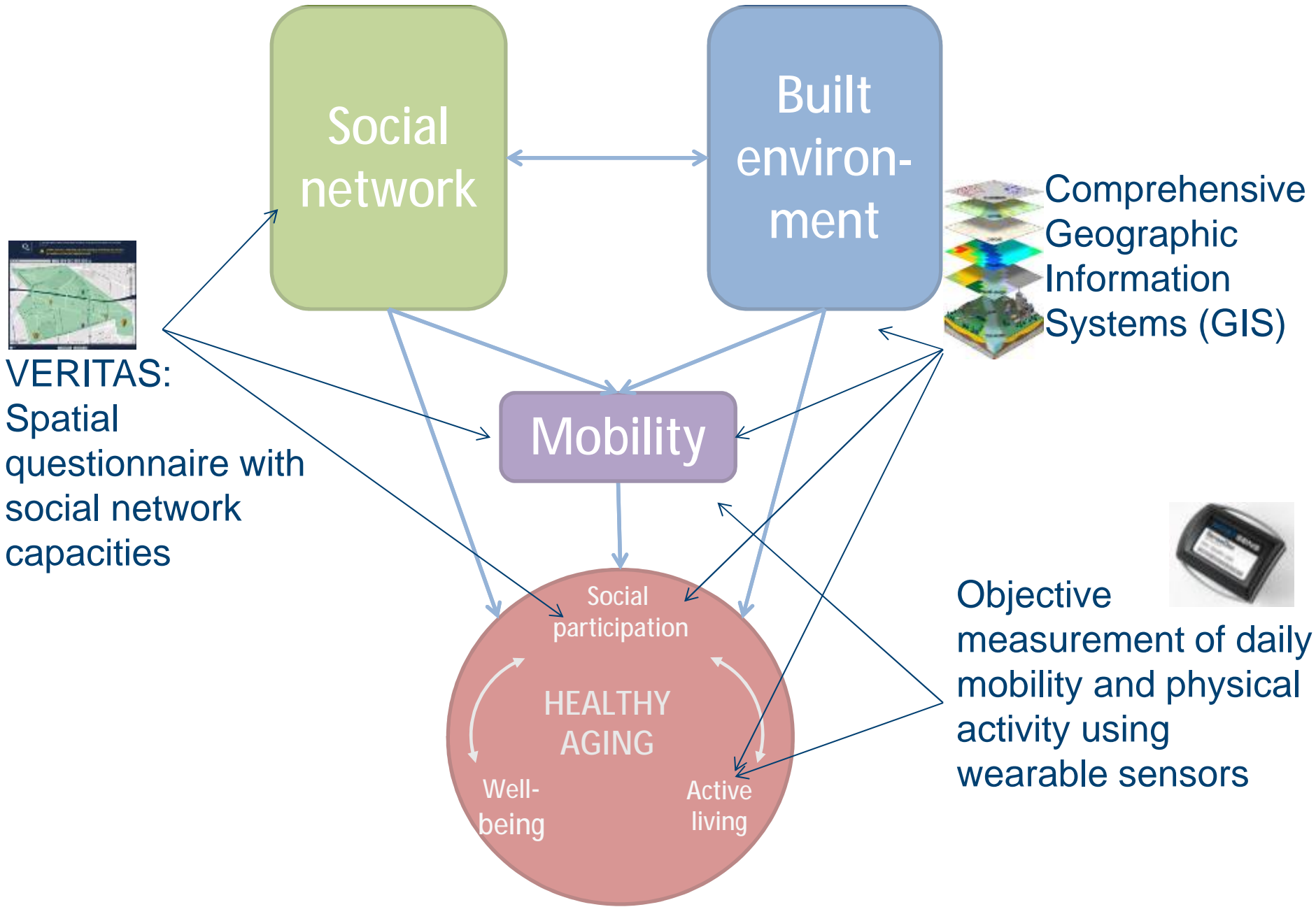


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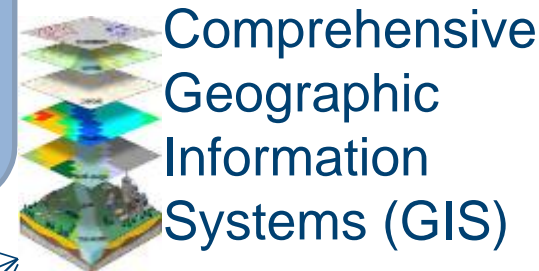


Objective  
measurement of daily  
mobility and physical  
activity using  
wearable sensors





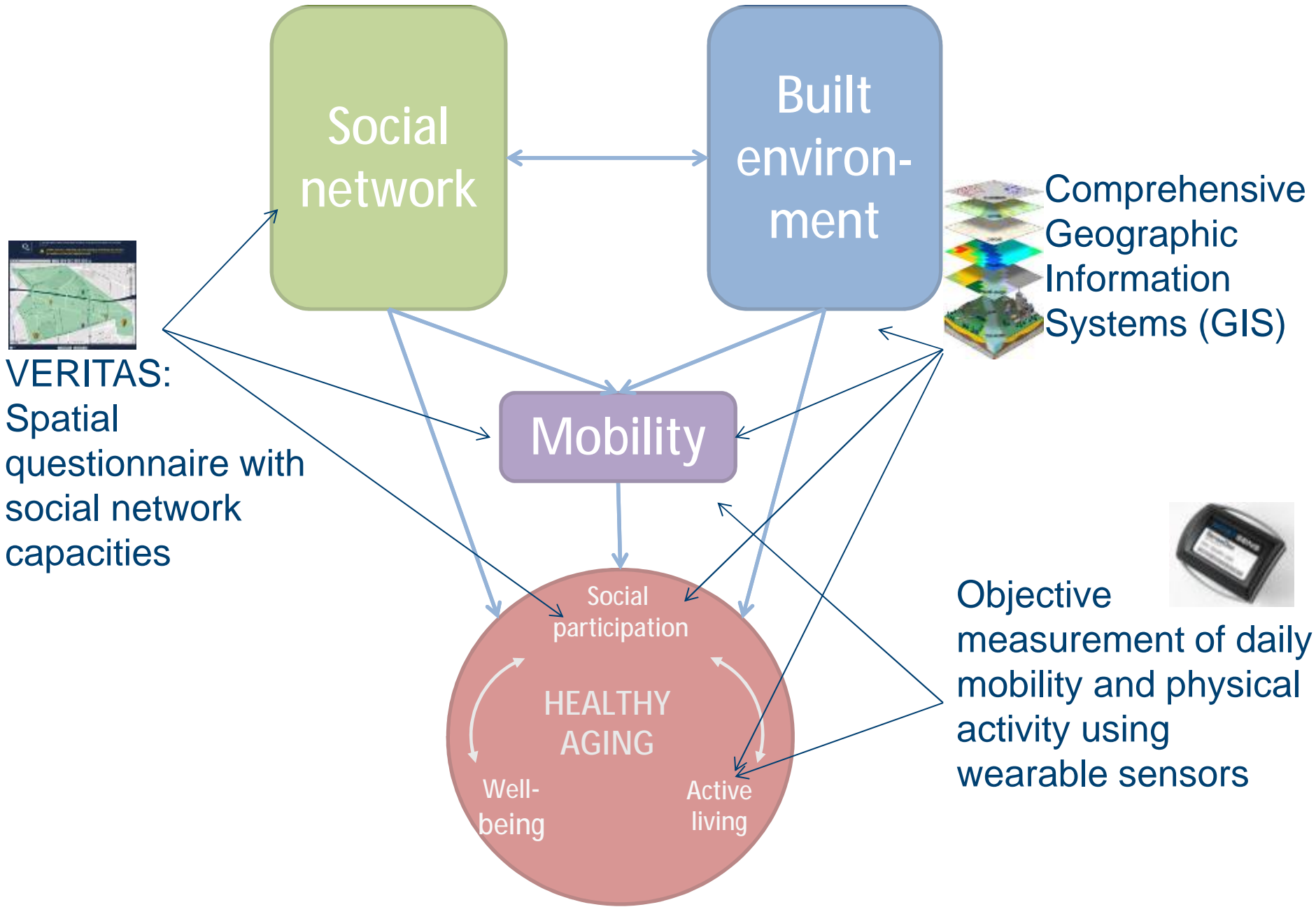
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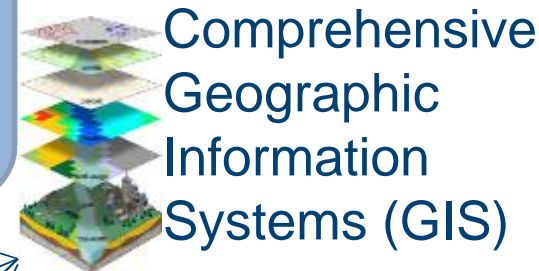
Comprehensive  
Geographic  
Information  
Systems (GIS)



Objective  
measurement of daily  
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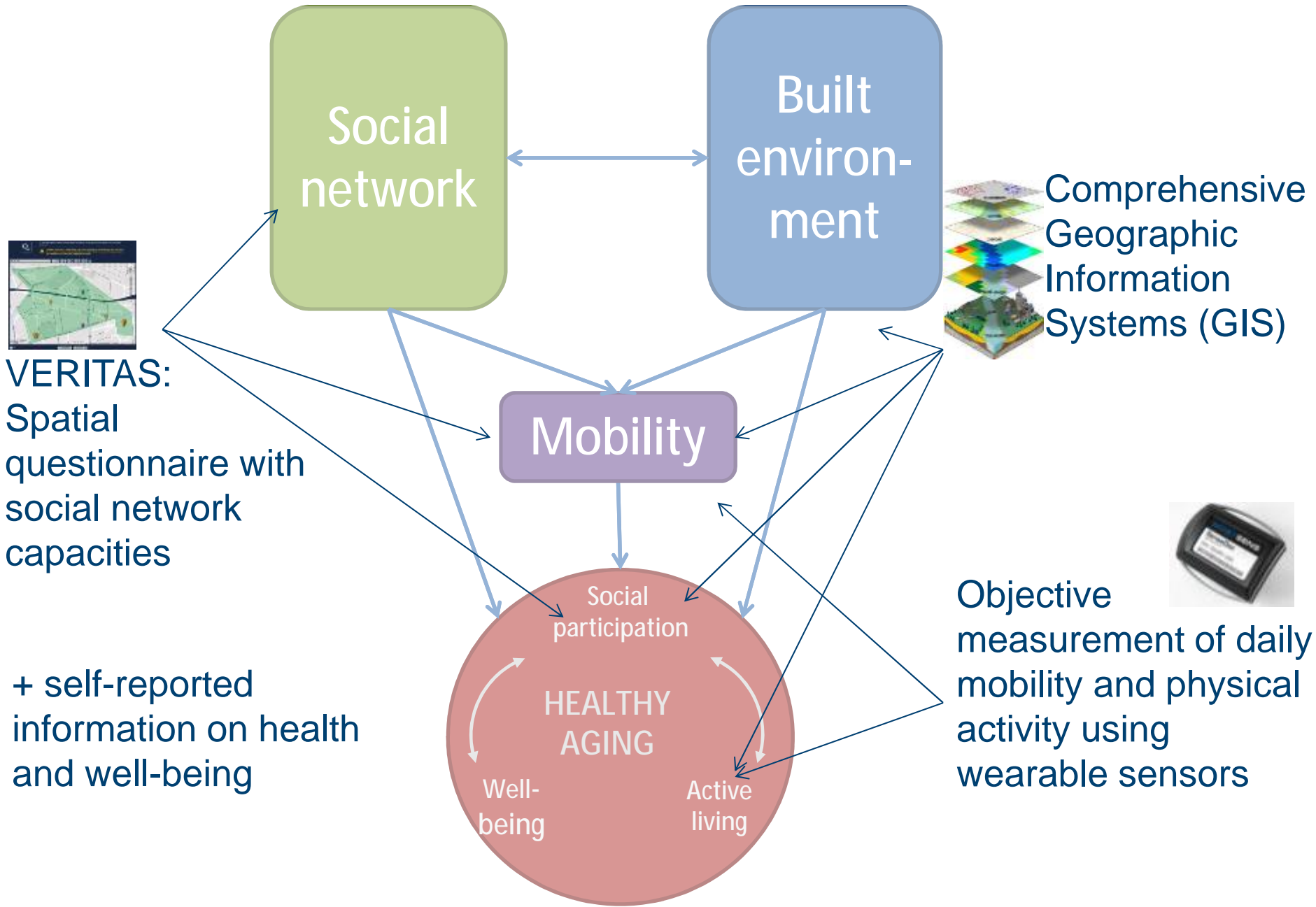
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Social network

Built environment

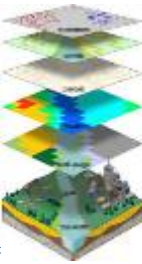
Comprehensive Geographic Information Systems (GIS)

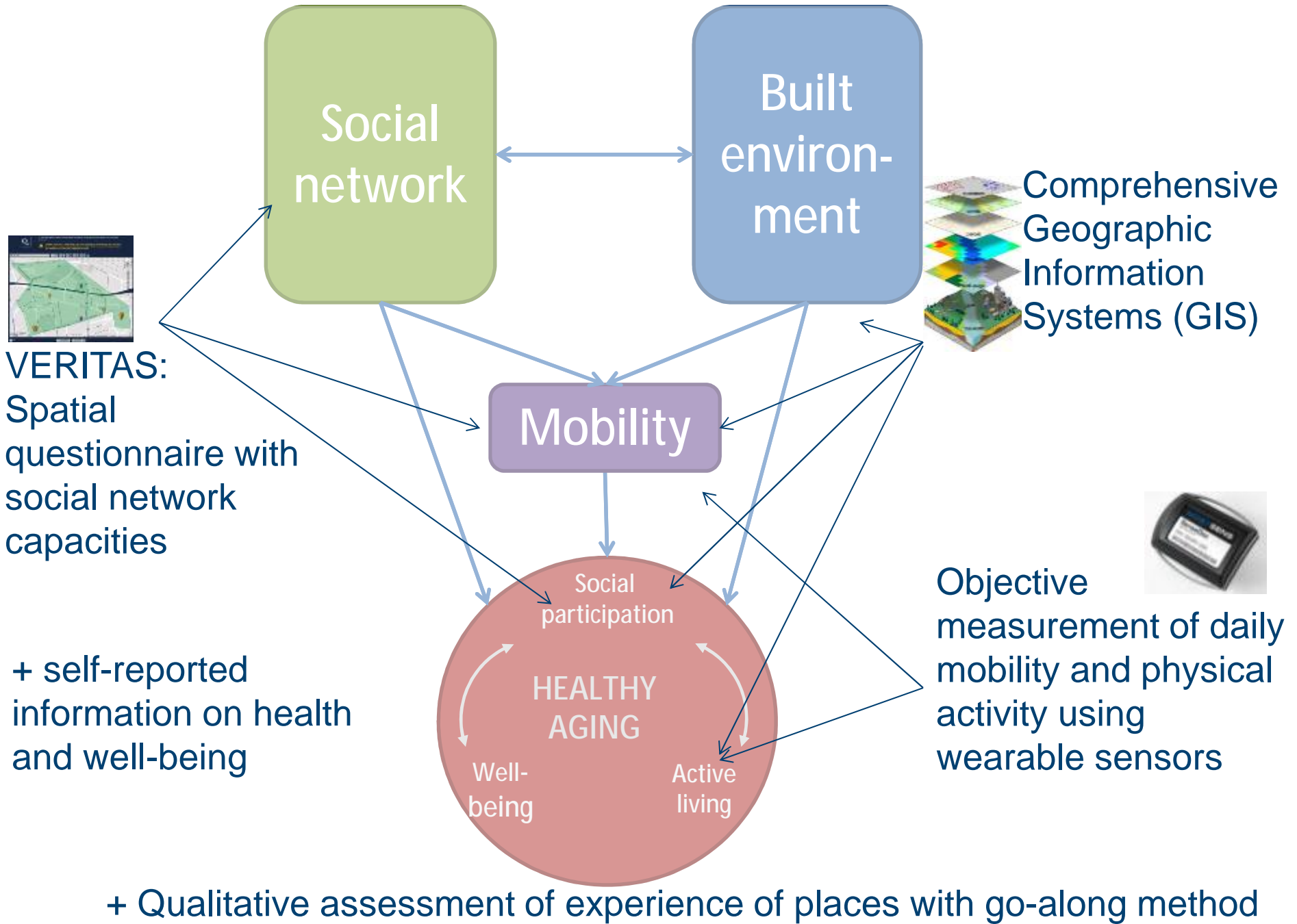
Mobility

Social participation  
 Well-being  
 HEALTHY AGING  
 Active living

VERITAS: Spatial questionnaire with social network capacities  
 + self-reported information on health and well-being

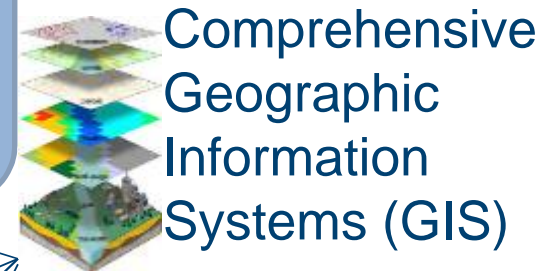
Objective measurement of daily mobility and physical activity using wearable sensors





VERITAS:  
Spatial  
questionnaire with  
social network  
capacities

+ self-reported  
information on health  
and well-being




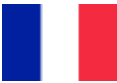

Comprehensive  
Geographic  
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Systems (GIS)



Objective  
measurement of daily  
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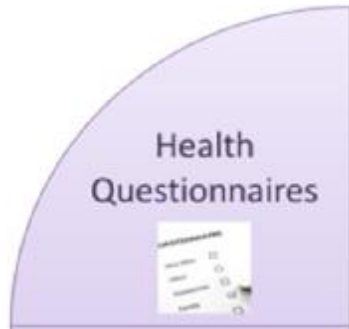
+ Qualitative assessment of experience of places with go-along method



-  – Canada: Sub-sample of NuAge cohort, baseline: 2005. CURHA: 173 participants, aged 79+
-  – France: Sub-sample of RECORD Study, baseline 2007, 520 participants with GPS and accelerometry
-  – Luxembourg: Newly created cohort, 500 participants at completion (Dec 2015), aged 65+







# Questionnaires

## Health

SF36  
MMSE  
Geriatric  
Depression Scale  
Subjective  
Happiness Scale  
Intern. Physical  
Activity Q.  
PASE

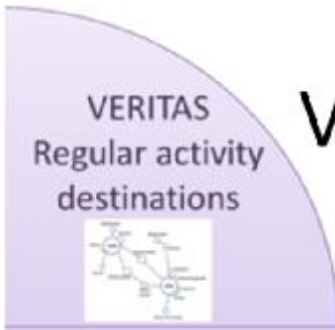
## Neighbourhood

Perceived  
accessibility  
Social capital

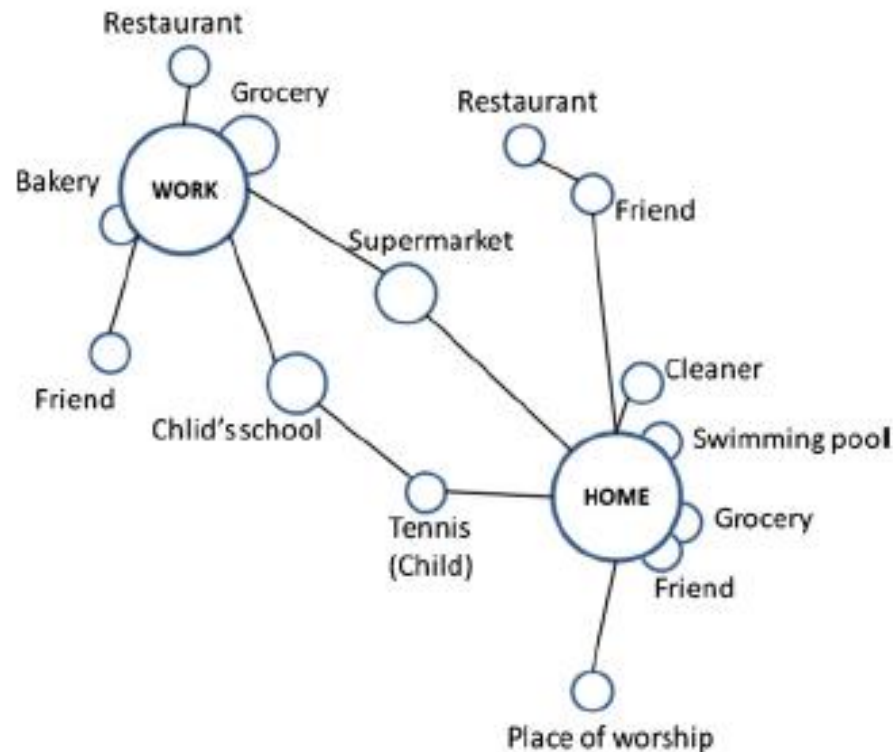
## Mobility

Life Space  
Questionnaire  
Transportation  
modes perception





# VERITAS: Collecting regular activity places, and more



Perchoux et al (2013) Conceptualization and measurement of environmental exposure in epidemiology: Accounting for activity space related to daily Health and Place, 21, 86-93

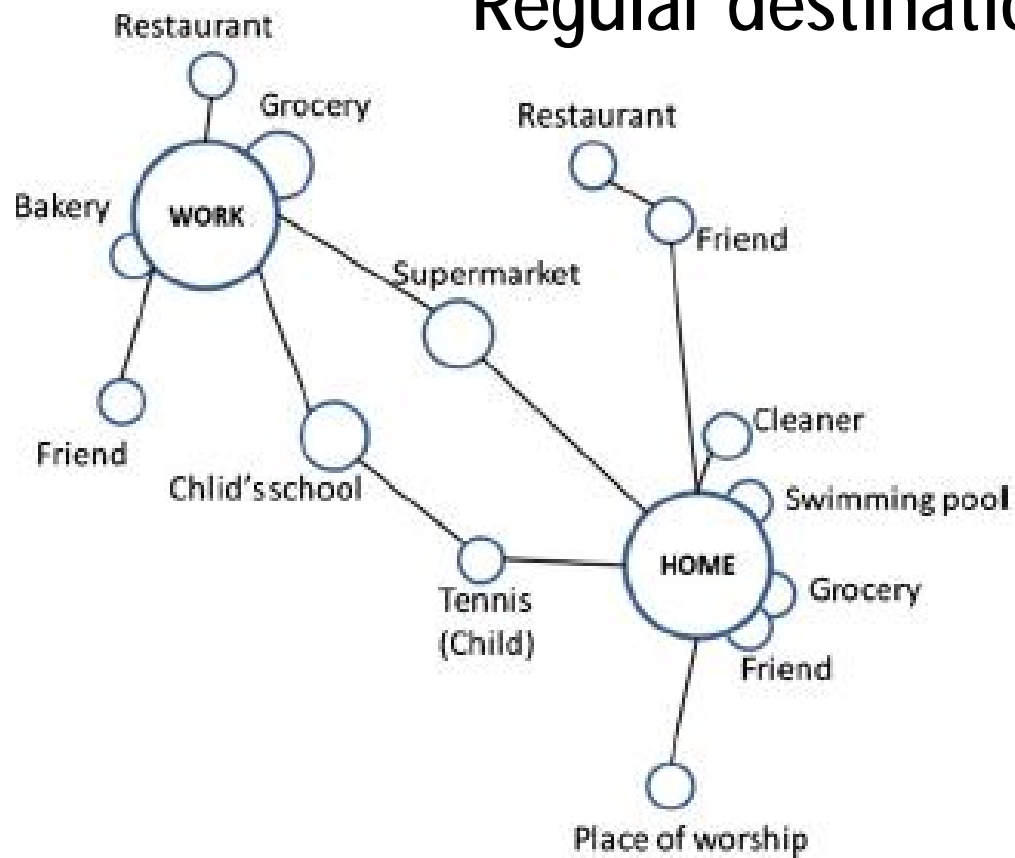
Chaix, B., Y. Kestens, C. Perchoux, N. Karusisi, J. Merlo and K. Labadi (2012). "An interactive mapping tool to assess individual mobility patterns in neighborhood studies." Am J Prev Med 43(4): 440-450.

Social Network module added to VERITAS



# Social Network Module within VERITAS

## Regular destinations – ‘With whom’?

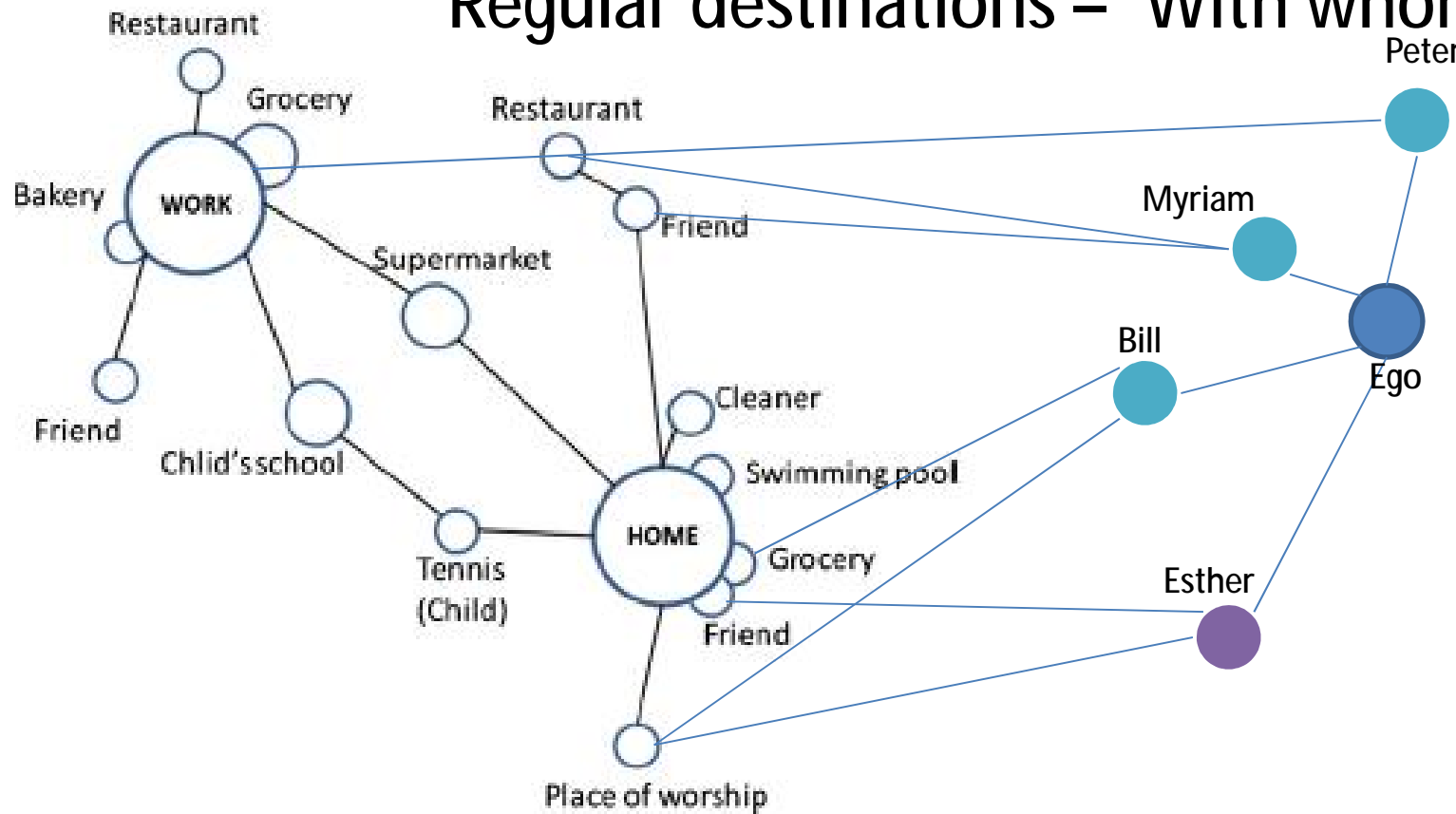


Social Network module added to VERITAS



# New Social Network Module added to VERITAS

## Regular destinations – ‘With whom’?

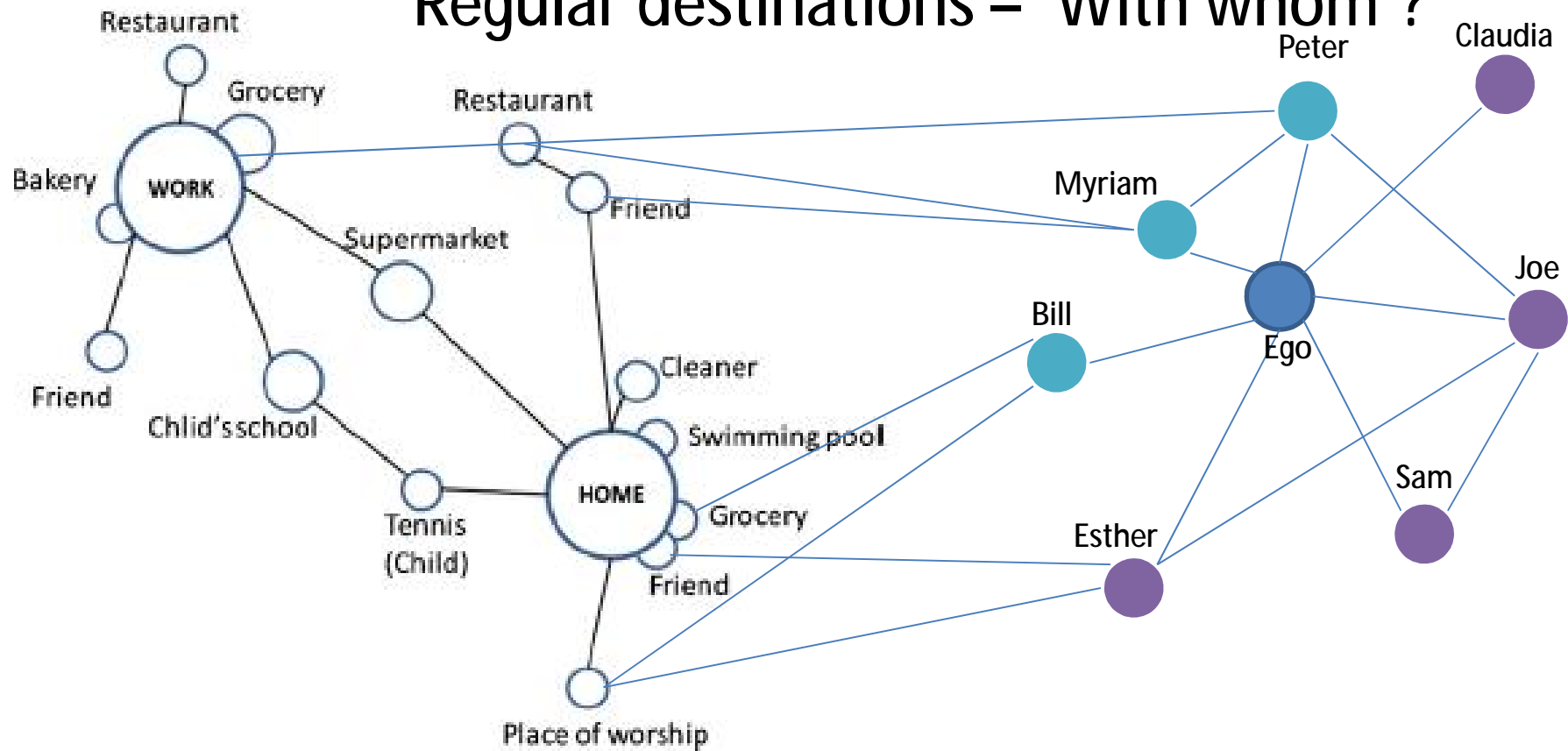


Social Network module added to VERITAS



# New Social Network Module added to VERITAS

## Regular destinations – ‘With whom’?





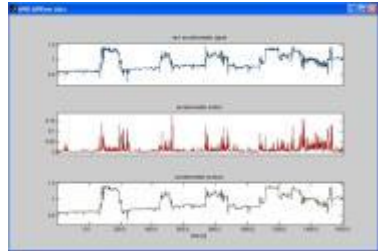
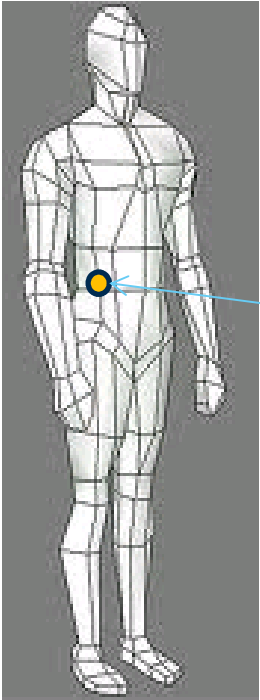
# Innovative tools: 7-day multisensor data collection

- Participants wear the SenseDoc for 7 days at the hip
  - Continuous GPS
  - Continuous accelerometry (50Hz)



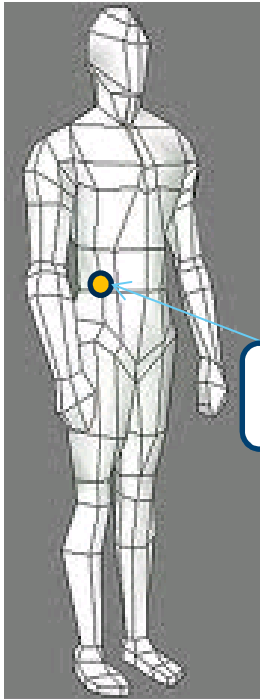
7-day GPS and  
accelerometry

# SenseDoc Multisensor Device



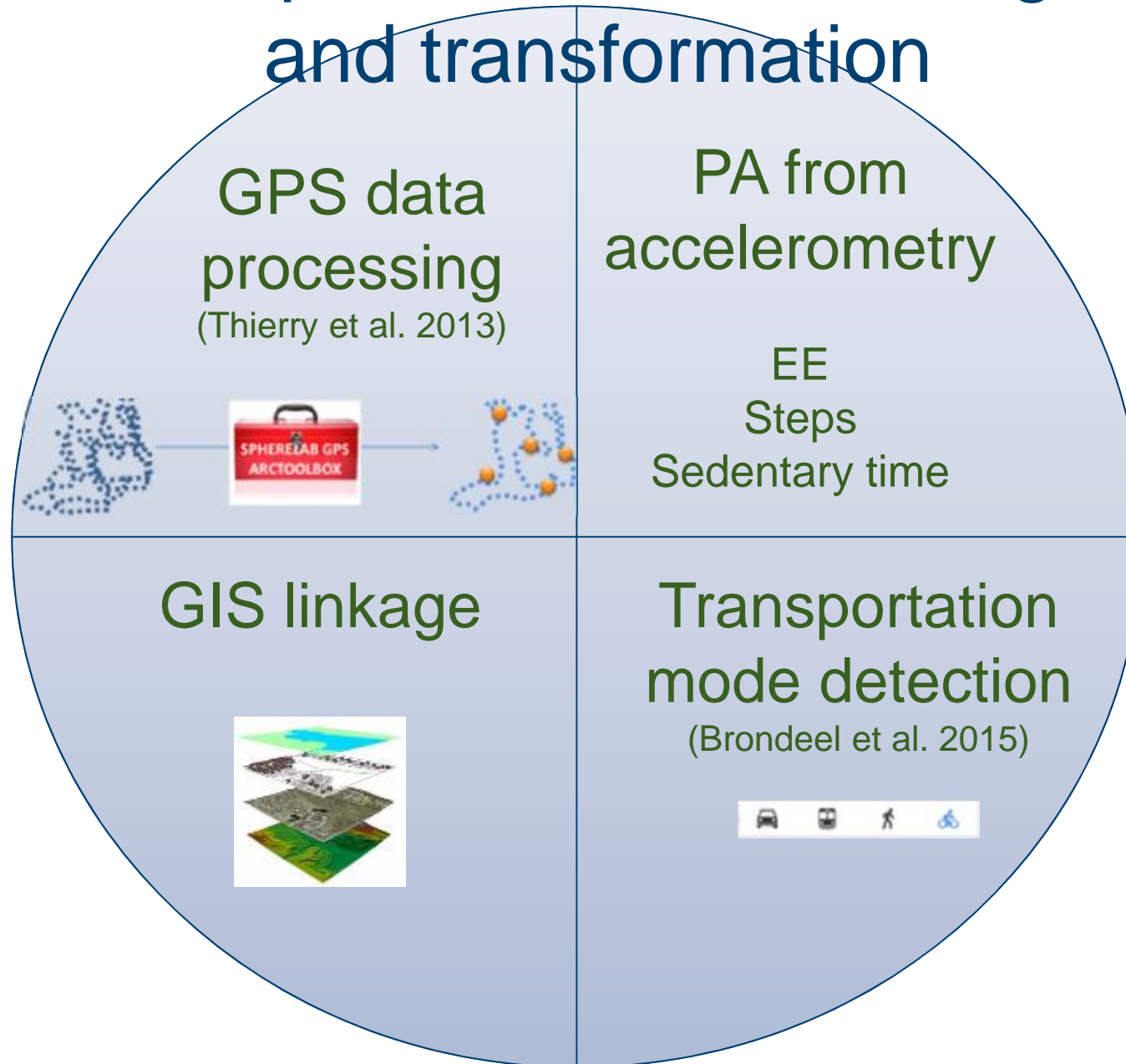
7-day GPS and accelerometry

# SenseDoc Multisensor Device



Acquisition

# A shared protocol for data integration and transformation





**Preliminary results  
(Data collection ongoing...)**

# VERITAS Destinations (Av. 14.9)



## Social / Cultural activities

Activity	n	Median Distance
Visiting friends/family	115	6,57
Cultural activities	70	3,83
Café / Bar / Restaurant	77	2,08
Sport activities	41	2,03
Spiritual / Religious / NCC	41	0,99
<b>Total/Average</b>	<b>344</b>	<b>2,62</b>



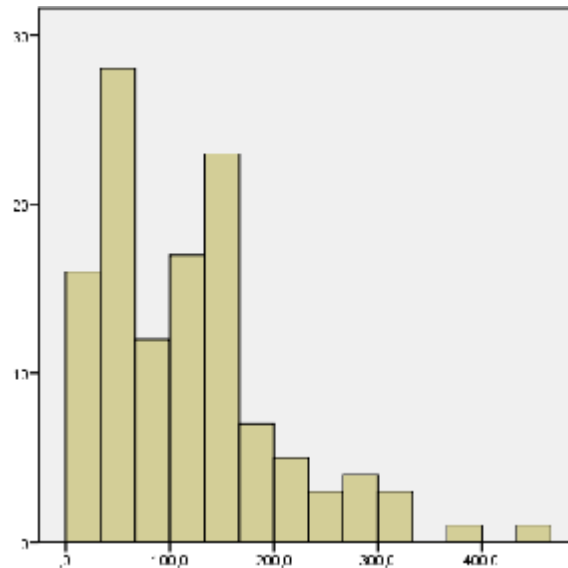
## VERITAS activity locations in relation to age

	Age		
	79 to 82	83 to 85	86 and up
Veritas number of locations	12	12	11
Veritas distance to home	3,1	3,5	2,6
Veritas SDE activity space	43,2	39,7	31,1

# VERITAS Destinations



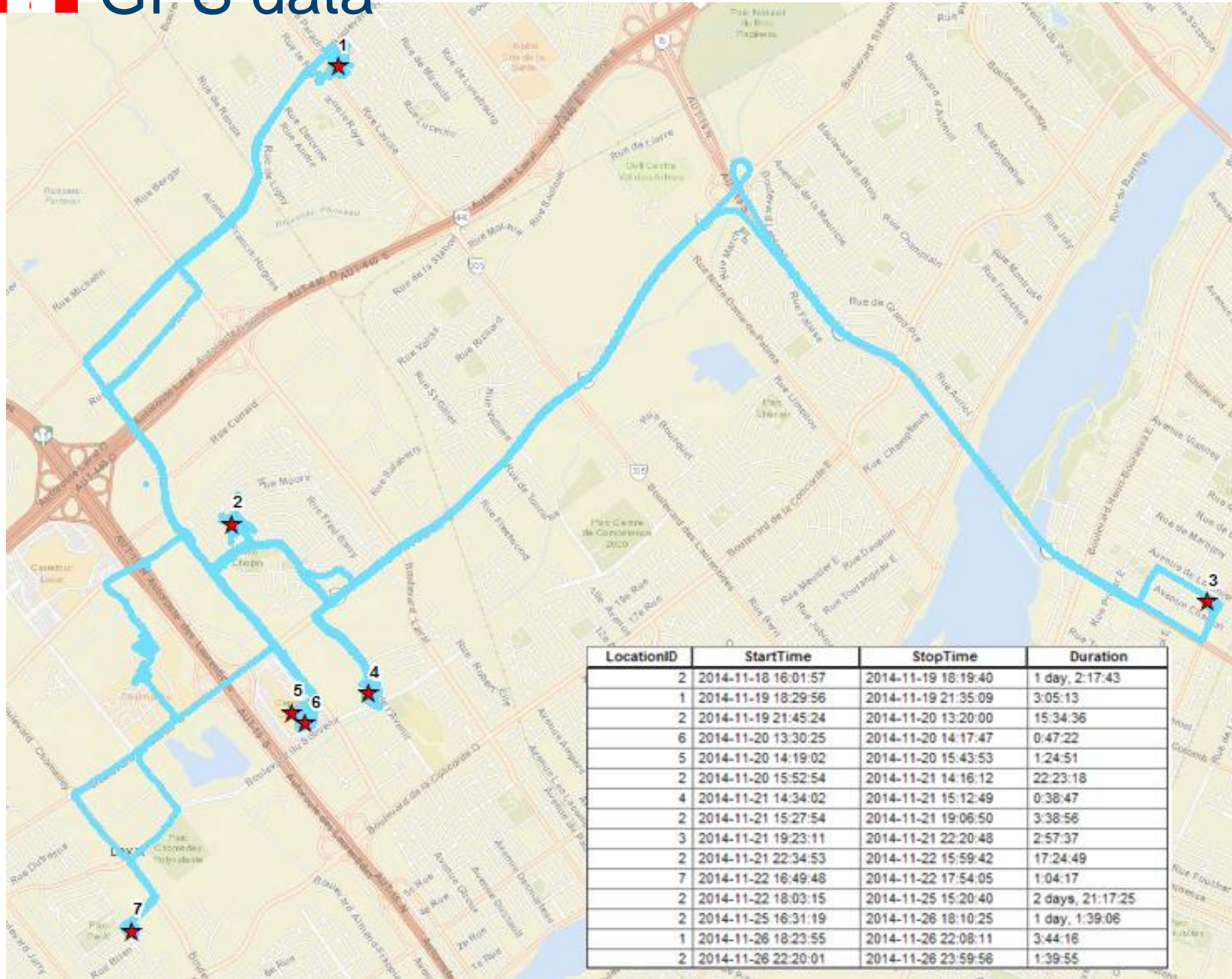
	Mean	Median	N	S. Dev	Minimum	Maximum
<b>Trips / activities per month</b>	<b>118,0</b>	<b>110</b>	<b>120</b>	<b>85,7</b>	<b>2</b>	<b>452</b>



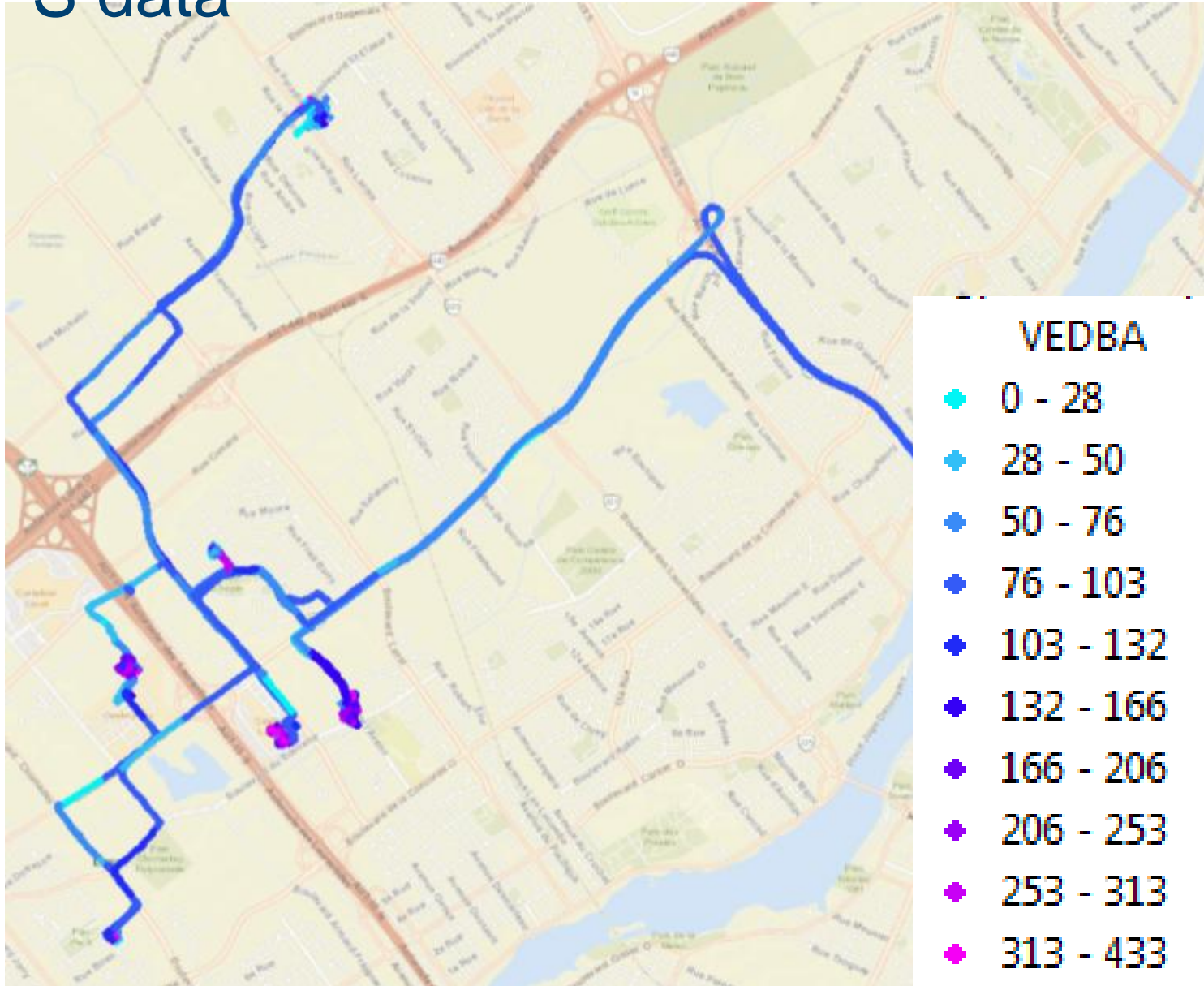
**# of trips / activities per month (distribution)**



# GPS data



# GPS data



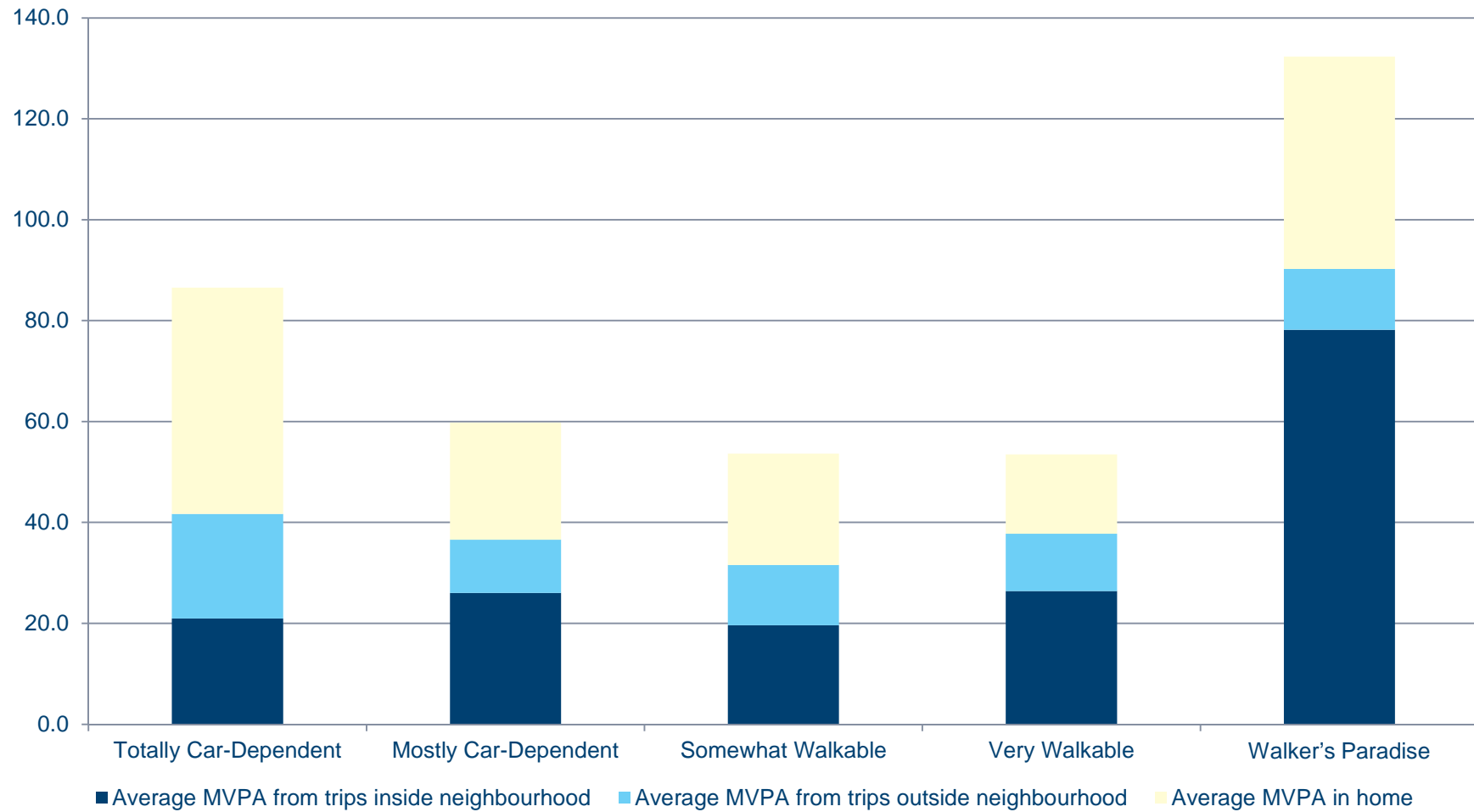
# GPS data



	Age		
	79 to 82	83 to 85	86 and up
GPS number locations	9	8	4
GPS locations distance to	3,5	4,5	2,3
GPS time outside home	13	10	6
GPS total trip length	91,8	90,0	35,0
GPS SDE Area Size	30,9	30,4	6,9
GPS Convex Hull Size	50,2	34,9	4,5



# Combining GPS, accelerometry and walkability

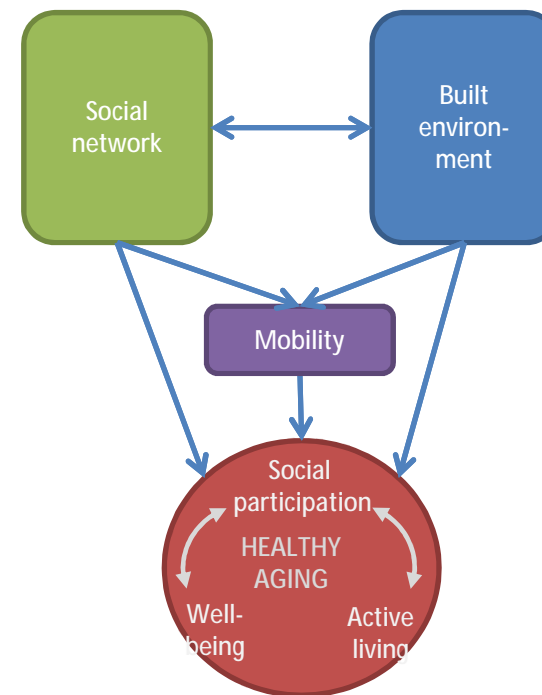




# Currently working on...

- Modelling walking trip prediction
- Modelling number of activity / trip locations
- Typologies of spatial mobility patterns / activity spaces
- Development of accessibility and walkability indicators

**+ multiple other analyses to come!**

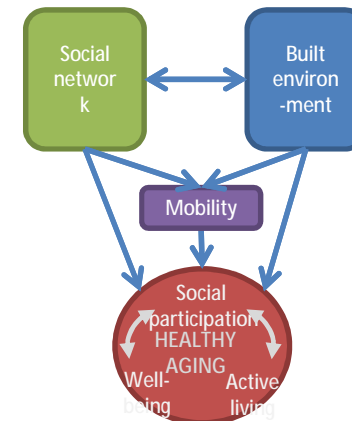
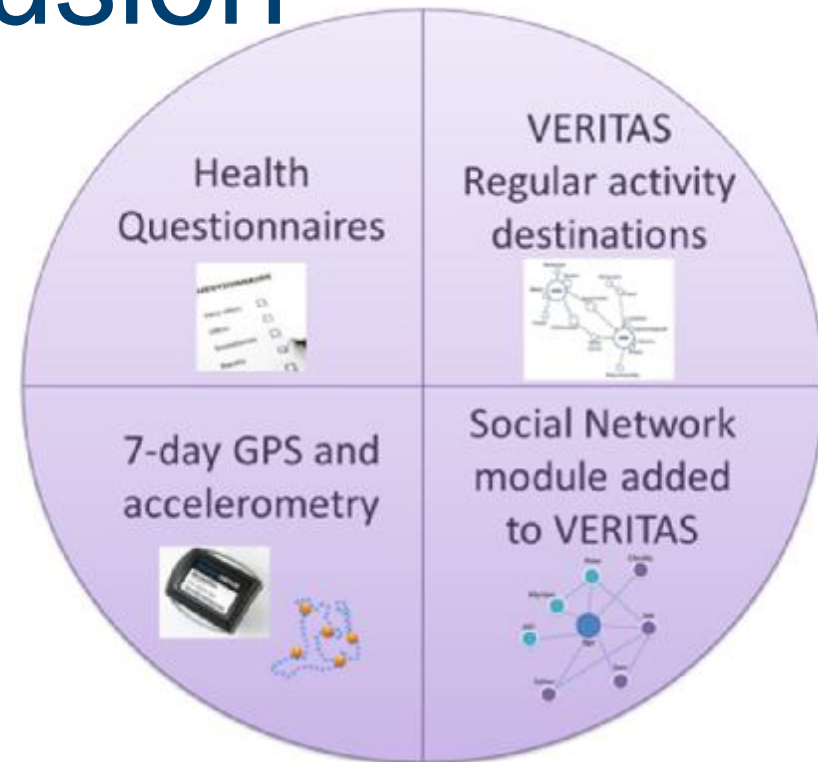


# Conclusion

à A comprehensive protocol for studying relations between built environments, mobility, social networks and healthy aging

à Protocol and tools available for other cities

à New ANR funding 2015: HANC: Healthy Aging in Cities: The combined role of social networks and built environment (Sueur et al.)



# Thank you!



Special thanks to the study participants!



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