Alliance for
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SIGNATURE EVENT

IoT and Edge computing : Societal Impact and Opportunities for the Green Digital Twin Transition

27 Sep | Brussels

2022

Diamond sponsors:

SIEMENS vodafone

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AIOTI Signature Event • 27 September 2022

How can IoT be deployed to foster mental and physical health in Urban Societies, thereby putting the weight on disease prevention instead of treatment?

Moderator
Celine Prins (AIOTI WG Urban Society Chair, Institute for Future of Living)

Meet our panelists

- Professor Jane Walsh (University of Galway)
- Fa Somers (Arthur's Legal)
- Pietro Dionisio (Medea)
- Asbjørn Hovstø (Hafenstrom AS)

Current State of Play, some key facts

70%

18.0% CAGR ('21-'26)

2030 -1 in 6 people

IoT

EUR 454b by 2028

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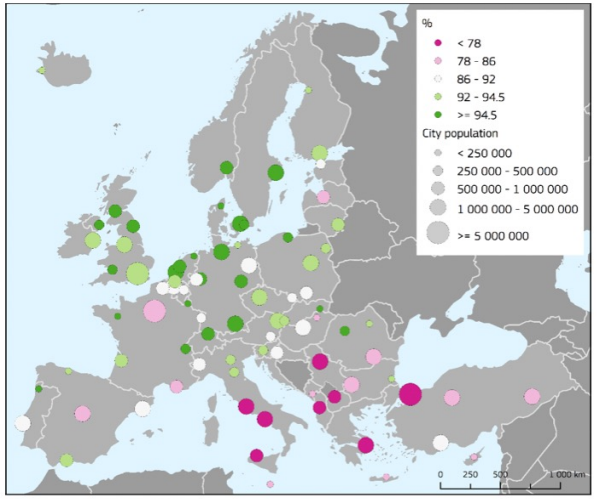
Are people in European cities….

Are people satisfied to live in their city?



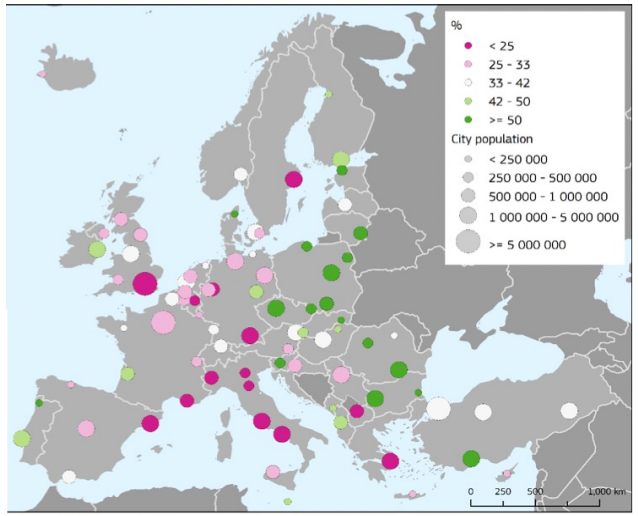
Satisfaction with living in the city

I am satisfied to live in the city: total agree (%)

Source: EC/DG REGIO
Note: %s based on all respondents, excluding don't know/not answered

9 out of 10

Satisfied to live in their city

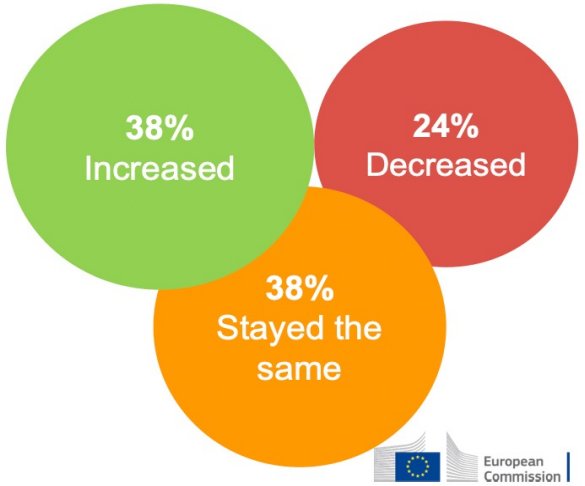


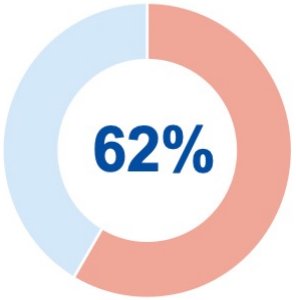
Quality of life in the city increased

Compared to five years ago, would you say the quality of life in your city or area has increased (%)

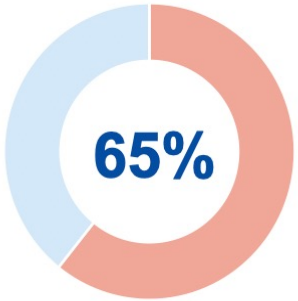
Source: EC/DG REGIO
Note: %s based on all respondents, excluding don't know/not answered

How is quality of life in your city compared to 5 years ago?

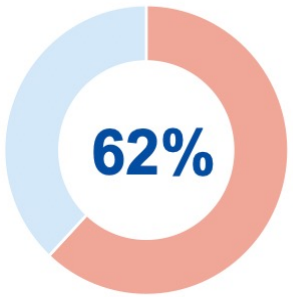




Satisfied with air quality



Satisfied with noise level



Satisfied with cleanliness

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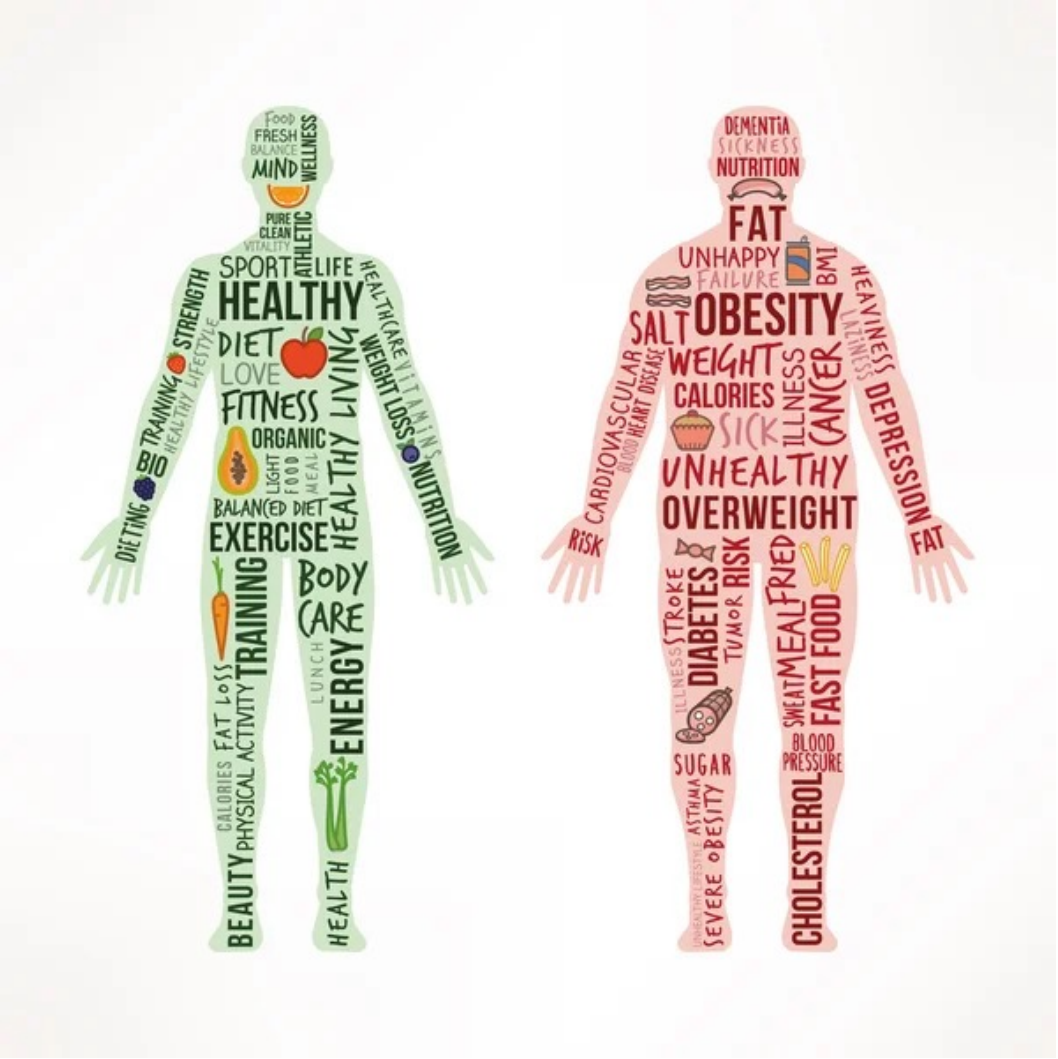
Challenges in Urban Societies

- "63% of deaths globally" are a result of unhealthy behaviour and lifestyle related diseases which could be Prevented!"

- Physical inactivity increases all-cause mortality risk by 20–30% correlation with changing patterns of transportation, increased use of urbanization, and technology



- **The European Air Quality in Cities (90%)**

- **Mental Illness in Europe (37%)**

- **Loneliness in Europe**

  (22%- 26% across

  regions)

- **Overweight or Obese in Europe (40%)**

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*https://www.who.int/news-room/factsheets
*Priscila Marconcin et al. 'The Association between Physical Activity and Mental Health during the First Year of the COVID-19 Pandemic: A Systematic Review', *BMC Public Health*, 22.1 (2022), 209 <https://doi.org/10.1186/s12889-022-12590-6>. *'How Lonely Are Europeans?' <https://joint-research-centre.ec.europa.eu/jrc-news/how-lonely-are-europeans-2019-06-12_en> [accessed 21 September 2022].
*Internet of Things (IoT) in Healthcare Market Size, Share & COVID-19 Impact Analysis, By Component (Devices, Software, and Services), By Application (Telemedicine, Patient Monitoring, Operations and Workflow Management, Remote Scanning, Sample Management, and Others), By End-User (Laboratory Research, Hospitals, Clinics, and Others), and Regional Forecast, 2021-2028 (Fortune Business Insights) <https://www.fortunebusinessinsights.com/infographics/internet-of-things-iot-in-healthcare-market-102188>. loneliness in Europe https://joint-research-centre.ec.europa.eu/jrc-news/new-report-loneliness-doubles-europe-during-pandemic-2021-07-26_en

Definition of Health

- World Health Organisation (WHO) defined the word **Health** in 1948 as a **'state of complete physical mental and social well-being, not merely the absence of disease or infirmity'**..
- **Well-being** is the state of being comfortable, healthy, or happy.
- **Wellness** defines a healthy lifestyle, by taking into consideration mind, body, and spirit for an overall feeling of well-being. Clearly stated: someone who is satisfying wellness is living well and is working towards ***the prevention*** of their own disease and disability.
- In essence, concise clear definitions of health, wellness and wellbeing respectively are to get well, live well and be happy.*

- **"Health is a state of complete physical, mental and social well-being not merely the absence of disease or infirmity" as well as "the ability to adapt and self-manage."**

*Max Albert Huldsworth, 'Health, Wellness and Wellbeing', *Interventions Économiques*, 62, 2019 <https://doi.org/10.4000/interventionseconomiques.6322>.

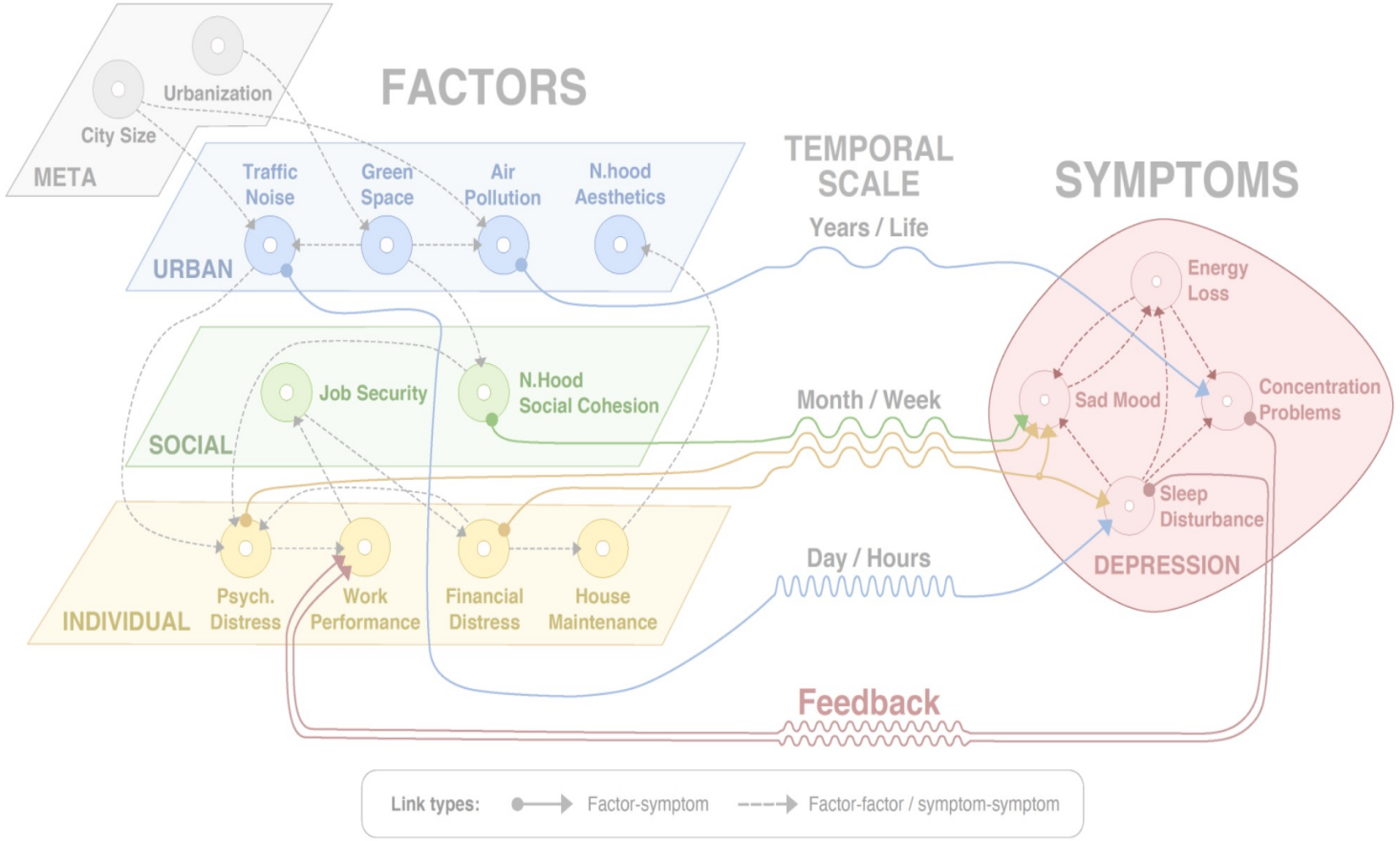
Societal Challenges in Urban Societies related to Healthy Urban Living & Lifestyle

Relationship between level of Urbanisation and prevalence of common mental disorders

Positive correlation between degree of urbanisation and prevalence of different CMDs.

Prevalence of CMDs higher in countries where **50-60%+** of population live in urban areas.

- Especially anxiety disorders



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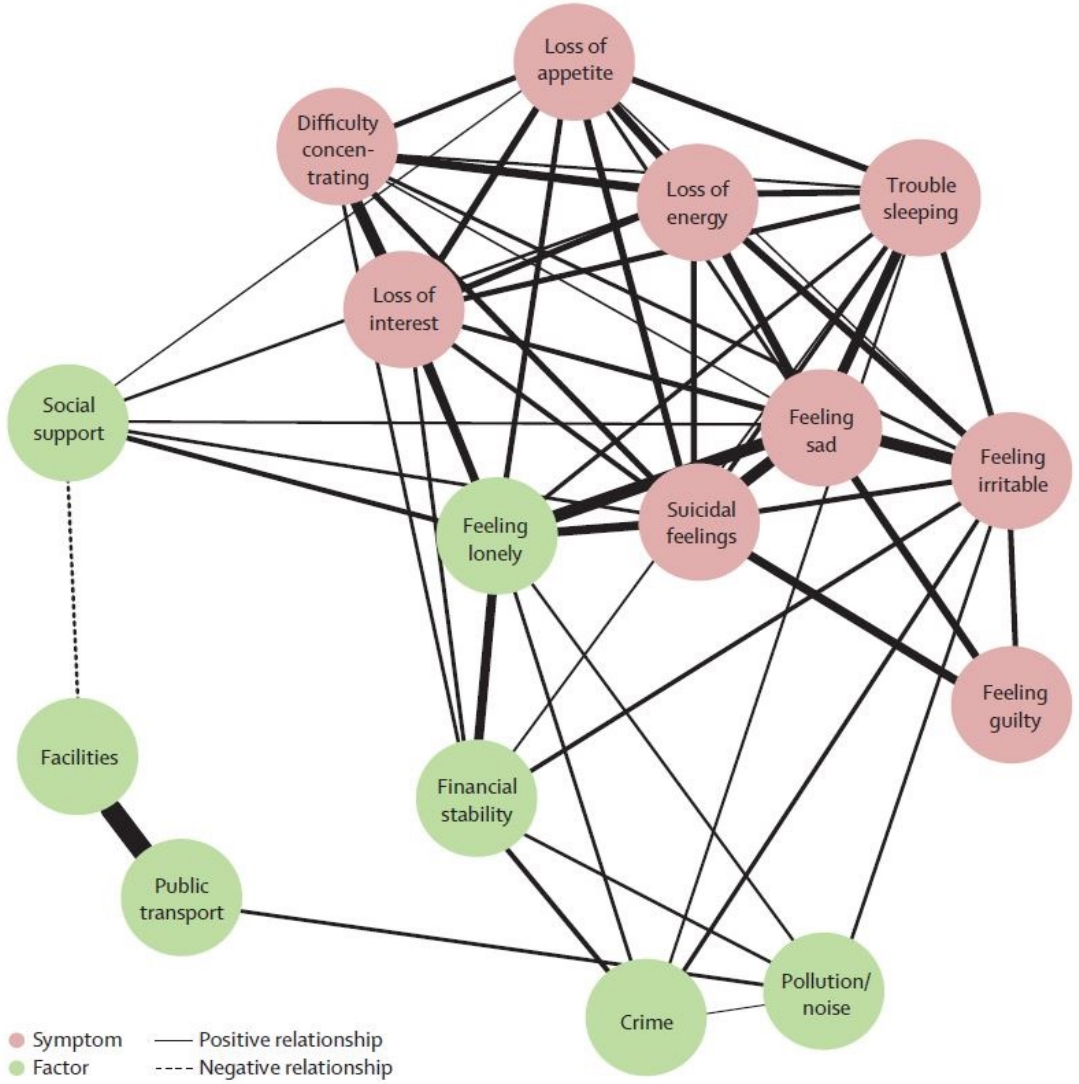
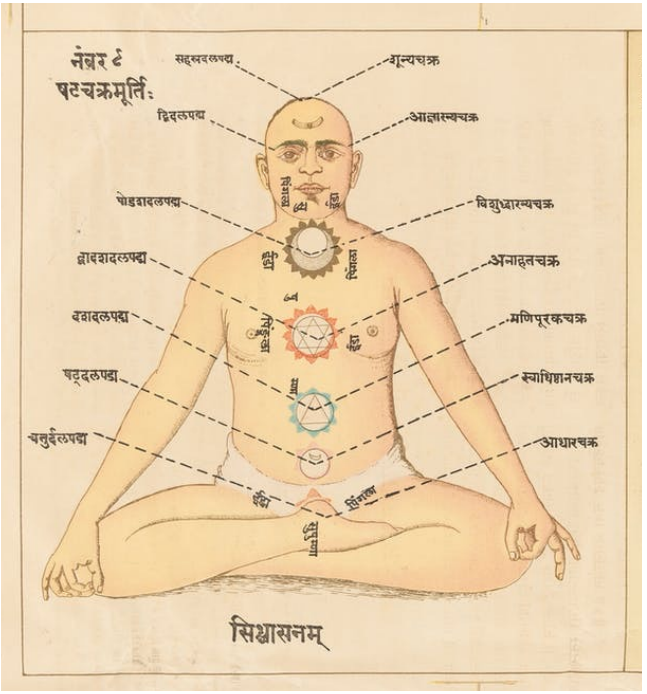
Theoretical Frameworks

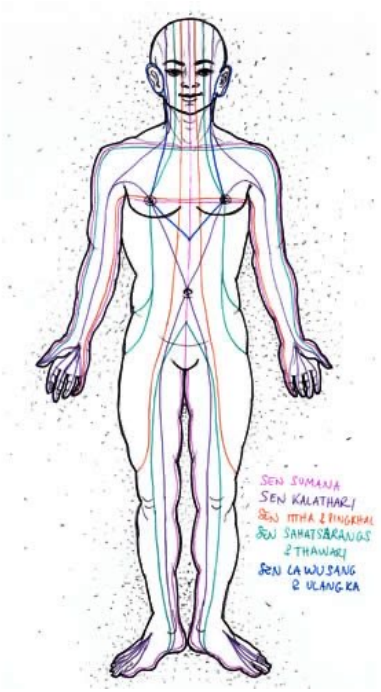
Complexity Science Approach

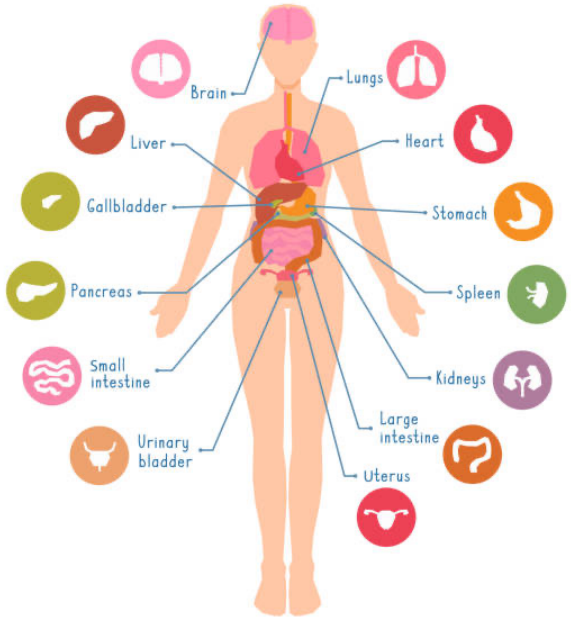
- This graph visualises the interwoven and multivariate nature of associations between urban factors and mental symptoms
- Interacting elements alone do not automatically comprise a complex system.
- Complex issues like urban societies and mental health may have circular causality, where outcomes (i.e. CMDs) feedback and amplify the explanatory factors (e.g. neighbourhood aesthetic) that contributed to the onset of the disorder in the first place

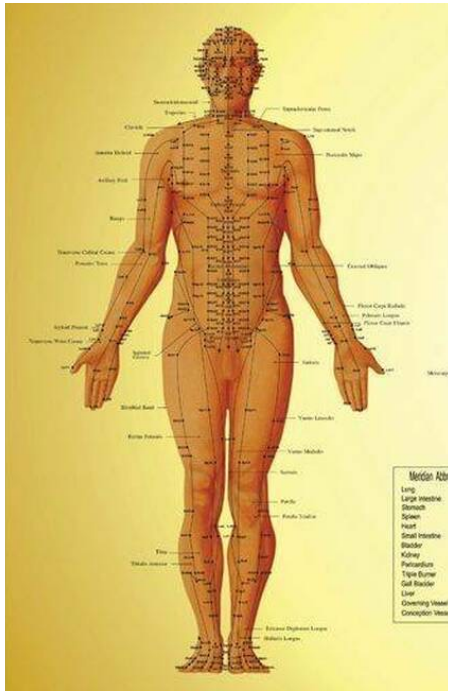


Make sense of senses through sensors









Rethinking the approaches to IoT – trustworthy, resilient, holistic, and ecosystem/human-centric innovation

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Challenges and Opportunities for IoT related to preventive health solutions

Let’s touch base on these perspectives

- Cultural and Behavioural Challenges in Urban Societies – Professor Jane Walsch
- How to design and deploy these IoT devices in an ethical way – Pietro Dionisio
- Trust and Trustworthiness, Privacy, Security – Fa Somers
- Adaptation of IoT devices in Complex Ecosystems in Urban Societies - Asbjørn Hovstø

Cultural and Behavioural Challenges in Urban Societies – Professor Jane Walsh

"What do you see as the biggest challenge(s) and biggest opportunity in the rise of wearable technologies

&

How will fields related to cognitive psychology change as technology evolves especially in complex ecosystems like urban environments?"

Psychology has a key role in digital transformation

There has been a growing sense of public distrust around data privacy and lack of regulation

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The Digital Health Revolution

- Industry is driving **rapid global change** in health technologies
- Telemedicine, AI, electronic health records are **reshaping interactions with health professionals**
- Technology has the capacity to **completely transform** the way healthcare is delivered.

World Health Organization

*"The vision of the global strategy is to improve health for everyone, everywhere by accelerating the development and adoption of appropriate, accessible…**person-centric digital health solutions**…. to promote health and wellbeing"*

Digital Health Strategy (2020-25)

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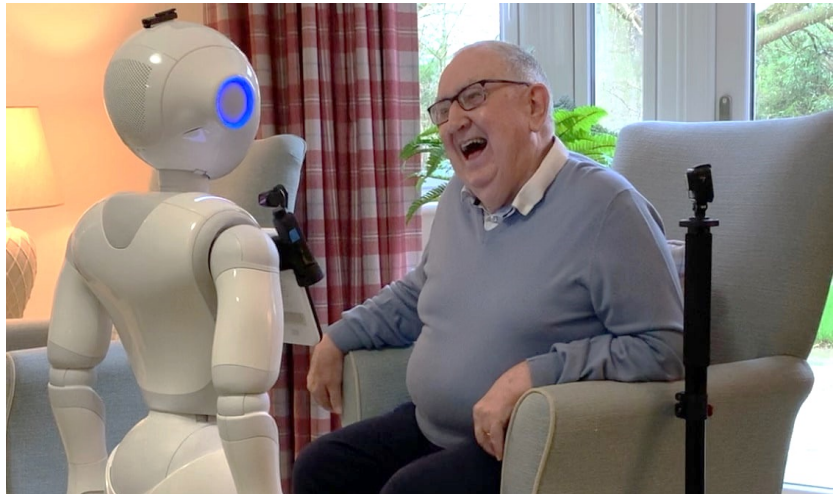
Why is Psychology so important in technology?



- Acceptability
- Engagement
- Design
- Efficacy

- **BEHAVIOUR CHANGE**

Understanding technology and behaviour

"There comes a point where we need to stop just pulling people out of the river. Some of us need to go upstream and find out why they are falling in"

Desmond Tutu

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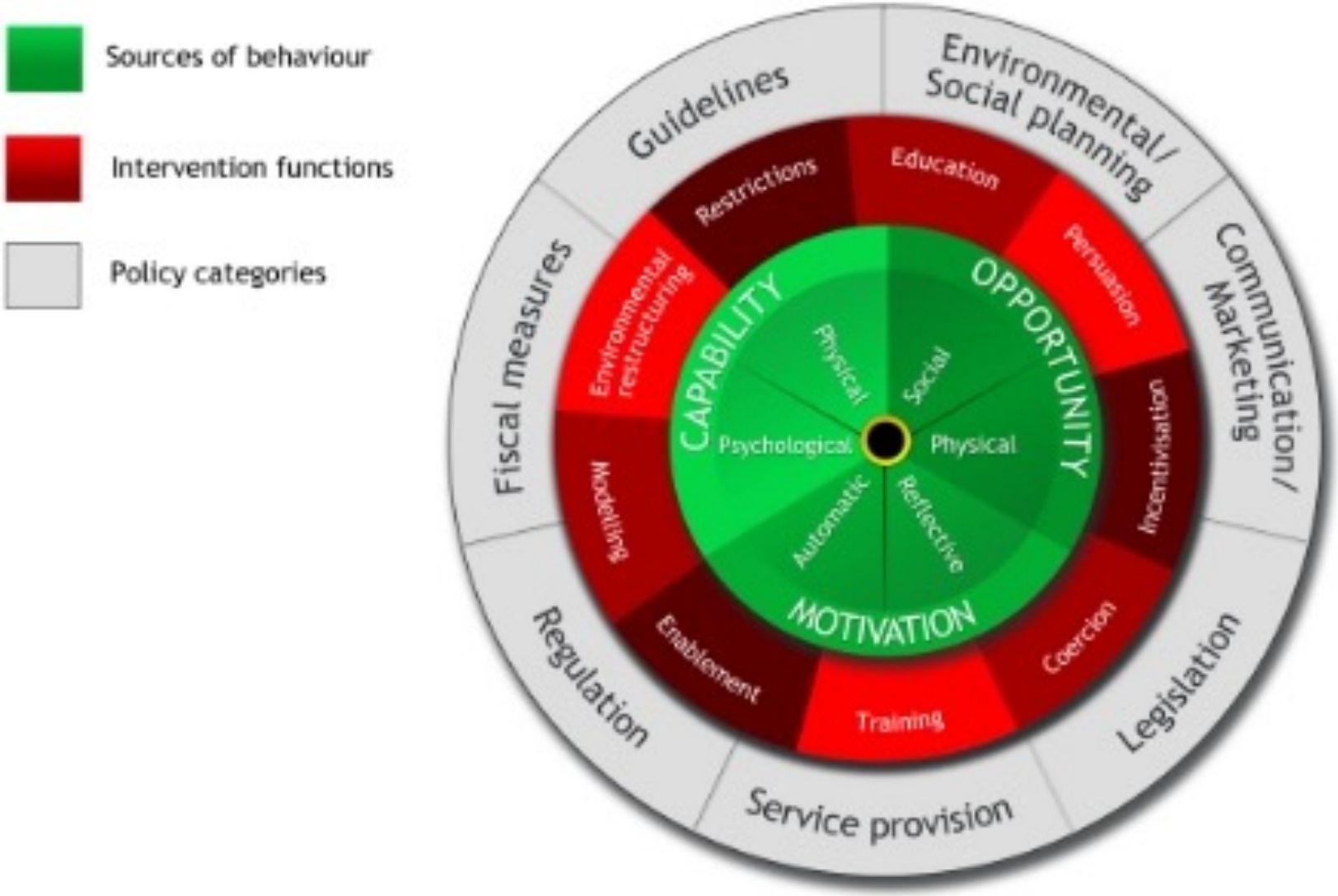
The Science of Behaviour Change



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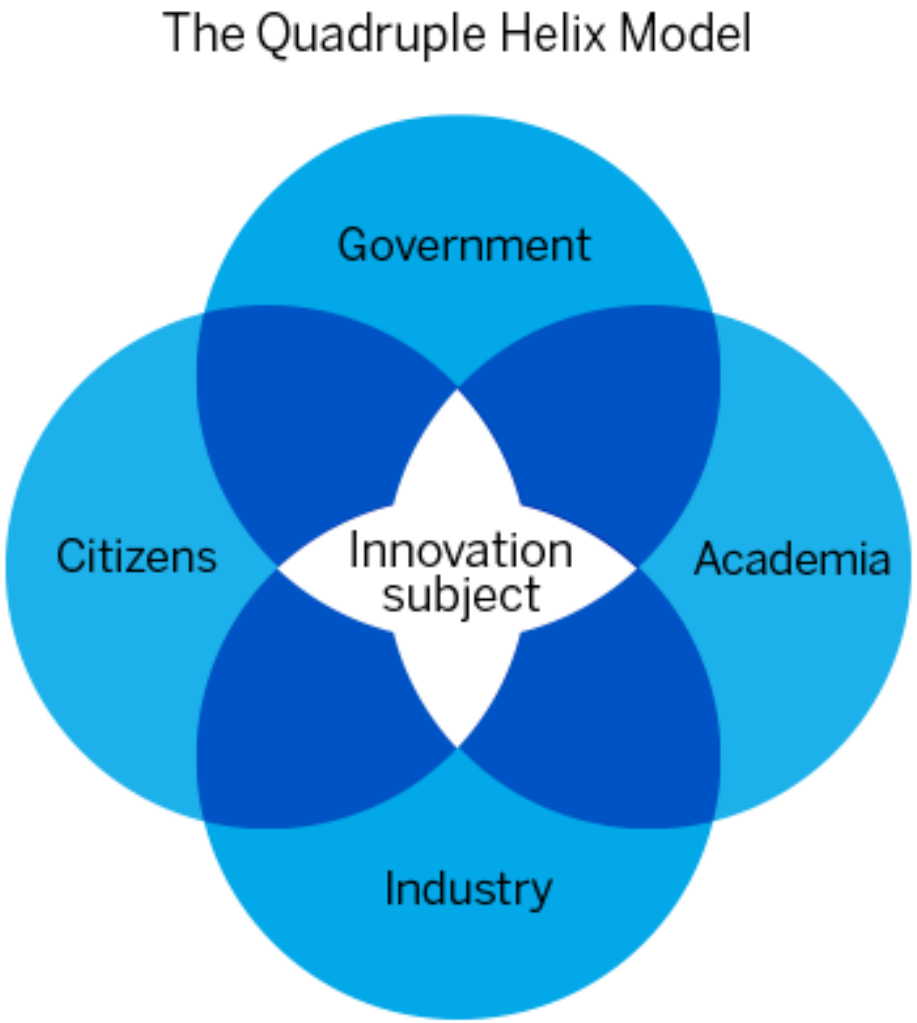
The Context


The Quadruple Helix Model
Government
Citizens
Innovation subject
Academia
Industry

How to design and deploy these IoT devices in an ethical way – Pietro Dionisio

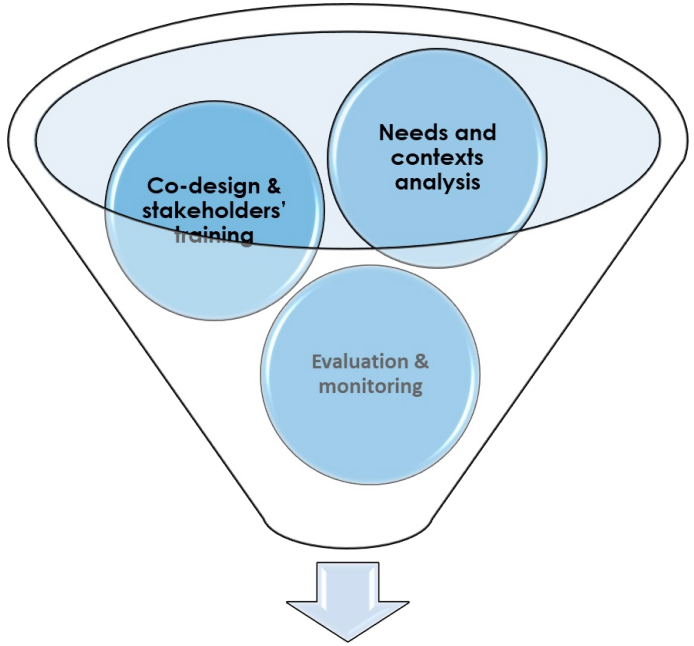
"How do we ensure that different levels of trust and ethics are being leveraged in public authorities, industry and digital ecosystems?

&

"Values differ between people, culture and environments expecially complex ecosystems like Urban Societies. What values can be implemented in Digital Health interventions- techniques?"

Strategies for wider adoption

Innovation is such only when: it is implemented and **produces benefits** towards a **specific goal**



Innovative services/tools

To ensure, **data quality** → **trust** → & **innovation adoption**

Starting from the need and analyzing a possible solution in terms of: feasibility, available resources, acceptance from users' standpoint, management and sustainability elements

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Impact Assurance strategy for supporting innovation deployment

Innovation

Better monitoring, more personalized services = a more independent life

ADDRESSING

- Ageing population and chronic diseases
- Inefficiency third sector systems
- Lack of personnel
- Inequities
- Sustainability & Societal Challenges

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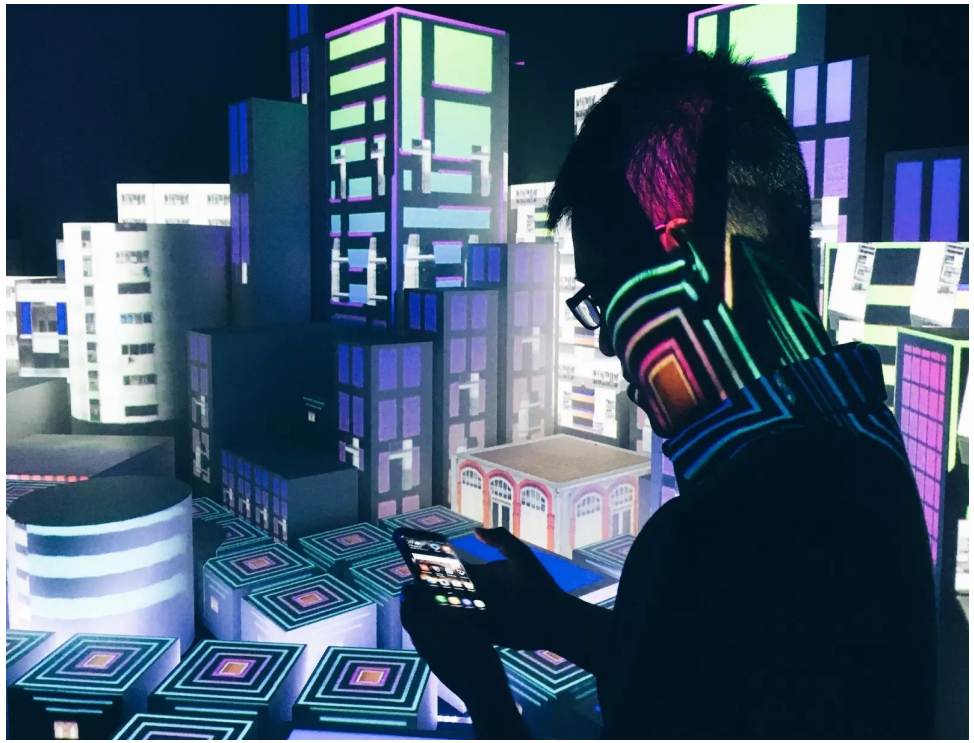
Barriers and Risks

- Gaps in innovation accountability
- The lack of trust in innovative decision support technologies is hindering the wider adoption
- Lack of transparency and trust
- Privacy and security issues
- Misuse of IoT tools
- Obstacles to implementation in real-world



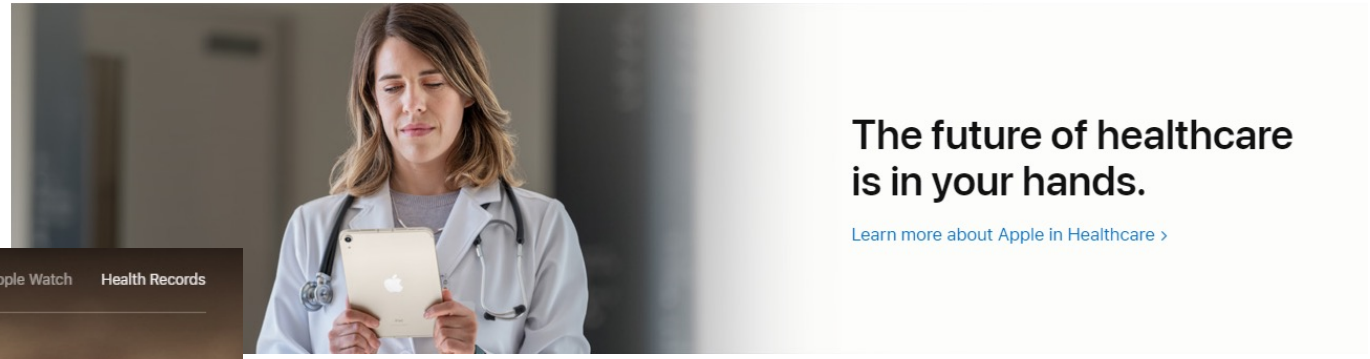
Trust and Trustworthiness, Privacy, Security – Fa Somers

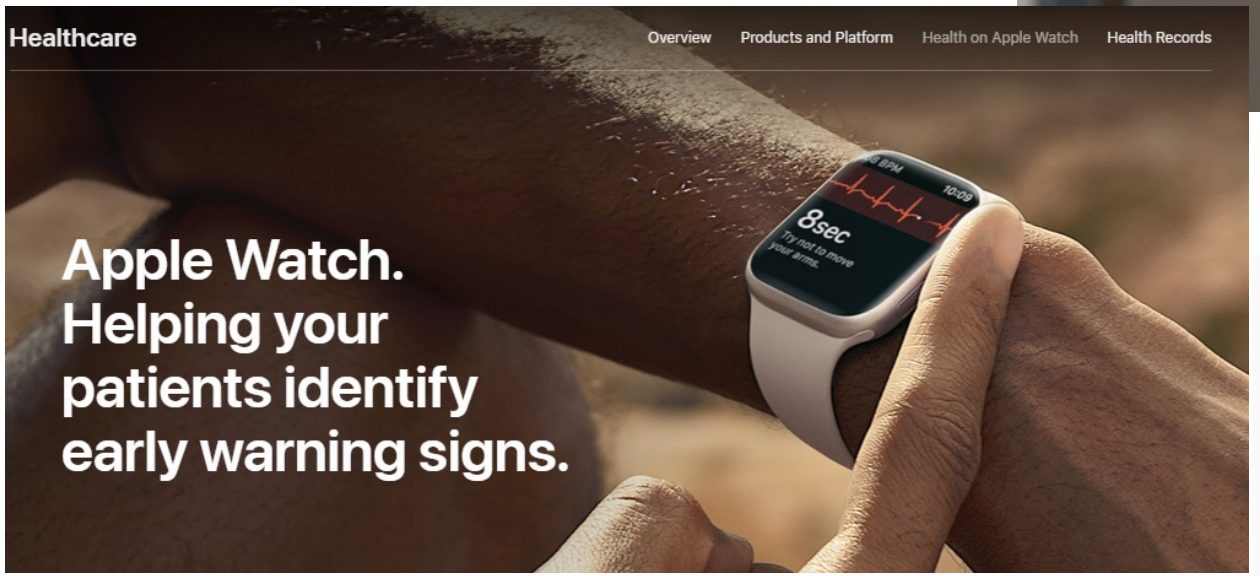
"What are the issues surrounding informed consent with regards to health-related personal data?"

&

"Why is the emergence of IoT neurotechnologies, in the consumer domain a threat for the European human rights framework? And how these threats should be mitigated?"

Medical Device vs. Health & Wellness Device





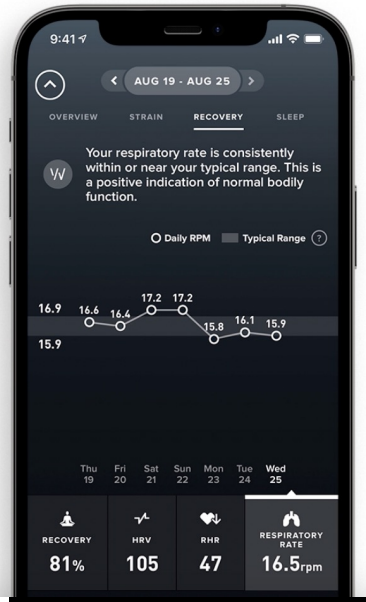
(h) Apple Watch, the heart rate sensor and its data and included Apple Watch apps are not medical devices and are intended for fitness purposes only. They are not designed or intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease.

Validation of irregular rhythm notification feature.

In 2017 and 2018, researchers at Stanford University School of Medicine worked with Apple to conduct the Apple Heart Study on the detection of atrial fibrillation, a heartbeat irregularity that is a leading cause of stroke and hospitalization. Over 400,000 Apple Watch users participated and helped validate the ability of wearable technology to aid in the early detection of this condition. The study led to the initial availability of the irregular rhythm notification. The feature was updated in early 2022 using advanced machine learning methods to improve the AFib identification algorithm.

See the results of the Apple Heart Study ↗

Medical Device vs. Health & Wellness Device



THE MOST IN-DEPTH FITNESS & HEALTH FEEDBACK

WHOOP monitors your sleep, recovery, and daily effort around the clock to deliver actionable insights on how you can optimize your performance.

TRACK HOW RECOVERED YOU ARE

Get daily insight into your body's recovery so you know when to take it easy and when to be more active.

LEARN MORE >

MONITOR YOUR ACTIVITY LEVELS

Measure how active you are and get daily targets for how active to be based on your body's recovery.

LEARN MORE >

New Whoop 4.0 launches – and it can track from your bra or pants

New Whoop wearable can track blood oxygen levels and offer skin temperature data

*WHOOP 4.0 is IP68 dustproof and water-resistant up to 10 meters for 2 hours. WHOOP 4.0 Battery Pack is IP68 dustproof and water-resistant up to 1 meter for 2 hours.

**WHOOP 4.0 is not a medical device and is not intended to diagnose or monitor any disease or medical condition.

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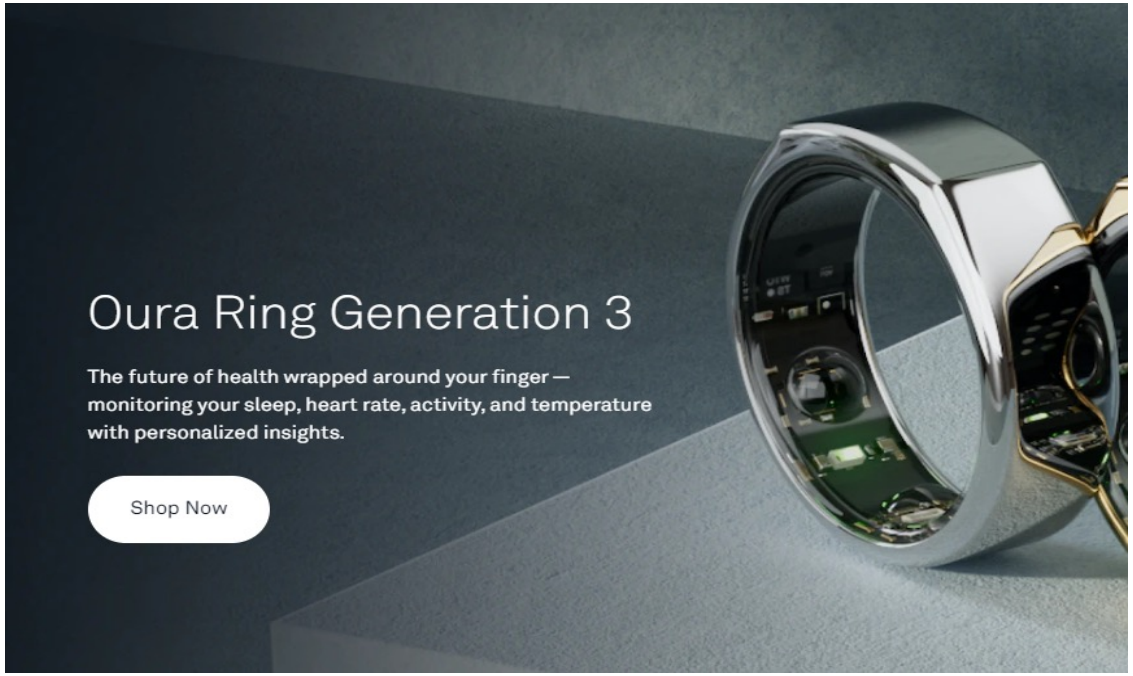
Medical Device vs. Health & Wellness Device

The Oura Ring is not a medical device and is not intended to diagnose, treat, cure, monitor, or prevent medical conditions/illnesses. Please do not make any changes to your medication, daily routines, nutrition, sleep schedule, or workouts, without first consulting your doctor or another medical professional.



Disclaimer: This research study was sponsored in part by Ōura. The purpose discussed in the study has not been approved by the FDA and the Ōura ring is not intended by Ōura to be used in this manner.

Can Researchers Use Oura To Spot Signals Associated with COVID-19?

Author: Oura Team | March 2, 2022

In 2020, the University of California, San Francisco (UCSF) launched a large-scale COVID-19 study, **TemPredict,** which aimed to discover if Oura Ring data could help identify signs of COVID-19. **Early results** revealed that Oura's temperature data could help spot when people's temperature is going above their normal and aid in early illness detection.

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Medical Devices Regulation

Medical Device: "Any instrument, apparatus, appliance, software, implant, reagent, material or other article intended by the manufacturer to be used, alone or in combination, for human beings for one or more of the following specific medical purposes:

- "Diagnosis, prevention, monitoring, prediction, prognosis, treatment or alleviation of disease"

'Intended purpose' means the use for which a device is intended according to the data supplied by the manufacturer on the label, in the instructions for use or in promotional or sales materials or statements and as specified by manufacturers in the clinical evaluation.

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Adaptation of IoT devices in Complex Ecosystems in Urban Societies - Asbjørn Hovstø

"How can we ensure that people can adapt and self manage different IoT devices and rely to the different data across borders f.i. during a health crisis "

&

"What is the room for improvement?"

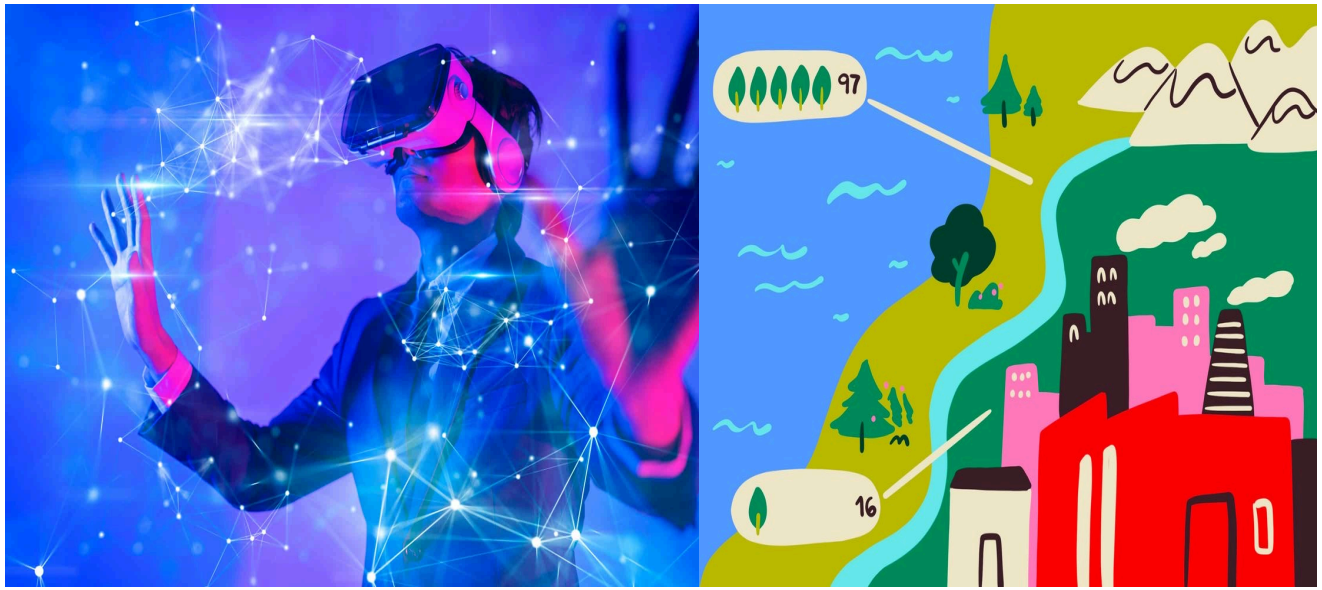
Societal challenges, Technological promises

- Community: **Share** senses, **share** achievements, **share** experience.
- Need a **toolbox** – on body sensors, machine learning and direct feedback.
- Technology allow anticipating needs and medical prognosis – **create insight**, not overtake decisionmaking.
- What about **privacy**?

State of The Art - Communication

- Yesterday: **sight, sound and movements**
- Today: **tactile information** and **context sensitive stimuli**
- Tomorrow: **AR and neurotransmitters**

- How will fields related to **cognitive** psychology change as **technology** evolves? Will ethics evolve?
- How to communicate with your counterpart? Who decides the intrinsic values when making decisions? How will it change with technology?



Thank you for listening

Any questions?

You can find us at @AIOTI_EU or email sg@aioti.eu

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