Understanding, detecting and influencing ***human behaviours*** *in healthcare*

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Introduction

INTRODUCTION

Behavior (from the **Glossary of Psychological Terms, American Psychological Association, www.apa.org)**

- **Behavior** The **actions** by which an organism adjusts to its **environment**.
- **Behavior analysis** The area of psychology that focuses on the **environmental determinants** of learning and behavior.
- **Behavior modification** The **systematic use** of principles of learning to **increase the frequency** of desired behaviors and/or **decrease the frequency** of problem behaviors.
- **Behavioral data** **Observational** reports about the behavior of organisms and the conditions under which the behavior occurs or changes.

Research Areas of intersection with IT

- Biomedical, Clinical, Healthcare Engineering and Informatics
- Human Computer Interaction
- Cognitive Informatics
- Affective Computing
- Persuasive Design

Behaviour Analysis, Detection and Intervention…of who?

- Individuals
- Community of Individuals
- Organized (or not…) Groups of Individuals

Technology can be used to…

A. …Understanding Behaviours

B. …Detecting Behaviours

C. …Influencing Behaviours

Question: which one is more relevant for your project?

1. Assistive Technology for Dementia
2. Self-management of COPD
3. Sedentary behaviours with the elderly
4. Prevent of Chronic Disease in 40-65 cohort

SmartHouse

Experimental Research Centre for Ambient Intelligence Applications and Services (CIAmI)

Smart House Living Lab

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POLITÉCNICA "Ingeniamos el futuro"

CAMPUS DE EXCELENCIA INTERNACIONAL

Smart House Living Lab: Mission and Objectives

The Smart House Living Lab aims to promote the quality of life and personal autonomy of society with the following principles:

- ✓ INNOVATE in AmI ecosystems and e-health.
- ✓ DEVELOPING competitive products for the Future Society.
- ✓ Opening new RESEARCH LINES aimed at better service to users.
- ✓ TO BE a platform where the most attractive ideas are implemented by the best researchers.
- ✓ To be a REFERENCE Research centre in UPM and the focus of investigations.

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Data Collection

- Obtrusive vs Unobtrusive
- Simulated Scenario vs. Real Scenario
- Controlled Environment vs. Free Living Environment

EXAMPLES

Parkinson's disease

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PERFORM project

2009-2011

- The PERFORM project was aimed to **tackle problems associated with the efficient remote health status monitoring, the qualitative and quantitative assessment and the treatment personalisation** for people suffering from neurodegenerative diseases and movement disorders, such as Parkinson's disease (PD).

- The PERFORM project has been researching and developing an innovative, intelligent system for monitoring neurodegenerative disease evolution through the employment of a wide range of wearable sensors, advanced knowledge processing and fusion algorithms.

- **http://www.perform-project.eu/**

PERFORM project

Day Monitoring wearable

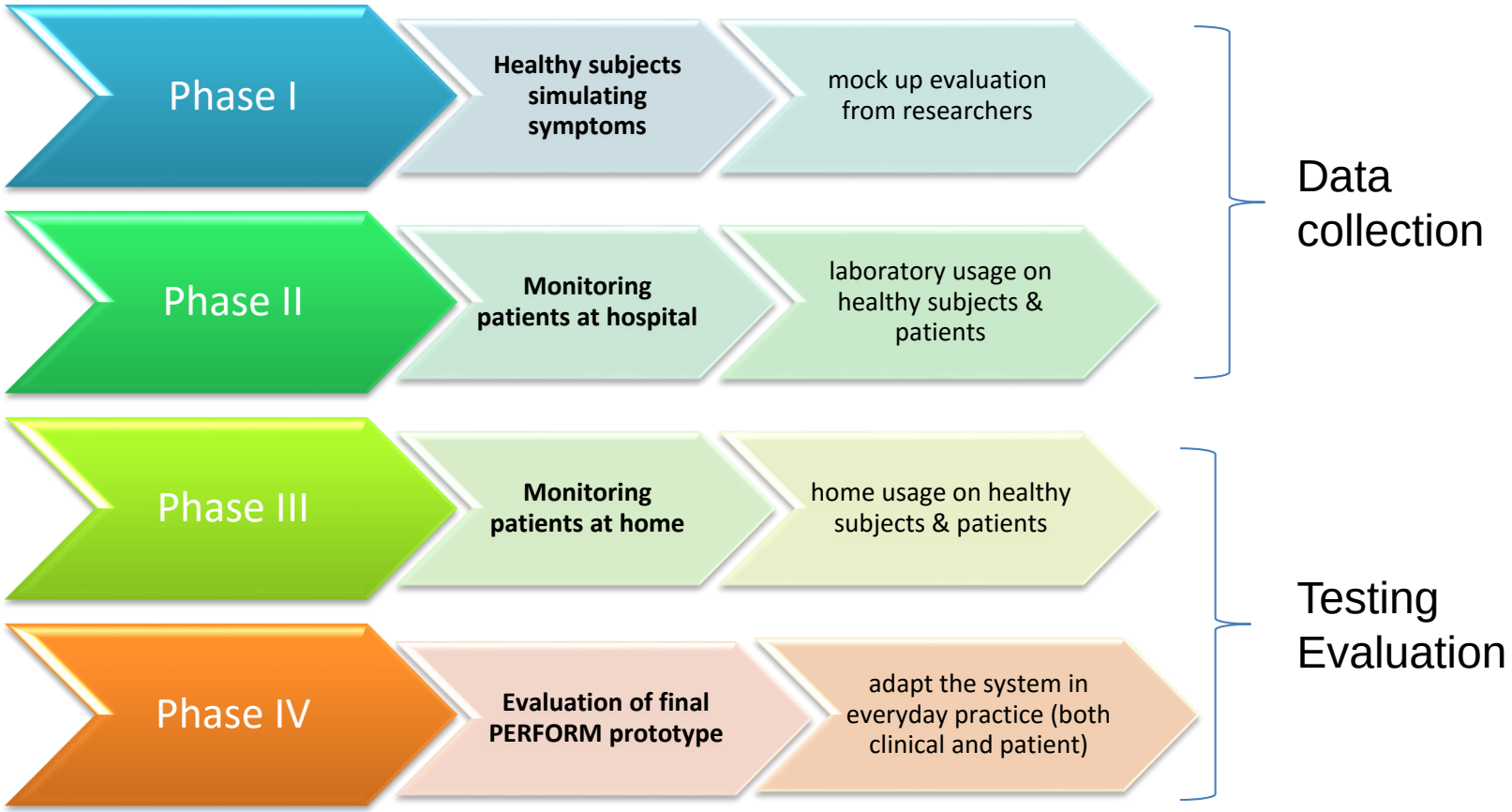
Gyroscope/ Accelerometer

Accelerometer

Accelerometer

Accelerometer / Control Unit

PERFORM project



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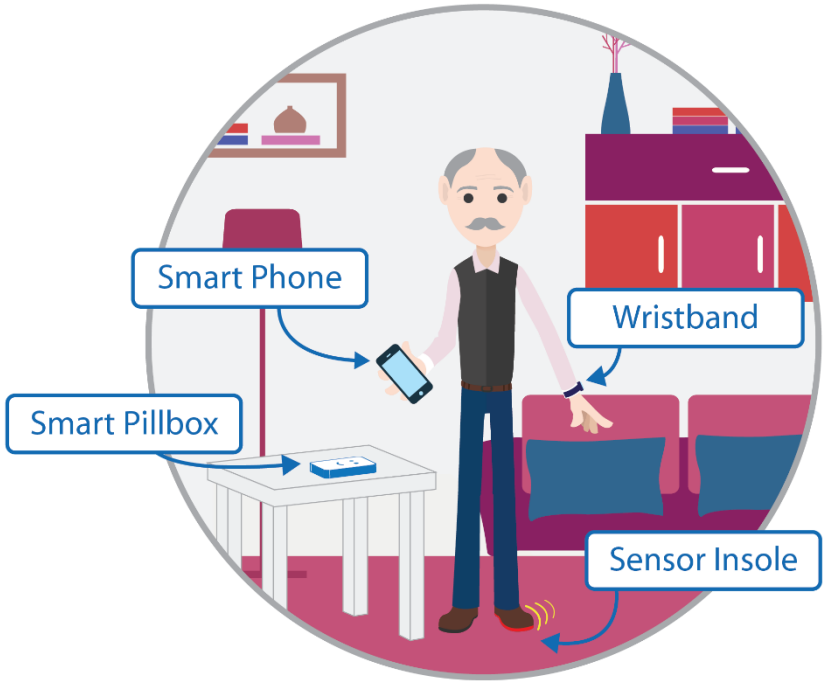


PD_manager

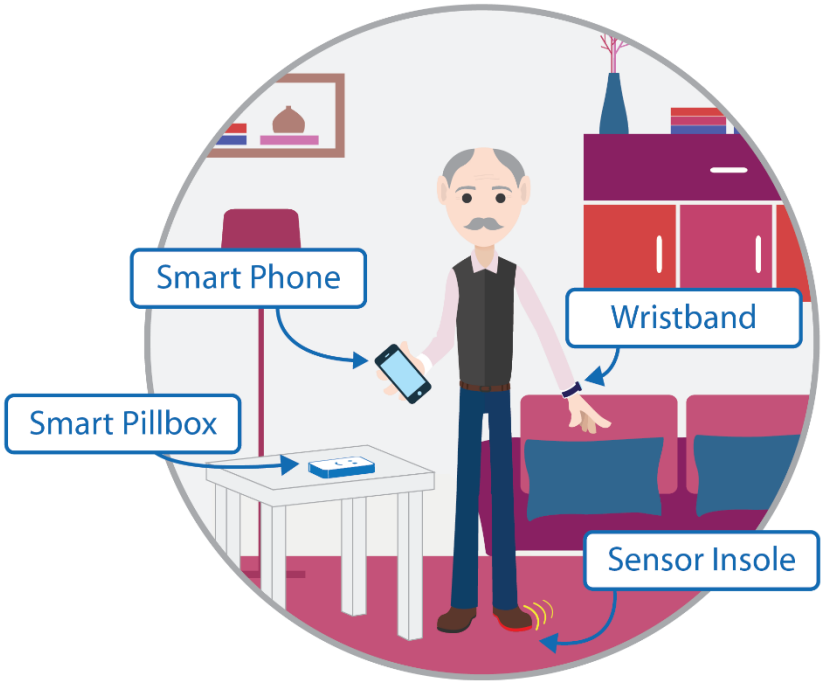
mhealth platform for Parkinson's disease management

PD_manager is a research project funded by the European Commission under the Horizon 2020 programme.

Specifically, PD_manager was born under the PHC-26 topic ***Self management of health and disease:*** *citizen engagement and mHealth aimed at "Empowering citizens to manage their own health and disease will result in more cost-effective healthcare systems by improving utilisation of healthcare, enabling the management of chronic diseases outside institutions, improving health outcomes, and by encouraging healthy citizens to remain so."*

http://www.parkinson-manager.eu

Rehabilitation based on Rhythmic Auditory Stimulation and Music



The PD_manager project aims to:

1) model the behaviors of intended users of PD_manager (patients, caregivers, neurologists and other health-care providers)

2) educate patients, caregivers and healthcare providers with the focus on occupational and speech therapies

3) propose a set of unobtrusive, simple-in-use, co-operative, mobile devices that will be used for symptoms monitoring and collection of adherence data (smartphone, sensor insole, smart pillbox, wristband with several sensors for acceleration, heart rate, etc.).

City4Age

Elderly-friendly city services for active and healthy ageing

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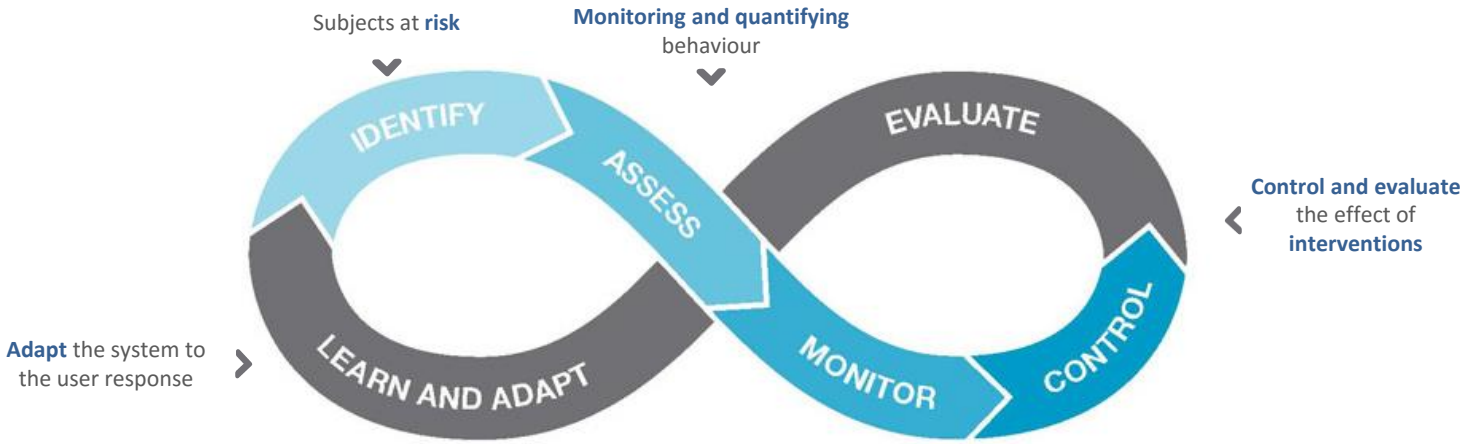
C4A Objectives

The main idea is that Smart cities can collect data in an unobtrusive way around individual behaviour, with the objective of:

- **Identifying** segments of population at risk;
- **Monitoring** segmented users according to their necessities in a Smart environment;
- **Intervining** in case cognitive or phiisical worsening is detected.



Validation

The **City4Age** concept will be validated in **six** cities, each one will develop different scenario, in order to study the posible interaction between users and cities.

Daily Activities

Mobility

Social life and security

City4Age

Social Interaction and loneliness

Daily Activities

Daily Activities

Simulation and evaluation of independent living services

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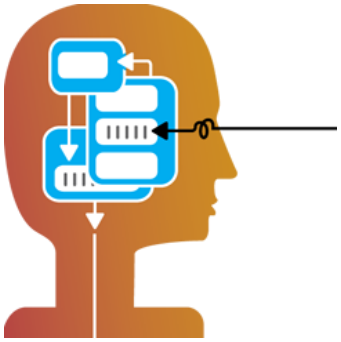
What do we have?

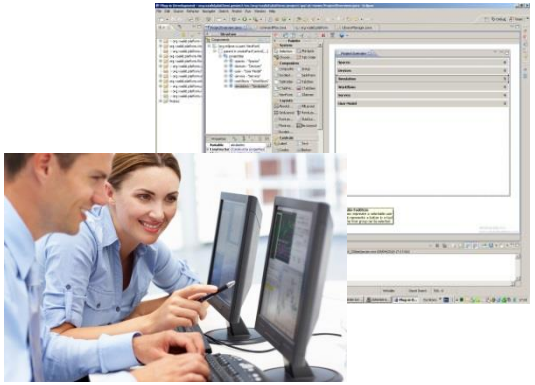
Cognitive & behavioral models



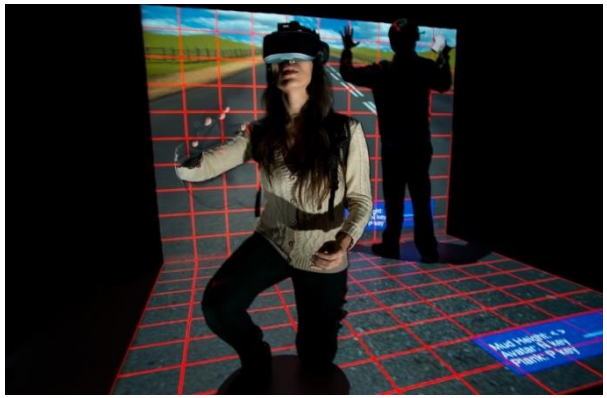
Validation techniques with final users

Elderly and impaired people

Developers



3D simulation

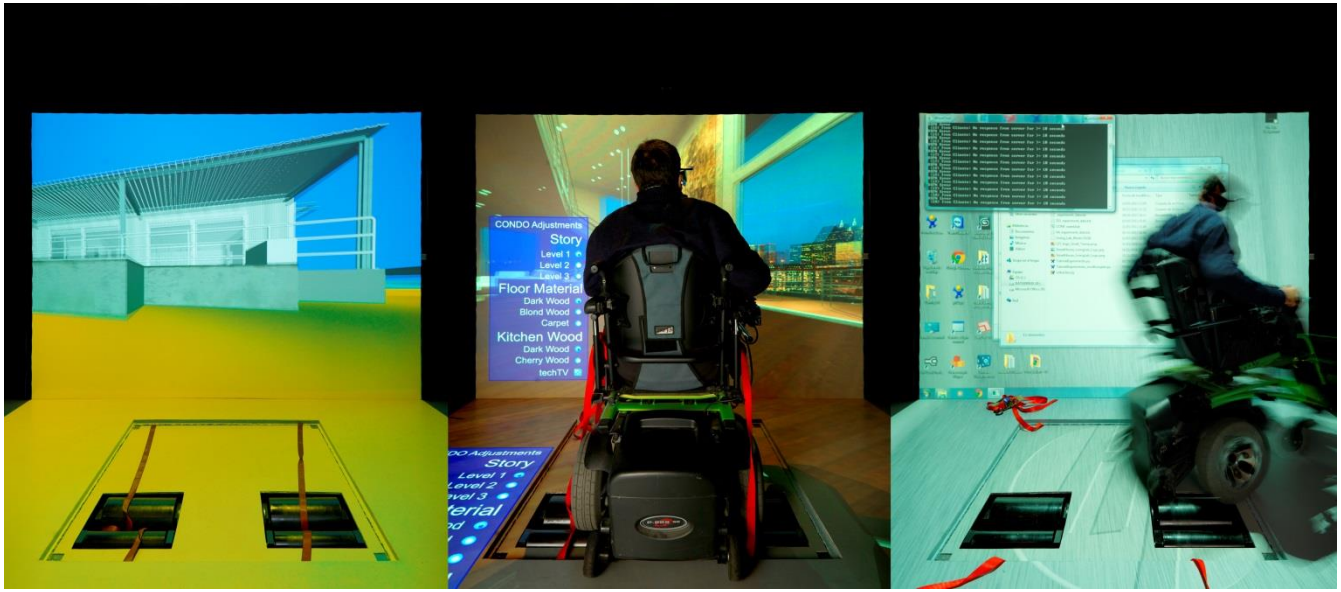


Living Lab Infrastructure

Simulation, Rehabilitation and Virtual prototyping Infrastructures

Design, implementation, evaluation and assessment.

- Platform for people with motor disabilities:
  - 3D simulation platform for conducting **stress tests** (**Cardio-respiratory stress test**) on people with **motor disabilities**.
  - Design of **rehabilitation and training** environments.
    - Wheelchair Slalom
    - Motor rehabilitation therapies



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Information Collection

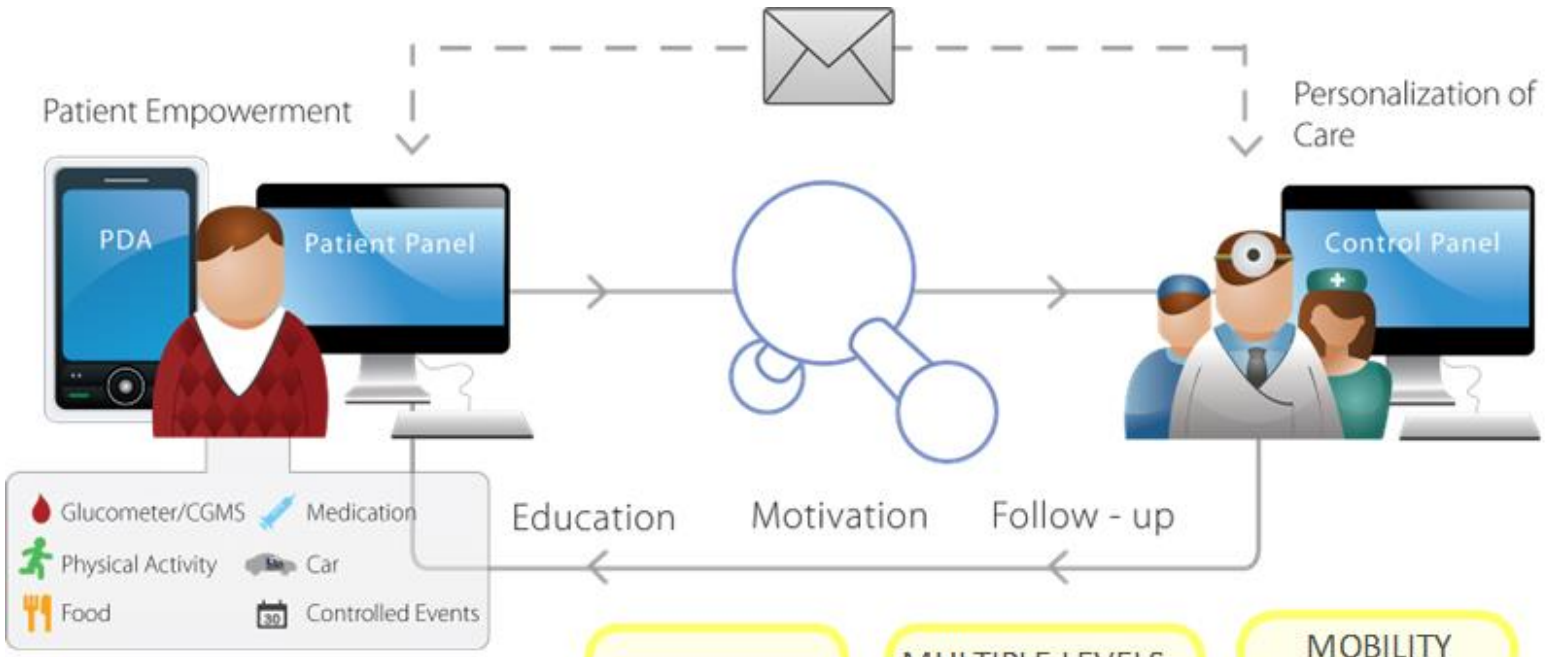
- Major Areas of Research: Cognitive Informatics, Human Computer Interaction
  - User/Usage/Goal Centered Design
  - User Needs Elicitation
  - Use Cases Developments
  - PERSONAS and SCENARIO
  - Focus Groups and Interviews, Heuristic Evaluations, Usability Tests, Logs, Questionnaires

EXAMPLES

- Monitoring Adherence
- Supporting Decision Making of Healthcare Professionals

DIABETES

METABO



MULTIPLE PLATFORMS

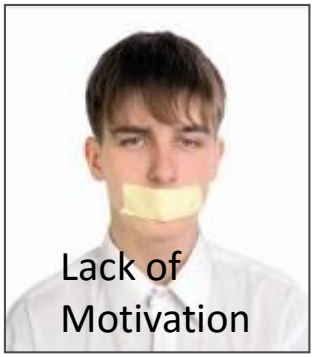
MULTIPLE LEVELS OF INTERACTION

MOBILITY
EFFICIENCY
LEARNABILITY
CONNECTIVITY

Adaptive care plan

Presentation of data

1. Identification of common Areas of Focus for all patients which must be reinforced and can drive a treatment strategy*



* These areas will define a first patient classification that will define the approach to take in his treatment. Later on other classifications can be done

2. Definition of User Archetypes*

ANA

T1DM young patient insulin treated

GEORGE

T2DM aged patient not insulin treated

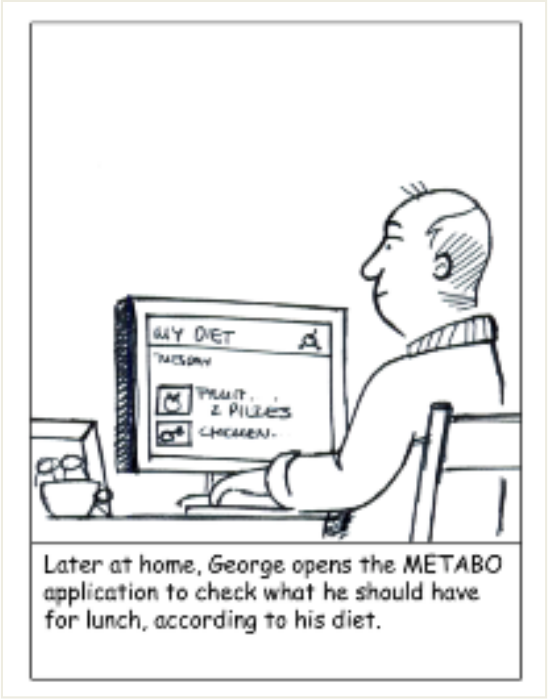
M. DOCTOR

Medical Doctor

Other Professionals

* These archetypes are necessary to define the user needs and the service required that will later be implemented in the technological platform

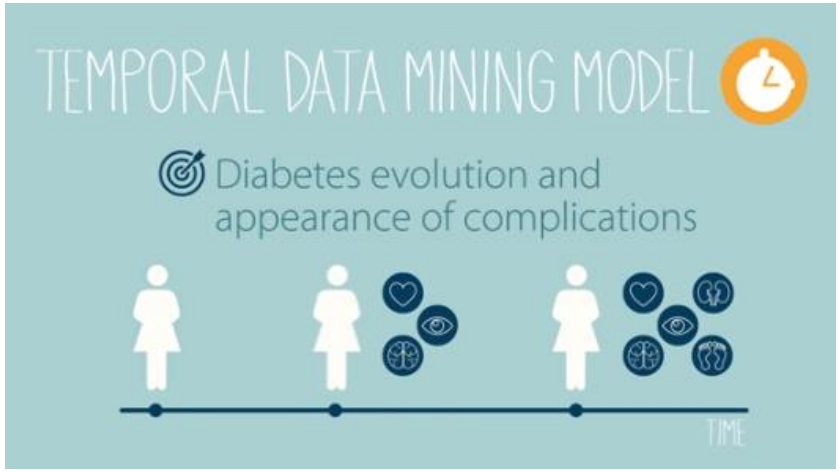
3. Definition of Usage Scenarios



MOSAIC –

mosaic
PROJECT

Provide professionals with algorithms, models and tools that improve the characterization of patients, evaluating the risk of developing T2DM and related complications.



The MOSAIC Models

Supported by the development of **mathematical models** thanks to multiple databases available from different European countries.

MOSAIC has created two new prediction models:

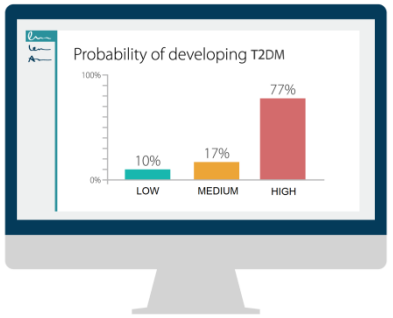
The probabilistic model goal is to identify people at risk of developing type 2 diabetes.

The temporal data mining model analyzes the evolution of diabetes with the aim of predicting and preventing the appearance of complications.

The MOSAIC Tools

Risk factors for type 2 diabetes detection

Supporting decisions in setting up prevention strategies in Primary Care and Healthcare Agencies.



Hospital Care Management

Risk-stratifying diabetic population, enabling managers to run services more efficiently, distributing resources according to real needs.

Clinical Decision Support in Follow-up Visits

Supporting GPs on following the optimum clinical pathways, mainly required specialist consultations and tests to be attended by patients.

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ENGAGEMENT BEHAVIOURAL FRAMEWORK

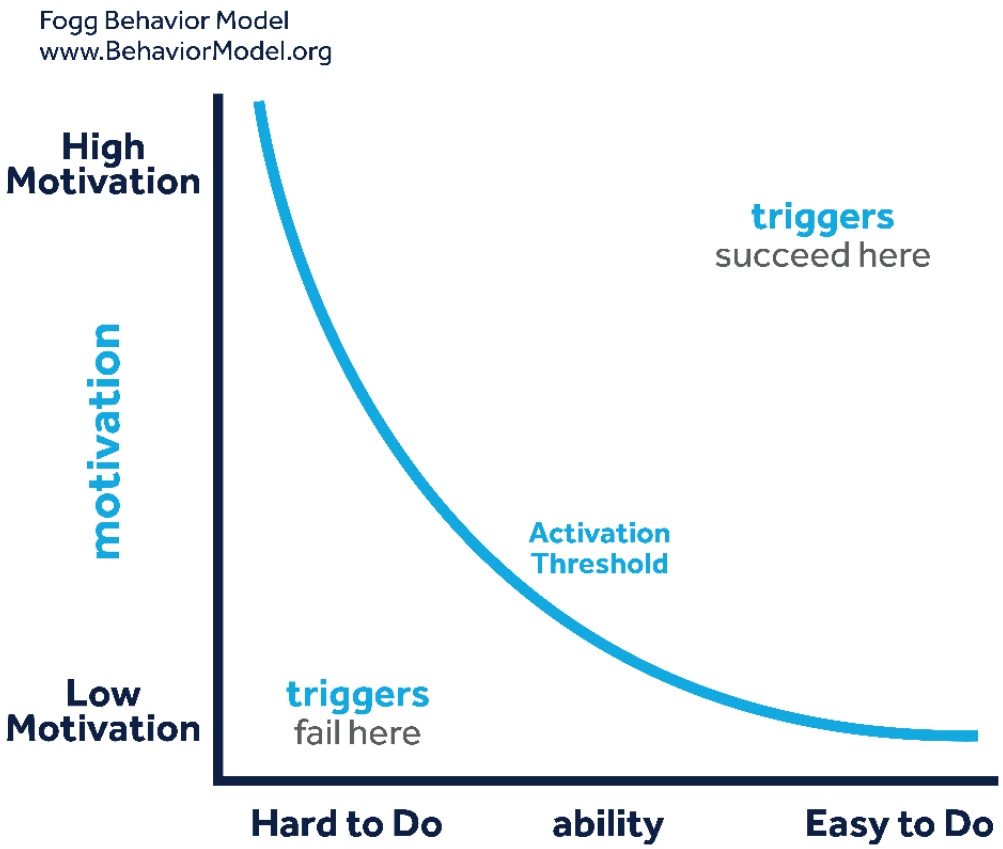
- Persusasive Design and Technology → Captology
  - Definition of Motivation to Change
  - Technology as a Media, Tool
  - Graphs, Grids
- Examples:
  - Patient Engagement, Empowerment, Activation
  - Improving Adherence in Chronic Disease Management and Prevention
  - User Training, Learning and Education
  - Cognitive and Phisical Rehabilitation
  - Adoption of new Healthcare Processes
  - ….

DETECTING BEHAVIOURS

- The Fogg Behaviour Model (FBM) is based on a behaviou 2009 (Fogg, 2009). A nents must converge o occur:

1. Motivat
2. Ability
3. Trigger

- When a ne of those three ele



"Design mantra" for behavior change: Put hot triggers in the path of motivated people."

Thank you

In memory of…