Self-determination-driven digital services for supporting aging-in place and well-being:
a study of relationships between longitudinal data from smart home and clinical data.

__HomeAssist Platform for aging in place__

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❖ **Host:** Bordeaux Population Health (BPH) Lab, ACTIVE team, in the context of the InnovCare project coordinated by the Fondation France-Japon de l'EHESS (FFJ)

❖ **Location**: Inria Bordeaux (with visits to French and Japanese partners)

❖ **Doctoral School :** ED SP2 – Univ. of Bordeaux

❖ **Program/funding**: PPR Autonomie- France 2030, Innovcare Project (EHESS) gathering nearly 20 research institutions in France and Japan.

❖ **Duration:** 36 months (starting nov. 2024)

❖ **How to apply:** contact helene.sauzeon@inria.fr, lucile.dupuy@u-bordeaux.fr, rafik.belloum@uphf.fr, with CV and letter of motivation (2 letters of recommendation will be welcomed)

❖ **Research topic** : Digital technologies for aging

❖ **Research Domains** : Cognitive science and User-centered interfaces; data science and vizualisation.

❖ **Keywords:** smart home (ambient-assisted-living platform, sensors, activity-verification); actimetrics and clinical data; frailty ; self-determined services; aging in place and well-being

About the INNOVCARE project

The increase in human longevity, and the aging of the population constitute a major challenge for our societies, which refers to forms of solidarity between generations, the heart of our social pact. One of the key issues concerns care for the elderly, who face a loss of autonomy and forms of vulnerability, especially since inequalities (according to gender, regions, professions, income, etc.) in terms of disability-free life expectancy are significant and persistent.

Our project's objective is to develop an alternative concept called **care-driven innovation**. Thanks to a multidisciplinary French- Japanese collaboration, we will thus analyse the policies and practices that put well-being at the centre of innovation.

In this context, the issue of long-term care has become a privileged area for the application of technologies, in the spirit of promoting a "silver economy". As such, Japan is often cited as an example with the use of personal robotics in specialized institutions or at home, which seems to be more accepted than elsewhere (Wright, 2023; Kodate et al., 2020). In general, the potential contribution of several technologies (notably robotics, artificial intelligence, information and communication technologies [ICT]) should be recognized: they seem to be able to partly solve problems of autonomy and vulnerability, whether it concerns communication, mobility or cognitive abilities (Kodate et al., 2020; Obayashi et al., 2020).
If this contribution is recognized as a possible response to problems related to loss of autonomy, it is also characterized by certain limitations, particularly from the point of view of well-being analysis, and that it is still very much marked by the perspective of the acceptability of technologies (Wright, 2023). For their part, despite rare exceptions (Morey, 2020; Allouche et al., 2015; Dupuy et al., 2015), care-centred approaches tend to put the human being at the heart of the analysis, setting aside what is technological.
Our goal is to bridge the gap between these two approaches by proposing a concept of care-led innovation and by focusing on the relationship between humans and machines.
Our hypothesis is that this is not a one-off problem, but a fundamental impasse related to the way in which social and individuals needs and technological responses are articulated. **Our conviction as SHS researchers is that there is an urgent need to reconnect social and technological dynamics, by proposing a concept and practices of innovation that make well-being (and not competitiveness) the ultimate criterion for innovation** (Lechevalier, 2019). Our proposal is that care-led innovation is one possible response.
The **present doctoral project** is in line with the InnovCare purpose, and focuses specifically on the **smart home** solution, whose originality lies in promoting **the self-determination of the older person** through monitoring and home assistance services **for aging in place**.

PhD's Scientific project - *Self-determination-driven digital services for supporting aging-in place and well-being: a study of relationships between longitudinal data from the HomeAssist-smart home and clinical data.*

To move forward the field of environmental gerontology, the PhD's project will rely on ergonomic methods of user-centered design of technologies and clinical research methods through the **HomeAssist** for autonomy and healthy aging of an ambient and personalized digital assistant at home. The originality of HomeAssist device is to propose digital therapeutics developed according to participatory design methods and with the ambition of supporting the person's self-determination (Self-Determination Theory, SDT; Deci & Ryan (1985 to 2022). Basically, SDT emphasizes the (psychological) need for agentivity or autotelicity (Greek: "autós: self" and "telos: goal"), i.e., the need to create one's own goals autonomously in order to be fulfilled by acquiring/maintaining oneself with self-chosen skills and social participations. This SDT-centered approach has already been proven valuable in the field of disability (e.g., Lachapelle et al., 2005), and is beginning to be explored in aging and dependency (Wehmeyer et al., 2017) with encouraging results in terms of healthy aging. Assistive

digital technologies (ATs) can also reinforce the self-determination of the older adults when they are designed with this purpose (Dupuy et al., 2016) and through a knock-on effect improve the autonomy and well-being of the person at home (Dupuy et al. 2017, 2021, Sauzéon & Dupuy, 2021).

The project objective is thus to assess digital actions that support self-determination (and thus autonomy, social participation and quality of life) of older adults with various levels of frailty conditions (non-frail, pre-frail, frail individuals). We targeted these clinical conditions because non-pharmacological interventions have been shown to be effective in reducing frailty syndrome, and even in returning the person to ordinary aging. Let us bear in mind that the pre-frailty and frailty conditions alone cover more than 40% of the over-65 (Cesari, et al., 2014).

By leveraging **data already collected from 131** pre-frail and frail **older individuals** who, for 12 months, used an ambient assistant-living co-designed to support self-determination and covering 3 domains of need (daily activities, home safety, and social participation) (Sauzéon et al., 2022), the aim is to analyze various clinical (cognitive assessments, frailty, autonomy, SDT, etc.) and use (User experience-related questionnaires, logs, actimetrics based on environmental sensors) data, in order :

1) **to relate the benefits regarding care with the use of assistive and monitoring services provided by HomeAssist** and

2) **to explore the predictive value of data provided by HomeAssist-based sensors for explaining clinical data**.

Main Activities

The PhD student will start at BPH lab by a familiarization with the experimental and software infrastructure used in the *HomeAssist* field study, as well as with the whole of data collected during the 12 months-experiment (clinical measures, actimetric measures, services usages). She/he will also familiarize with the recent results studying what are the required characteristics of actimetric data needed to produce robust and generalizable activity verification (Belloum et al., 2020, Volanschi et al., 2020). This will enable to **formalize precisely the context and the properties of studied daily activities**, and to address a technical challenge consisting in **managing longitudinal** (i.e;, over 12 months), **ecological** (i.e., prone to breakdowns) and **multimodal** (i.e., from various sensors types) **data**. In parallel, the candidate will explore various statistical techniques and modeling that could be used to **study the directional links between collected actimetrics, HomeAssist usages and perceptions, and clinical data** (everyday functioning, social links, quality of life, psychological wellbeing, social participation, etc). These activities aim to design a user-centered tool that enables clinicians (psychologists or doctors) to visualize and understand these links effectively. By doing so, the tool will meet the needs of clinicians who are currently seeking tools capable of displaying the evolution of older adults over a long period of time (for example, a year or more) in order to detect 'weak signals' indicating early signs of decline. This intuitive visualization will facilitate early intervention, as clinicians can identify trends over time, such as decreasing sleep duration, which is a key predictor of older adult health.

This work will benefit from various potential collaborations with PhD students and interns both at BPH lab and in InnovCare network.

Skills

Required knowledge and background:

Candidates should have an outstanding expertise in at least one of these areas, and ideally have experience in several of them:

- Digital technologies for aging: Ambient assisted living devices, sensors, monitoring and assistive technologies,

- User-centered Methodologies for assessing with users: ergonomics and cognitive science

- Experience with information visualization; Human-computer interface (HCI) for users without technical expertise

Other requirements:

- Good skills in programming languages and web development such as python and javascript
- Motivation to work on a project that combines data science, HCI and ergonomics, cognitive sciences and clinical studies of older adults

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