

# THE SPACE OF MOVEMENT BETWEEN REAL AND VIRTUAL: THE PURPOSE OF A PILOT PROJECT

## LO SPAZIO DEL MOVIMENTO TRA REALE E VIRTUALE: UN PROGETTO PILOTA

Valeria Agosti<sup>a</sup>, Nicola Lovecchio<sup>a</sup>, Eleonora Ciceri<sup>b</sup>, Antonio Borgogni<sup>a</sup> and Angelo Compare<sup>a1</sup>

<sup>a</sup> Dipartimento di Scienze Umane e Sociali, Università di Bergamo, Italia

<sup>b</sup> MediaClinics S.r.l., Lissone (MB), Italia

<sup>a</sup> Department of Human and Social Sciences, University of Bergamo, Italy

<sup>b</sup> MediaClinics S.r.l., Lissone (MB), Italy

valeria.agosti@unibg.it

### Abstract

To realize physical activities guidelines for ageing people, the promotion of walking groups seems to be an effective way. Walking groups, supported by wearable and portable technologies, seems to be a good opportunity to merge social, educational, and physical promotion in elderly. The SCC Innovation Hub & Living Lab Network project and the Walk&Talky service move in this direction, in order to better identify the effective outcome to ameliorate technology's purpose and consequently ageing people participation. In particular, Walk&Talky is a service that supports walking leaders and walking groups participants by keeping track of the performed physical activity and monitoring their fatigue status while walking. Through this tool, we aim at easing the psychological burden of constantly checking the adequateness of physical exercise (which is left to the automatic tools, e.g., wearable sensors), allowing the elderly to enjoy the social aspects of the walking group activities. This should allow them to put sociability and relationships as the core of the activities.

Promuovere la partecipazione ai gruppi di cammino sembra essere ad oggi tra le proposte più efficaci per invogliare le persone alla partecipazione all'attività fisica. Organizzare le attività dei gruppi di cammino prevedendo l'utilizzo di sistemi di monitoraggio portatili ed indossabili sembra inoltre avere utilità non solo per il monitoraggio dei parametri fisiologici ma anche promuovere la socialità e l'educazione alla pratica motoria dei partecipanti, soprattutto negli anziani. Il progetto SCC Innovation Hub & Living Lab Network e il servizio Walk&Talky si muovono in questa direzione, con un servizio che supporta sia gli accompagnatori che i partecipanti ai gruppi di cammino: monitorando i parametri fisiologici e anche lo stato di affaticamento durante le camminate, l'obiettivo è di alleggerire l'onere psicologico di controllare costantemente l'adeguatezza dell'esercizio fisico (che è lasciato, ad esempio, ai sensori indossabili), in modo che ai partecipanti anziani possano godere degli aspetti sociali del gruppo e consentire loro di porre la socialità e le relazioni al centro delle attività.

### Keywords

Active ageing; physical activity; walking group; wearable technology; wellbeing.  
Invecchiamento attivo; attività fisica; gruppi di cammino; tecnologia indossabile; benessere.

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### 1 Author Contribution

Valeria Agosti: conceptualization; writing (original draft preparation, review and editing)  
Nicola Lovecchio: conceptualization; writing (review and editing)  
Eleonora Ciceri: conceptualization, investigation and writing for the Walk&Talky section  
Antonio Borgogni: supervision; writing (review and editing)  
Angelo Compare: supervision and final review, funding acquisition.

## Introduction

In recent years, the political and social debate on the ageing of the population and on the increase in longevity has given rise to a new idea of welfare moving around the concept of *Active ageing* (López-López & Sánchez, 2019). Defined by the World Health Organization's (WHO, 2002) as «the process of optimizing opportunities for health, participation and security to enhance quality of life as people age», it is now clear that the idea of Active ageing is related not only to the physical area but also to social, economic, cultural, spiritual and civic participation, since the focus is no longer on the binomial dependency and passivity but on autonomy and participation (Foster & Walker 2021). Ageing thus takes place in a biopsychosocial framework, where the regular practice of physical activity can play a key role in prevention, protection but also promotion for the maintenance of health and well-being in the elderly population (Lovecchio & Vago, 2014; Dias et al., 2017). Unfortunately, despite these shared recommendations, and with reference to industrialized countries, there is evidence that participation in physical activity in this group is still very low and with a high dropout rate (Meads & Exley 2018); at the same time, it has been shown that participation in physical exercise become a daily routine if constitutes an opportunity for socializing and meeting (Kassavou et al., 2013). Particularly, it has been shown that outdoors *walking groups* (WGs) are a potentially attractive physical activity intervention, especially among the elderly, whose positive effects on health and well-being levels involve both the physical and cognitive areas, regardless of activity level (Hanson & Jones 2015). Walking is a form of physical activity that does not require special or expensive equipment or a gym membership; it is safe even for the inactive elderly and constitutes one of the most useful practices for keeping a good state of health and well-being. In fact, regular performance is recommended, both in adulthood and in the elderly, to contrast numerous degenerative diseases as well as cognitive impairment (WHO, 2004, 2010; Olanrewaju et al., 2016).

Walking should therefore become a habit of daily life for adults and elderly people: the WHO (2015), in a recent report on active ageing and health, underlines the need for a systemic change that must not only involve health systems instead implying the development of strategies that involve the elderly in full autonomy and self-determination, making use of social and educational strategies in a *lifelong learning* vision. Lifelong learning implies non-formal community-based programs that act as a compensatory and supportive strategy for physical and psychological well-being useful to foster autonomy and self-management. In this context, the support of *mobile technology* or of *wireless devices* and *wearable sensors* can constitute a valid support for the elderly, not only for the monitoring and the management of physiological parameters but also to support participation in WGs (Narushima et al., 2016; Helbostad et al., 2017): technology can and must also be useful to support the Walking Leader (WL), which takes responsibility for the organization and management of the WG (Wilcox et al., 2015).

The *Walkability project* we propose in this paper, is part of this framework, which moves as an attempt to use portable and wearable technology at the service of Active Aging in a context of well-being. It is a pilot project designed for activities of structured WGs, where technology allows to create a virtual space supporting the real environment in the management of both walks and walkers.

## The Walkability pilot

The Walkability pilot onto which we base the work described in this article takes place in a *Living Lab* in the context of the SCC Innovation Hub & Living Lab Network project (<https://sccinnovationhub.org/>). The project has set itself the goal of creating a Living Lab Network useful to:

a) collect quantitatively and qualitatively data for the training of complex systems, for the training of Artificial Intelligence (AI) algorithms and test on a large scale an integrated ecosystem of solutions, enabling technologies, Industrial Internet of Things (IoT) products, 5G connectivity and applications able to assist citizens in interacting with Smart Cities to improve active lifestyles in a constantly changing society and urban environments.

b) design, develop and validate on a large scale, through pilot projects, solutions for assisting people in raising their quality of life in a society and in ever-changing urban environments.

The main results of the project will be the technological platform for the management of data collection within the Living Labs and for the development of AI algorithms, AI modules and services developed in the pilot projects.

Taking place in a Living Lab, the Walkability pilot is based on a research framework, which starts from the founding assumption that if it is true that health passes through a complete state of psychophysical well-being, and if it is true that education requires a lifelong approach, then it is also necessary to think for educational interventions where physical and sports activities go beyond the boundaries of real space and integrate with the virtual world, even for the elderly. This need has become even more evident due to the SARS-CoV-2 pandemic.

The Walkability pilot study, by creating a network between companies, universities, associations, and health institutions, aims to go beyond the socio-health threshold (and therefore the mere medicalization of physical interventions aimed at the elderly population) to re-gain social and educational dimensions, to implement a “true-virtual” and virtuous didactic environment within protagonists move in a *ubiquitous space*: real and virtual intertwine to design a unique motor learning environment.

The real leading actors of the project, as described below, are the elderly enrolled in the WGs of their municipalities and the associations that manage and realize the activities using the public parkland. The virtual is realized in the *Walk&Talky service*, contained in an application for smartphone (downloadable by each participant) designed to create a virtual system of relationships, where the *body in motion* is the protagonist in a real social network and also (but not only) in a digital dimension.

### **The real space of movement: Walking group and Walking leader**

Walking in green areas and in the countryside has become a popular recreational way of exercising. In recent years, there has been an important interest in the creation of adequate urban and peri-urban environments for WGs also in Italy (Borgogni & Farinella, 2017) groups of people who organize walks together. It has been shown that to promote the creation and membership of WGs, they must be organized in limited geographical areas (Borgogni, 2020), where a social system already exists, as well as being guided and managed by a WL, who is a peer, a participant who at the same time has the additional responsibility of supervising walks and ensuring that participants are safe and comfortable (Wilcox et al., 2015).

WGs are often organized by Associations and local administrations with a dual objective: to reduce the sedentary lifestyle of the elderly population and to promote sociality and interpersonal relationships. In effect, participants in these groups usually adhere to the activity since they are suggested by one of their contacts, rather than their primary care physician or a friend who is already part of the group. Indeed, the main reasons that encourage people to join WGs (where social relationships is the core), is the practice of physical activity while spending some time with other participants (Ginis et al., 2013).

In the context of the Walkability project, the WGs involved report to Associations operating in an area of north-west Italy. The healthy elderly participating in the WGs, aged between 65 and 80 years, already involved in Association activities, will be able to take part in the walking activities. The WL, participants who also assume the responsibility of leading and monitoring the group, will be trained in the basics of first aid and physical exercise routine, to be able to propose even small exercises before and after the walks.

### **The virtual space of movement: The Walk&Talky service**

The service we propose, named Walk&Talky, allows participants to maintain their health status monitored in real-time while they are taking part in the activities of a walking group. Walk&Talky is composed of a mobile application (which can be installed on the participants' smartphones) and an ECG monitoring device mounted on a T-shirt. The service allows the

digitalized management of some phases of the activities and a monitoring of the state of health. It therefore offers a personalized experience to each WG participant: in the virtual space, which does not replace but is additive to the real space, they will have the possibility to monitor in real time their level of well-being and fatigue during walks.

The system is designed for elderly users, who are unwilling to make technology the leading actor of their activity and are not so confident to interact with complicated systems. The design of Walk&Talky is thus non-intrusive: it allows WL to make the roll calls at the beginning of each walk (mocking the normal functioning of a WG) and sends notifications to the interested parties (fatigued participant and WL) whenever a fatigue state is detected. All the other functionalities (i.e., visualization of the walked distance, visualization of the fatigue state during a walk, assessment of each walk, visualization of exercises performed at home) are not mandatory, meaning that each participant can decide to access these functionalities by consulting the mobile application at the time of need, or to ignore them. Walks can be conducted almost in their original form, wearing the ECG monitoring device, leaving the smartphone in the backpack, and checking the application only when it sends notifications. This approach preserves the normal pattern of the walk, adding to the overall experience only what is needed to monitor the health status of participants and making them feel more secure.

Fatigue assessment is done automatically by the system, by acquiring ECG signals via the wearable sensors and processing them to compute a fatigued/non-fatigued state. Such an automatic assessment can be done using several techniques, depending on the amount of data at hand. If no datasets are available, a simple way of assessing if a participant is fatigued is to use the Tanaka equation (CDC, 2020; Tanaka et al., 2001) to transform the heart rate into a fatigue level. Alternatively, one could decide to build a dataset that relates Heart Rate Variability features (henceforth, HRV) to fatigue levels. HRV is a good indicator of fatigue, as it can indicate if the heart of an individual is under stress. The dataset would be then built by i) continuously monitoring participants ECG and use it to derive HRV features (input features); ii) periodically ask participants if they feel fatigued (labels). Such a dataset can then be used to train a machine-learning algorithm to automatically assess fatigue.

Service users participating in the WGs will also report their *personal feelings* through assessment questionnaires that can be filled in at the end of the walk via the mobile application. Such questionnaires are posed as a subjective restitution of the physical experience realized not only in quantifiable clinical data, but also in a personal, emotional, intimate dimension of the walking experience, which opens up new perspectives of quantification.

The last step of the Walk&Talky service is that the administrative staff of the Associations will be able to share (in anonymized form) with other authorities and stakeholders all the service statistical and physiological data, as to preserve the protection of subjects' data while performing knowledge sharing.

### **Conclusion and future perspectives**

The project presented is the pilot part of a very solid but, at the same time, evolving theoretical framework. The ageing of the population, growing longevity, the political and social need to promote Active Aging are very topical issues that require *ad hoc* welfare policies, including in the promotion of physical activity for elderly people. The organization of WGs fits into the same context in which the proposed technology is intended to be a support, and not a substitute, for these social actions.

So far, we have illustrated the idea of the *virtuous marriage* between technology and physical activity in the management of a WG, but the sequel of the activity in the coming months will be oriented not only to ad hoc experiments of technology but also in a research work that will test technology also in the management of the participants' home fitness.

In fact, starting from the international guidelines proposed by the National Institute of Health, to make strong the idea of the educational project and well-being, a series of physical exercises, proposed in commented images will be devised, and inserted in the application (Figure 1). These will constitute an exercise guide not only for the *how and how much to move*

but also *on the why* it is useful that the exercises are performed in that way. This implies to think about the moving body from an ecological perspective, which then leads the elderly to know and recognize, independently, their own state of well-being.



Figure 1. A screenshot of the Walk&Talky application, developed by MediaClinics. The screen shows the data of a performed walk, i.e., walk duration, steps, walked distance, detected fatigue state. Plus, there are two buttons in the lower part of the screen that allow participants to, respectively, access a library of exercises to be done at home and access the statistics on all the performed walks.

The international literature has been guiding us in this direction for years, but there are still few operational proposals seeking solutions that are not a mere replacement or a substitute for physical activity, but which are instead integrated learning environments. The pandemic has certainly contributed to accelerating the digitization process, including public health interventions focused on physical activity of elderly people (Agosti, 2021).

The Walkability pilot moves in this direction and the Walk&Talky service is conceptualized as an educational service, not only in the way of providing a performance measurement tool. It integrates, in fact technology into the social (and physical) system of the elderly, where the body also becomes the protagonist in another dimension: a deep interweaving within social network that extends, from analog to digital, from real to virtual and vice versa.

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