The AI Ethics Principle of Autonomy in Health Recommender Systems

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Abstract

The application of health recommender systems (HRSs) in the mobile-health (m-health) industry, especially for healthy active aging, has grown exponentially over the past decade. However, no research has been conducted on the ethical implications of HRSs and the ethical principles for their design. This paper aims to fill this gap and claims that an ethically informed re-definition of the AI ethics principle of autonomy is needed to design HRSs that adequately operationalize (that is, respect and promote) individuals' autonomy over ageing. To achieve this goal, after having clarified the state-of-the-art on HRSs, I present the reasons underlying the need to focus on autonomy as a prominent ethical issue and principle for the design of HRSs. Then, I pursue an inquiry on autonomy in HRSs and show that HRSs can both promote individuals' autonomy and undermine it, also leading to phenomena of passive ageing. In particular, I claim that this is also due to the concept of autonomy underlying the debate on HRSs-based m-health, which is sometimes misleading, as it mainly coincides with informational self-determination. Using ethical reasoning, I shed light on a more complex account of autonomy and I redefine the AI ethics principle of autonomy accordingly. I show that autonomy and informational self-determination do not overlap. I also show that autonomy encompasses also a socio-relational dimension and that it requires both authenticity conditions and social recognition conditions. Finally, I analyze the implications of my ethical redefinition of autonomy for the design of autonomy-enabling HRSs for healthy active ageing.

Keywords: Artificial intelligence, AI ethics principles, Relational autonomy, Health recommender systems, Machine-learning.

1. Introduction

The application of artificial intelligence (AI), and specifically machine-learning (ML) algorithms, in the field of healthcare has expanded significantly in the last decade (Jian et al. 2017, Esteva et al. 2019, Tran et al. 2019). ML algorithms—probabilistic models capable of mining and learning from vast amounts of raw, unstructured, and

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heterogeneous datasets to discover valuable patterns and correlations, often invisible to the human eye, and make predictions on the basis of them—have shown great potential for preventive and personalized medicine and healthcare (Miotto et al. 2016, Harerimana et al. 2018, Cowie et al. 2018, Barton et al. 2019, Dudley et al. 2015), for home-care health monitoring (Zoppo et al. 2020, Zheng et al. 2020), and e-health services via mobile-health (m-health) such as telehealth and telemedicine (Rubeis et al. 2018, Karako et al. 2020, Santoro 2020); domains recognized as crucial for the design of agetech, i.e., digital systems (from apps and wearables devices to domotics for ambient assisted living) that aim to improve autonomy for the elderly and promote healthier and active aging (Sixsmith and Gutman 2013, Haux et al. 2016, Neves and Vetere 2019).

Indeed, the deployment of the predictive power of AI and ML to design personalized agetech for geriatric patients and active ageing is rapidly growing, ranging from the prevention of diseases, such as Alzheimer and dementia, to the promotion of physical and mental activities (Rubeis 2020, Chen 2021, Pollack 2005, Sixsmith 2002) for fit adults not impaired by severe pathologies and/or disabilities.

In this field, health recommender systems (HRSs) are a promising and widely used ML-based technique governing today the majority of agetech and m-health devices. HRSs increasingly rely on ML's profiling and even on predictive analytics to deliver personalized and preventive healthcare via recommendations about adults' health and lifestyle habits on the basis of their inferred or discovered health profile (Wiesner and Pfeifer 2014, Sanchez-Bocanegra et al. 2015, De Croon et al. 2021). HRSs are described as powerful tools to maintain and promote autonomy in later life, ultimately fostering a healthier and active ageing process by recommending better health choices and personalized actionable knowledge (De Croon et al. 2021, Ho 2020), which in turn can trigger behavior changes in lifestyle and improve the overall health quality of older adults, while minimizing or preventing health risks, such as physical and psychological decline related to ageing (Elsweiler et al. 2016, Rabbi et al. 2015, Sadasivam et al. 2016, Radha et al. 2016, Nouh et al. 2019, Ho 2020).

Although there is no specific research on the ethical implications arising from the design of HRSs for the elderly, scholars have started to outline the potential undermining impact of AI and ML-based e-health technology on patients' autonomy (Rubeis et al. 2018) and active ageing (Ho 2021), and they have pointed to the need to integrate ethical considerations about how AI and ML techniques impact elderly's autonomy when designing ML-based agetech (Rubeis et al. 2018, Ho 2020).

While there is no research on the ethical aspects of HRSs or the ethical principles that should steer their design, some studies have highlighted the ethical risks related to the design and use of recommender systems in general (RSs), i.e., not specifically applied for health-related purposes (Paraschakis 2016, Milano et al. 2020, Varshney 2020). For example, Paraschakis (2016, 2017, 2018) showed how RSs used in e-commerce applications can expose users to behavior manipulation by using people for online experimentation (or a/b testing), claiming the need for an ethical framework of principles for the design of RSs (2017). Milano et al. (2020) mapped the main ethical challenges raised by the design of RSs and acknowledged the impact of RSs on users' autonomy (ranging from privacy to behavior nudging and manipulation) as one of the most pressing concerns. Varshney (2020) recognized the detrimental impact of RSs on users' autonomy and

argued for the need to redefine the AI ethics principle of autonomy and to operationalize it in the design of RSs.

This paper contributes to this initial discussion on the use of AI-based, and specifically RS-based, techniques in healthcare, by focusing on HRSs as increasingly embedded in m-health systems for improving people's autonomy, especially in ageing. More specifically, the paper claims that an ethical inquiry into the concept of autonomy in HRSs is needed to revise the AI ethics principle of autonomy as currently developed and operationalized in the m-health industry and to adequately design HRSs-based agetech systems for active healthy ageing.

Towards that end, the paper is structured as follows. Section 2 highlights the main reasons underlying the choice to focus on the ethical principle of autonomy in the design of HRSs-based m-health for active ageing. Section 3 explains how autonomy is understood in the m-health industry for active ageing as well as in the literature in ethics of AI, ML, and RSs. I argue that autonomy mainly overlaps with informational self-determination and that this understanding as such is inaccurate and might lead to disengagement, withdrawal, and, ultimately, passive ageing, rather than enabling people's active ageing. Section 4 discusses how an ethical inquiry into the concept of autonomy is needed to design autonomy-enabling HRSs-based m-health that can effectively promote active ageing. Drawing insights from moral philosophy, I seek to ethically redefine the concept of autonomy, which is more complex than what is currently informing the AI ethics principle of autonomy (HLEGAI 2019, WHO 2021), and I highlight different dimensions and sub-conditions that need to be considered into the design of HRSs to adequately promote individuals' autonomy in ageing. Section 5 shows how understanding autonomy via ethical reasoning leads to redefining the AI ethics principle of autonomy and clarifies what it takes to operationalize autonomy in HRSs for active ageing. Finally, section 6 concludes.

2. Autonomy *for* HRSs

The application of HRSs in the m-health industry, especially for healthy and active ageing, has grown exponentially in the last decade (Kamran and Javed 2015, Afolabi et al. 2015, Ferretto et al. 2017) as has the corpus of (mostly technical) literature about their design and use (Sezgin and Özkan 2013; Wiesner and Pfeifer 2014, Kamran and Javed 2015; Calero Valdez et al. 2016, Hors-Fraile et al. 2018, Schäfer et al. 2017, De Croon et al. 2021). However, as De Croon et al. (2021) noted, there is no literature on the ethical implications that can arise from the design and use of HRSs for older adults and laypersons,[1] broadly, and there is no ethical framework of principles for the design of HRSs.

This dearth of literature in ethics of HRSs is problematic. Indeed, ethical risks for individuals in reference to general RSs have been already uncovered (Tang and Winoto 2016, Paraschakis 2016, 2017, 2018, Milano et al. 2020, Varshney 2020). Thus, when RSs are deployed and designed for a sensitive and morally-loaded field such as that of healthcare (i.e., HRSs), an ethical inquiry into them turns out to be mandatory.

This section aims at contributing to fill this gap by focusing on the HRSs used in the m-health industry to foster active healthy ageing. In particular, I argue for

[1] The layperson is usually understood as a non-healthcare professional.

the need to focus on autonomy as a prominent principle for the design of HRSs. There are at least three reasons for the specific choice to focus on autonomy.

First, in the nascent literature in ethics of RSs, autonomy has been acknowledged as one of the most pressing concerns (Milano et al. 2020, Varshney 2020). As a specific category of RS, HRSs can also rely on ML profiling (Sezgin and Özkan 2013, Wiesner and Pfeifer 2014, De Croon et al. 2021). Thus, they can collect and act upon vast amounts of individuals' personal data directly or by proxy in order to label and categorize individuals as part of certain groups rather than others; groups to which recommend certain personalized options (from information, ads, and products to tasks and actions up to a particular treatment and drug) rather than others. Through ML profiling and users' categorization, HRSs can also come to infer individuals' choice-driving elements thanks to a predictive knowledge-discovery approach (Tiribelli 2023). The latter is specifically driven by the use of specific ML-based techniques (also called recommender techniques): *a) content-based filtering*, *b) collaborative-filtering*, and *c) knowledge-based filtering*.[2] These techniques are more and more combined in the design of HRSs to increase the accuracy of personalized recommendations so that HRSs are often call *hybrid* RSs (De Croon et al. 2021). Indeed, it is also important to outline that HRSs are more and more based on probabilistic ML. In this case, the recommendations developed do not follow causal links, because the model is not designed to follow preset rules. The goal/main task in ML is predefined by designers, that is, in HRSs, produce an effective recommendation, which with probabilistic ML is developed by the system by continuously *learning* how to better achieve this goal. To the extent the main goal of a recommendation is to guide users towards the recommended choices, and this often implies using techniques to nudge users (Milano et al. 2020, Varshney 2020) towards a behavior change (Hors-Fraile et al. 2018, De Croon et al. 2021), usually by recommending information that can exploit and target (discovered or inferred) individuals' choice-driving elements to reshape their initial preferences, users' autonomy becomes a paramount issue (Tiribelli 2023).

The second reason for focusing on autonomy in HRSs for active ageing is that the respect for autonomy is widely acknowledged as one of the main principles for healthy active ageing (WHO 2002, Gebremariam and Sadana 2019). As a consequence, the way in which novel technologies (e.g., HRS) can promote or undermine autonomy by design has a huge bearing on the promotion of healthy active ageing. Indeed, in the broad field of AI-based techniques for active ageing, a growing corpus of research is asking for the inquiry on and then the integration by design of ethical considerations about the impact of ML-based techniques on people's autonomy (Rubeis et al. 2018) and in particular on the elderly's autonomy (Ho 2020).

[2] *Content-based filtering* is an RS technique that recommends items that are similar to other items preferred by a specific user. It relies on the characteristics of the objects connected to users' previous choices and behaviors. *Collaborative-filtering* is the most used and mature RS technique; it works by comparing previous actions and choices of multiple users to find common patterns to predict users' future choice-behavior and generate personalized suggestions. *Knowledge-based filtering* is another RS technique that incorporates knowledge by logic inferences. It dynamically combines explicit knowledge about an item with users' previous choices and expressed or inferenced preferences, along with other techniques based on users' feedback before, during, and after the recommendation.

The third reason is that autonomy is widely acknowledged as both a core ethical principle in the fields of bioethics and medical ethics (Beauchamp and Childress 2019) and one of the most prominent ethical principles for the design of AI-based techniques in general (FLI 2017, IEEE 2017, Montreal Declaration 2017, HLEGAI 2019, AI for People 2018, Floridi and Cowls 2019) as well as in healthcare (WHO 2021). Thus, any novel AI/ML-based technique applied for health purposes such as HRSs ought to take autonomy into account.

In the next section, I claim that even if HRSs have great potential to promote autonomy and ultimately, healthy active ageing, as they are currently designed, they risk triggering also passive ageing: as I will show, this is also due to the way in which autonomy is currently understood and then operationalized into the design of m-health for healthy active ageing. I show why this account of autonomy is inadequate and highlight the need to redefine autonomy through ethical reasoning.

3. Autonomy *in* HRS-Based m-health

In the m-health industry, there is a widespread idea about the beneficial potential of AI and ML to promote individuals' autonomy and ultimately their healthy active ageing, especially via the use of HRSs (Smyth 2019, Sahoo et al. 2019, De Croon et al. 2021), which are described as capable to "recommend the right thing to the right person at the right time" (Sahoo et al. 2019). The general idea is the following: since HRSs can deploy ML's predictive capacity on unceasingly growing datasets and medical records (Wiesner and Pfeifer 2014, Schäfer et al. 2017) and elaborate and act on them via combined/hybrid techniques (Verbert et al. 2012), which work by amplifying the degree of personalization of recommendation, HRSs have the potential to empower users' autonomy by delivering highly personalized and preventive health information.

However, this is not necessarily the case for at least three reasons.[3]

First, when HRSs are based on ML they can also be inaccurate: ML's probabilistic capacity to find new patterns, though very often precious in preventive diagnosis and personalized medicine (Schäfer et al. 2017, Pollack 2015), is not infallible, as it can attribute weight to correlations and "find patterns where sometimes none actually exist" (Boyd and Crawford 2012: 668).

Second, since ML often operates like a "black box" (Pasquale 2015), users' autonomy can be undermined when they rely on health recommendations that are communicated as highly tailored on their health profile when instead they can also result from macro-objectivizing group profiling and categorizing techniques, e.g., collaborative filtering, and their functioning is opaque to laypersons in terms of complexity (Pasquale 2015, Watson et al. 2019) and/or digital literacy (Kim and Xie 2017), creating asymmetries in knowledge and action between users and HRSs' providers.

Third, there is a widespread misunderstanding about the way in which autonomy is understood in the m-health industry (Morley and Floridi 2019) and in HRSs (De Croon et al. 2021). The widespread idea is that any technology that

[3] It is possible to add another way in which HRSs can affect users' autonomy by exposing them to privacy infringements. Considering that this is the most discussed challenge in the field of AI and ethics and that, today, there are highly privacy-preserving ML techniques for AI applications in healthcare (e.g., split learning and federated learning), in this paper, I stress the need to focus on other issues that are relevant but have received less attention.

puts the users 'in control' will empower their autonomy—their capacity for self-determination over choices, actions, and life (Rich and Miah 2014). Thus, since m-health and HRSs can give laypersons more control over their health, lifestyle, and behaviors (Lupton 2014) through data, information, and recommendations *on* and *for* their health, they are considered to be effective in making people more independent and improving their health (Bravo et al. 2015) by empowering their capacity for self-determination. To summarize, the notion of autonomy that emerges from HRS-based m-health overlaps with *informational self-determination*: the individual's capacity to make better and more independent health choices and stay more active and healthier in ageing improves thanks to highly personalized health information.[4]

However, this notion of autonomy is grounded on the conceptually inaccurate overlap between autonomy and informational self-determination, which might counteract, instead of promote, the autonomy of laypersons, and especially the autonomy of the elderly, in the process of healthy active ageing.

Although it is reasonable to assume that once laypersons have been informed about their health status and how to improve it by HRSs this information will result in more autonomous and better decisions about their health and lifestyle, limitations and failures about the efficacy of these systems for patients' autonomy in ageing have been reported (Lee and Coughlin 2014, Mittelstadt et al. 2014, Vezyridis and Timmons 2015, Lupton 2016; Hoque and Sorwar 2017, Taipale and Riitta Hänninen 2018, Fang et al. 2018, Owens and Cribb 2019, Lucivero and Jongsma 2018). These are mainly connected to a lack of consideration of "aged heterogeneity" (Grigsby 1996, Fang et al. 2018, Taipale and Riitta Hänninen 2018), which is ignored by this autonomy empowerment narrative (Mittelstadt et al. 2014, Vezyridis and Timmons 2015, Owens and Cribb 2019, Lucivero and Jongsma, 2018). Specifically, at the core of this criticism is the way in which the design of these systems fails to consider individuals' contextual complexities, from individual health needs, deep vulnerabilities, and psycho-physical characteristics to socio-economic circumstances, digital literacy, and moral and cultural values, which play a critical role in an individual's capacity to act upon a recommendation and be effectively motivated by it (Lupton 2016, Owens and Cribb 2019).

Indeed, even if HRSs can rely on fine-grained profiling techniques that can allow them to find patterns to group individuals into categories and then re-mine them through feedback loops in order to find common characteristics *between* and *within* diverse groups (e.g., collaborative filtering), the result (i.e., what is recommended) might not be a tailored health recommendation for the user, considered as a specific person, which in some aspects may not be entirely or well captured by ML's datafication process (Giovanola and Tiribelli 2022). Rather, the result often reflects common models on health management (from common practices to stereotypes), grounded on how an ideal healthy user should behave, as being mostly recurrent in data, and beyond their being scientifically-based or instead the product of common sense and/or opinion.

[4] Among the countless applications in this field, an indicative example of m-health is provided by the Wave app, a top-ranked HRSs-based app where the improvement of health conditions in fit and ill users is described as follows: *improve* your health by: *a)* taking *control* of your health, *b) tracking* your symptoms, medications, and daily activity, and *c) learning* from AI-enabled personal insights (i.e., health recommendations).

For example, consider the m-health apps that standardize the recommendation of five meals a day and an exercise routine of not less than 10,000 steps per day in order to improve well-being in ageing (Tudor-Locke et al. 2011). The HRSs-based apps that recommend what and how many times to eat, the number of hours to sleep, and the steps to take per day generally operate by developing personalized recommendations via nudging notifications (Galič et al. 2017) on the basis of how the users are profiled and categorized, by unceasingly reminding them to complete the task and rewarding or blaming them based on the task accomplishment (Owens and Cribb 2019). These systems usually ignore aspects such as social, cultural, and religious choices (e.g., practicing Ramadan) which deeply mediate the way in which individuals can and want to pursue those health goals. This means that even if these recommendations are accurate and the users' goals are well captured, HRSs generally ignore the broader moral and socio-cultural dimension informing and motivating the user's agency and lifestyle.

This is problematic because it can create a gap between what the users should do to achieve certain goals and the *way* in which they really can and want to pursue those goals. This is a motivation gap and can result in low adherence to actively responding to HRSs' health suggestions. For example, this is visible in the behavior of the elderly who ignore recommendations and try to find ways to fool AI-based technology (Ho 2020). This might lead also to phenomena of depression, withdrawal, disengagement and, ultimately, passive ageing, when people feel uncapable to follow health recommendations both because of a lack of competence and as deeply in conflict with their deep convictions.

To summarize, I claimed that despite the beneficial potential of HRSs for active ageing, the notion of autonomy emerging from HRSs-based m-health might hamper instead of enabling active healthy ageing. The reason is that this notion of autonomy is informed by a misleading empowerment narrative, whereby autonomy overlaps with informational self-determination, and the potential of the design of HRSs for active ageing is limited to a model focused on informational empowerment.

This limit asks for a reconceptualization of autonomy for the design of HRSs-based m-health for active ageing and, more broadly, for a redefinition of the AI ethics principle of autonomy. Indeed, the AI ethics principle of autonomy has been criticized as being vague, mainly lacking a well-defined conceptualization (Varshney 2020) that, at best, overlaps with informational self-determination and is mainly addressed via informational privacy's preserving techniques (Floridi and Cowls 2019, HLEGAI 2019, WHO 2021).

In the next section, I show that an in-depth ethical inquiry is needed to highlight that autonomy and self-determination do not overlap. Thanks to ethical reasoning, I claim that a more complex account of autonomy should inform both the AI ethics principle of autonomy and the design of HRSs in order to develop HRSs-based systems to effectively promote healthy active ageing.

4. An Ethical Redefinition of Autonomy

In this section, I pursue an ethical inquiry on autonomy, drawing insights mainly from theories developed in moral philosophy. I first clarify the relationship between autonomy and self-determination and show that this is just one of the two main dimensions of autonomy. Then, I show that autonomy encompasses also a socio-relational dimension and I highlight the key conditions that need to be

considered in order to promote these two dimensions of autonomy and to operationalize a more complex account of autonomy in HRSs.

The relationship between autonomy and self-determination has been widely discussed in moral philosophy, especially in the liberal tradition[5] that emphasizes the dimension of autonomy as self-government, control, and independence and that grounds it in the individuals' capacity to choose, act, and behave according to the interests, reasons, beliefs, and values they can reflectively endorse. In this sense, most liberal accounts of autonomy are committed to what is called the "endorsement constraint" (Kymlicka 1989, Dworkin 2000): autonomy is respected only when people can embrace and endorse, i.e., critically reflect, identify with, or rejects and modify what guides their choices and actions. Thus, self-determination is expressed in the individual's capacity to be in control of her choices and actions, meaning to control the capacity to steer her behavior according to factors that are somehow her own (Frankfurt 1988, Dworkin 1989, Ekstrom 1993, Michael 2005, Korsgaard 2014, Thomas 2017). When there is enough agreement on the idea of autonomy as self-determination, many more differences emerge when it comes to detect the sub-conditions to achieve autonomy (Killmister 2017). However, two main families of sub-conditions seem to widely permeate the long-standing liberal debate on autonomy: *a) competency* conditions and *b) authenticity* conditions.[6]

Competency conditions refers to various capacities that an individual should own and be able to exercise in order to be defined as autonomous, ranging from minimum rationality for deliberation and decision-making processes to freedom from debilitating pathologies and systematic self-deception. Competency conditions are highly criticized in the debate on autonomy, both in moral philosophy and bioethics, because they only express a formal or 'procedural account' of autonomy. They focus on the procedure through which a person comes to endorse options and values and claim that is sufficient to determine autonomy, and not on the substance of the process, that is, if the options on which a person chooses embed the values and projects she deems meaningful. This focus on competencies results problematic especially when it comes to attributing autonomy (and recognizing the connected dignity) to people who experience constraining socio-economic or health conditions, for instance, those affected by physical or physiological decline and/or debilitating pathologies, as in the case of the elderly (Jaworska 2009).

Instead, much more agreement there is about the second family of sub-conditions, namely, authenticity conditions. Authenticity conditions also express the possibility of identifying with commitments, beliefs, ground-projects by endorsing them as the motives of choices, actions, and behaviors. However, in particular, authenticity conditions stress that autonomy is respected only when the options on which a person can exercise her reflective endorsement substantially incorporate the values and projects she deems as being deeply meaningful.

These accounts of autonomy have been found particularly interesting in medical ethics and active ageing because they allow for conferring autonomy also to people affected by psychophysical decline and disabilities, who revendicate

[5] Since a full survey of these views cannot be undertaken here, I focus on representative samples of these accounts. To expand the debate, see Skinner 2012.

[6] For a more detailed discussion in moral philosophy, see Christman 2004; for bioethics and medical ethics, see Stoljar 2011 and Owens and Cribb 2013.

their feeling of being autonomous when they can live by choosing the activities, commitments, and projects they consider to be deeply meaningful for their life, even though they are impaired by pathologies in other more basic activities (from moving to speaking up to hearing and remembering). However, these traditional accounts of autonomy as self-determination have also been widely criticized (Oshana 1998, MacKenzie and Stoljar 2000, Westlund 2009), as they focus exclusively on an individualistic dimension of autonomy, whereby individuals are conceived to be independent and self-isolated.

In opposition to this limited understanding of autonomy, some scholars, coming both from moral philosophy (Oshana 1998, MacKenzie and Stoljar 2000, Westlund 2009), and from medical ethics and bioethics (Stoljar 2011, Entwistle et al. 2010, Wardrope 2015, Owens and Cribb 2013), started to recognize the key role that the socio-relational dimension plays in the development and enjoyment of autonomy. Even if with conceptual variations, the theories lead to what can be labelled as 'relational autonomy' (MacKenzie and Stoljar 2000). The core idea is that, beyond exercising critical abilities, such as reflective endorsement, autonomy is respected when the social conditions surrounding us allow for 'significant' options, which in turn cannot prescind from the socio-relational and cultural dimension by which we are embedded and shaped (Oshana 1998). While traditional accounts of autonomy refer to an isolated individual reflecting on her own desires (and can therefore lead to individualistic accounts), relational accounts of autonomy claim that the processes of establishing authenticity can only occur in social conditions, as through the socio-relational and cultural dimension people develop what have significance for them and motivates their agency. Authenticity conditions that fail to mention the contributory role of this socio-relational dimension serves to valorize the life of the separated individual and to denigrate the social and interpersonal factors that inform and define the possibility for autonomy: "in their view, autonomy rests an individual undertaking, a set of capacities which a person, apart from others, might exercise" (Oshana 1998: 81). More specifically, the exponents from relational autonomy stress how, in countless ways, people are constituted by factors that lie beyond their reflective control but which nonetheless structure their values, thoughts, beliefs, and motivations (Taylor 1991); thus, "we cannot say that we are autonomous only when we can step back from all such connections and critically appraise and endorse them" (Bell 1993: 24-54).

Despite the heterogeneity of this debate, some authors investigated this relational element for autonomy and found the conditions to promote it via social support or social recognition (herein after: *social recognition* conditions), as being crucial to maintaining and fostering individuals' capacity for self-trust, self-esteem, and self-respect, which in turn are highlighted as necessary for people to properly express their agency (Grovier 1993, Anderson and Honneth 2005, Benson 2005, Westlund 2014).

These contributions argued in favor of considering both the conditions outlined (authenticity via reflective endorsement constraint and relatedness via social recognition) as being necessary for respecting and promoting autonomy. More specifically, they agreed on the idea that autonomy requires the ability to act effectively on one's own values and projects (either as an individual or as a member of a social group), but that this condition alone is not enough to account for autonomy to the extent that today oppressive conditions of various kind can increasingly threaten autonomy by eroding or removing one's sense of self-confidence (i.e., self-trust, self-esteem, and self-respect) required for effective agency. Consequently, it is necessary

to work also on relatedness conditions for social recognition and support, as they can enable (maintain and foster) individuals' self-trusting status, which has been found to be crucial for the full enjoyment of autonomy (see Anderson and Honneth 2005, Grovier 1993, Benson 2005, McCleod and Sherwin 2005, Westlund 2014).

To sum up my arguments, thanks to an ethical inquiry, I have shown that autonomy and self-determination do not overlap, and that we need a more complex notion of autonomy that encompasses a socio-relational dimension too. The notion of autonomy I proposed encompasses both self-determination via *authenticity conditions* (reflective endorsement of options embedding what is meaningful for us, as expressing our identity and thus better motivating our agency) as well as a socio-relational dimension, which asks us to revise authenticity conditions in light of relatedness, namely, to promote the former along with conditions of *social recognition*, insofar as they are critical to enabling (preserving and promoting) self-respect, self-esteem, and self-trust, which are required for people to be motivated in their agency.

The proposed ethical redefinition of autonomy is of particular importance for our discussion on autonomy in HRSs and for the discussion on the AI ethics principle of autonomy in HRSs, as I will show in the next section.

5. Autonomy in HRSs Revised

In this section, I analyze the implications of the ethical redefinition of autonomy proposed in section 4 and highlight areas where further work is needed, at the conceptual and the technical levels, in order to design autonomy-enabling HRSs for active ageing. I show that two conditions of autonomy are crucial to further develop the AI ethics principle of autonomy and to identify what is needed to promote a more active and healthier society via AI and specifically via HRSs.

As previously noted, *authenticity* and *social recognition* specify the conditions that ought to be met and promoted to enable a more complex account of autonomy. *Authenticity* conditions refer to the possibility of embracing what we deem to be meaningful in order to be considered autonomous and to be adequately motivated to express our agency. These are articulated in: *a)* the exercise of reflective endorsement and *b)* the options that substantially include what we value most in our life (such as reasons, interests, values-commitments, ground projects, etc.). Considering these conditions in light of active ageing is of particular importance. Indeed, users' non-identification with the lifestyle recommended by healthcare providers or HRSs can lead to the erosion of self-esteem and a sense of passivity that goes beyond being more or less in control of their health via information (e.g., being in control of one's health and activities, but feeling passive towards them); in turn, passivity can easily lead to phenomena of disengagement and withdrawal, disabling motivations to act over health and ageing.

Ensuring and promoting authenticity conditions in HRSs requires that the design of HRSs respect and foster the person's capacity to reflect and endorse what she values mostly as expressing her identity. The information provided by HRSs contributes to meeting the authenticity conditions, as it allows awareness and critical reflection. However, as previously argued, information might be not enough to adequately motivate adults' agency over health and aging. Thus, ensuring authenticity conditions in HRSs requires designing them so that HRSs recommend options in compliance with the interests, activities, projects, and goals that the person values most.

In practice, HRSs can include a space for the preferences, interests, and projects the person values most or they can be designed to include structured or semi-structured interviews between HRSs and users, on the basis of which, through ML's profiling, HRSs can learn the users' preferences, values, and goals. HRSs can then recommend options in compliance with the individual's expressed preferences by re-organizing other options that are morally less meaningful (e.g., taking 10,000 steps per day or going to bed at 11 pm) in a way that the latter does not impede the former. For example, HRSs can recommend how many glasses of water an individual should drink per day, what meal she should eat to stay healthy, or what time she should take her medicine. However, this information or these options should not interfere with a series of activities that the person prioritizes as being highly meaningful in her life, ranging from participating in social and recreational activities to respecting specific food orientations based on religious beliefs or a shared social commitment. Moreover, HRSs should not act on re-shaping users' initial meaningful preferences to trigger a behavior change; rather, they should inform and integrate them via recommendations using the ML predictive capacity to learn how to achieve better health goals by respecting, safeguarding, and promoting what the user defines as truly meaningful. Autonomy is indeed truly respected and enhanced if the options suggested, the alternatives the user can access and afford, are valuable and meaningful—no matter how extensive the list of alternatives. To clarify: if the user does not experience the alternatives recommended by HRS as options that are deeply valuable in her life, while others that are felt as meaningful are discouraged or inhibited, a serious question on if her autonomy is respected in those circumstances raises. This is something that HRSs must assess case-by-case as it differentiates on the basis of the users' heterogeneity in moral values, commitments, and motivations, but that the ML techniques behind HRSs can work on via profiling and hybrid filtering techniques.

Social recognition conditions highlight the social and relational support needed to maintain and foster users' self-confidence to motivate them so they can adequately express their agency when various kinds of social conditions can weaken it. Ensuring and promoting social recognition conditions in HRSs requires that their design recognizes how individuals develop based on social and cultural circumstances and on heterogeneous contexts. This means that the design of HRSs should promote real and affordable opportunities that foster the development and expression of social recognition. In practice, this might be possible, for instance, by designing questionnaires that help users to reason, evaluate, and express the social and cultural features characterizing their agency. ML might use that information to learn how to develop specific recommendations that can effectively connect the user to the social recognition and support she can derive from her encounter with people who not only pursue the same health goals but also share value commitments and common moral ground projects that shape how to achieve those goals.

This condition is extremely value laden for elderly people who increasingly live at home, very often with the same people over time, or in isolated conditions. For example, HRSs can recommend online and offline activities in the community. These activities can be connected to those the users expressed as meaningful inferable via content-based filtering as well as new ones emerging from the relational context of analysis through collaborative filtering. This might also include recommending interactions with people with common interests, values, and

projects on the basis of the meaningful preferences they expressed during the phases of interaction with the HRSs. By doing so, HRSs can provide individuals with different modules or pathways of recommendations to achieve the same heath goals, on which the person can choose and express her satisfaction.

This operationalization of social recognition conditions differs substantially from the current technical integration of relatedness by design in HRSs, which is empowered via control and social pressure and which mainly involves healthcare providers, family, or friends to motivate behavior change (Sax et al. 2018). This operationalization of social support wants to harness ML's filtering techniques to put the person in *meaningful relationships* with others who not only pursue the same health goals but share also how she wants to pursue them, by creating real opportunities to foster meaningful social recognition that is critical to motivating agency.

In summary, redefining the AI ethics principle of autonomy in HRSs requires further work on identifying and implementing ways that really enable laypersons' autonomy, especially the elderly's autonomy, to promote more active and healthier ageing. Meeting the AI ethics principle of autonomy for active ageing entails more than operationalizing aspects such as privacy, accuracy, and the explainability of the recommendations: HRSs ought to promote conditions of authenticity and social recognition, as they are not just necessary to respect autonomy at a minimum threshold but to enable and foster it during a delicate phase of life, such as ageing.

6. Concluding Remarks

This paper aimed to provide insights for ethically orienting the design of HRSs for promoting people's autonomy and active ageing by redefining the AI ethics principle of autonomy. To achieve this, I showed that autonomy in HRSs and AI overlaps with self-determination and I claimed that this account is inadequate for the design of autonomy-enabling HRSs for active ageing insofar as it might also trigger passivating phenomena. Thus, I pursued an ethical inquiry into the concept of autonomy and I argued for a more complex account of autonomy that combines self-determination and a socio-relational dimension, and promotes conditions of authenticity and social recognition. Finally, I showed how my ethical redefinition of autonomy helps design autonomy-enabling HRSs for healthy active ageing.

Although I am aware that much more needs to be done in this direction, I am confident that this inquiry can help better substantiate the AI ethics principle of autonomy and better understand what it takes to operationalize autonomy via design of HRSs in a way that might be useful for further implementations in AI for active ageing.

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