Beyond "Assistive": Four Tensions in the Design of AAL Based on the Capability Approach

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Abstract
The capability approach claims that when it comes to welfare, the focus should not lie on means and outcomes, but opportunities. Ambient and assistive technology (AAL) can act as an enabler, but is rarely explicitly designed on principles derived from this framework. In this provocation paper, we provide a critical reflection on AAL systems for older adults based on the capability approach by exploring four types of tensions: *human vs. AAL care*, *paternalism vs. autonomy*, *individual vs. community* and *empowerment vs. productivity.* We argue for implementing capability concepts in the design of AAL systems to improve dignity and welfare.

Introduction
As a conceptual framework of well-being, development, and justice, the "capability approach" has revolutionized modern welfare economics as well as health and development policy. It rejects the idea of measuring well-being through subjective satisfaction, i.e. the mere *utility*, or through access to goods and resources [10]. In contrast, it looks upon a person's ability "to do things he or she has reason to value" [26]. Consequently, people are free to decide what they value and ultimately choose to do [26]. The various living conditions a person can or cannot achieve are called *functionings* and the ability to achieve them

Definitions

Agentive amplifiers = Technologies that empower an individual in his/her capacity to act. They can be regarded as capabilities.

Agency freedom = The freedom of an individual to act according to own ideas and values, which can go beyond personal well-being.

Capability = An opportunity that is actually available to an individual and which he or she can decide to pursue.

Functioning = A state of being or doing that is valued by an individual. It can be achieved through the selection and realization of respective capabilities.

Utility = A measure to determine an individual's satisfaction through the consumption of commodities.

Well-being freedom = The freedom of an individual to pursue his or her own well-being.

capabilities. Therefore, quality of life is conceptualized as dependent on these two. Commodities and resources do not directly determine quality of life, but *conversion factors* influence the degree to which a person can turn them into *functionings* [24] – see Fig 1.

Since its initial formulation by economist Amartya Sen, the capability approach has stirred the interest of researchers exploring ethical questions about the use and impact of information technologies [8, 10, 21]. It has been suggested this theoretical framework can support interaction and system design to move from usability requirements towards enhancement of users' competences [4]. Its applications in human-computer interaction (HCI) have so far largely included evaluations of technological systems. For example, technology attributes have been filtered through constructs of this theory to understand e-citizenship and its impact on individual freedom [5] or collective empowerment in underserved communities [18]. Capabilities also support discussions about societal goals of technologies [28]. However, such work is not yet translated in the design of AAL systems: the research community has yet to define *conversion factors* for turning technological resources into *functionings* [4], although field work in empowerment and agency is growing [30].

In this paper, we understand AAL as *capabilities* [9] and argue that systems can be designed as "*agentive amplifiers*" [29] of well-being. We choose to look at four *tensions* informed by the capability approach, which are particularly relevant for the field of AAL, with a focus on older adults: *human care vs. AAL care, paternalism vs. autonomy, individual vs. community, empowerment vs. productivity*. For each tension, we formulate a provocation (P1-P4), reflect on existing examples and on opportunities in system design. We suggest there is a need to embed capability concepts in the design of AAL, to achieve systems which truly improve welfare.

Human care vs. AAL care

P1: *Assistive technologies should not replace human care, but be designed to integrate personalized human care to enhance capabilities of users.*

Studies of community-based long-term care have, for some time, considered substituting personal care with assistive technologies [2]. In line with policies on optimizing resource efficiency in the aged-care sector, the design of ambient and intelligent healthcare has been directed towards smart home environments to support older adults during their activities. Automation, activity recognition, and anomaly detection are used to inform prompt reaction in emergencies and to enhance decision making for care professionals [11, 15].

However, this approach poses several challenges from the perspective of enhancing user capabilities. Firstly, it is overly focused on the priorities of the healthcare sector, namely on resource efficiency. But even while doing so, the concerns of care professionals who are not yet prepared to integrate complex systems in their work are overlooked [23]. Studies in telecare point out that technology should not be used to replace face-to-face contacts [22], and that for older adults, human contact is more important than technical assistance [23]. Therefore, other relevant networks of users can be integrated within AAL systems, including family members, relatives, neighbors, care workers, administration of care services and local community.

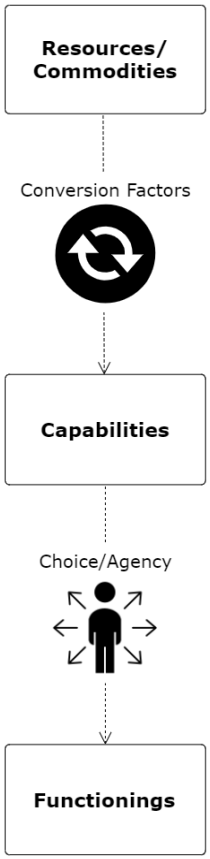

Figure 1: Illustration of key concepts of the capability approach: resources and commodities are transformed into capabilities with the help of conversion factors. The individual's agency moderates the extent to which capabilities become functionings.

Paternalism vs. Autonomy

P2: *The design of ambient and assisted living systems should allow for personalization of well-being.*

Existing AAL systems aim to support elderly in different domains of life including physical activity, hydration and nutrition, mental health, social engagement, or cardiovascular health [15, 17]. In these areas, AAL monitors and provides suggestions about changes in lifestyle. For example, individuals are encouraged to make social contact through dancing [13], supported to be more physically active [11], or are reminded about healthy sleep habits [6]. However, healthcare is not value-free and many systems are based on implicit assumptions about the choices and tradeoffs that individuals are willing to make to improve their health [7]. But physical health and well-being are not absolute equivalents. Some individuals may choose for an unhealthy lifestyle, in accordance to their values.

From the perspective of the capability approach, freedom of choice plays a central role [25]. Unequal relationships should not motivate disregarding the fundamental principle of autonomy. AAL can be perceived as paternalistic and deprive frail individuals of the sense of being in control of their own lives, instead of promoting independence [27]. While users may not always act rationally, it is therefore essential that AAL systems are designed to enable informed decision making and personalization based on the individual values and choices which contribute to a person's well-being.

Individual vs. Community

P3: *AAL systems should acknowledge the interdependencies between community well-being and individual well-being, outside of mere socializing.*

AAL acknowledges the role of community and social circles in the well-being of elderly. Therefore, existing systems, for example, offer companionship [16], analyze the communication habits of users [12], or support socializing [13]. However, in the process of system design, the relationship between individual and community well-being needs to be carefully understood.

Social influence plays an important role in forming an individual's values. Public reasoning is integrated in personal assessment [26]. Furthermore, the capability approach distinguishes between *well-being freedom* and *agency freedom* (see Definitions). It is recognized that individuals are not only concerned about their own well-being but can also pursue other goals. These include the well-being of others and the orientation towards certain ideals and moral standards [3, 20]. For example, in a service-oriented collaborative platform, older adults were keener to offer aid than to receive it [14]. Not simply the idea of socializing, but the possibility to be an active member of society and contribute to other's well-being was what motivated participants to be active users. Individual well-being can therefore lead to a greater net gain for society. And individual well-being can be improved through an active participation and engagement with community well-being.

Empowerment vs. Productivity

P4: *AAL should be used as an amplifier for individual opportunities, and not to encourage a discourse on productivity.*

AAL research has paid a considerable amount of attention to developing technologies which can lead to an "active" ageing process, by supporting older adults in daily activities or early detection of health problems [1]. But while the purpose of AAL is to support active ageing, this research area is deeply connected to the changing discourse in ageing policy and gerontology which relates issues of dependency in old age to productivity and economic efficiency [31]. This discourse is framed around the purpose of maintaining an active contribution of older people for as long as possible, to reduce economic pressures on health care systems at a national or even global scale.

However, the capability approach emphasizes opportunities over outcomes, empowerment over productivity. Authors such as Martha Nussbaum [19] developed a list of central human capabilities, but the framework does not place an overemphasis on these. Basic capabilities such as "bodily integrity" and "bodily health" [19] may enable older adults to maintain independence in daily living or even bring a societal contribution, for example by supporting their families and watching over grandchildren. But the end goal should not lie outside the field of care, as it is the case with independent living or making a societal contribution. In the sense of improving capabilities, the aims of care should be the individual's empowerment and already be realized within the process itself [7].

Reflections

The capability approach shows that the freedom to achieve well-being is essential and that this freedom is to be understood in terms of individuals' abilities, their opportunities to do and be what they value. AAL systems aim to support older adults in their daily lives, but do they truly enable the freedom to achieve well-being? How much freedom do users actually have to build their own definition of well-being and live by it?

- How do AAL systems look like when we do not design for telecare but for including other individuals "in the loop"? AAL might mean designing for multiple stakeholders and for supporting individuals through their personal networks.
- How do we design for personalized well-being? If we are to focus on capability and not just usability, then we must leave universal design behind and embrace value-sensitive design.
- How do AAL systems support the individual in his or her active role as a member of society? AAL should not solely focus on smart home environments and socializing, but on community networks, peer-to-peer and local platforms.
- Are users empowered through systems in the implementation of capabilities? This should not be seen as a goal that lies outside the field of care, but should already be realized within the care process itself.

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