

**Title**

The rise of the “innosumer” – how the baby boomers will shape the future of consumption

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**Abstract**

Demographic aging is among the most striking challenges industrialized economies face; it will lead to profound changes in consumption structures. How these changes will affect innovation, however, is thus far not well understood. In this paper we make a first step towards closing this gap and establish the challenges associated with demographic aging on the map of innovation scholars. We present empirical results of our research into the modes of thinking that underlie design processes targeted at older persons. These modes are limited in two ways—they concentrate on older persons as being characterized by generic, age-related decrements, and they frame older technology users as passive recipients of technology. Current design practices for older persons, therefore, imply a threefold risk. They are likely to generate technology that is unattractive for older consumers, that provides limited cues for meaningful activity, and that suppresses the co-creational inputs of older persons to innovation. To rectify this, we propose a complementary perspective on the relationship between technology and aging that revolves around older persons as active consumers of technology. We discuss implications for further research on technology and aging that revolve around a new concept that we call “innosumer”.

**Keywords:**

Aging; innovation; script; gerontechnology; consumer; co-creation.

## 1. Introduction

Aging is among the most striking societal changes that industrialized economies face. In Western Europe, the percentage of those aged 65 and over will rise from 18,3% in 2010 to 25,4% in 2030; in Northern America it will increase from 13,2% in 2012 to 20,2% in 2030.<sup>1</sup> New technology and innovation is frequently positioned as a promising way to tackle associated challenges such as the increasing pressure on rising health and care costs, or the strive towards more active and independent forms of living in old age [1-4]. However, the overwhelming majority of these approaches treats technology as a mere solution to otherwise independent problems of aging [5,6], and reinforces negative stereotypes about older persons by framing them as inherently problematic. Technology designed for older persons predominantly speaks to later life in terms of physical and cognitive decline. In this paper, we trace this claim empirically and develop a more balanced approach towards older technology users. We argue that, in order to fully grasp the ongoing transformation of technological change and consumption in aging societies, we should see older persons as *active co-creators of technology*. We develop this argument in three steps:

In Section 2, we briefly review recent literature about the consequences of demographic aging for future consumption structures. While common wisdom seems to suggest that aging is generally associated with decreasing interest in technology, our analysis suggests something else. We find support for a marked cohort effect, where those that have appropriated changing generations of new technology during the life course are likely to do so in later years as well. The available literature suggests that the near future of consumption, when more *baby boomers* will retire,<sup>2</sup> can best be described by a combined cohort and transitional effect, which results in more *active patterns of technology consumption* among older persons.

In Section 3, we *revisit* material from our own empirical research to explore the practices of designers when they address older persons. Our material reveals the often subtle mechanisms through which an imagery of later life comes to dominate these practices that frames older persons as passive respondents of technology defined by a set of handicaps that distinguish them from “normal” consumers. Using insights from Science, Technology and Innovation (STI-) Studies, we specify how this imagery fails to recognize important characteristics of the lived realities of older persons, user-technology relations more generally, and the configurational nature of many technologies relevant in dealing with the challenges of aging. We show that this considerably constrains the capacity of current innovation activities to create technology that fits the lived realities of older persons. Hence we argue that our current understanding of older persons *in relation to technology* is in need of revision.

In Section 4, finally, we develop the cornerstones of such a revision. We propose that older technology users should be seen as *innosumers*. We develop this new theoretical concept, position it in the existing literature on users in innovation processes, specify

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<sup>1</sup> Source: United Nations Population Prospects, <http://www.un.org/esa/population/>.

<sup>2</sup> The term baby boom usually refers to the exceptionally high birth rates after World War II that occurred in Western European countries and North America. While the timing of the baby boom has been slightly different in these countries, we use the term *baby boomer* to describe those born between 1946 and 1964.

promising directions for further research, and demonstrate how such research might help freeing older persons from being reduced to a less capable variant of “normal” technology users and consumers.

### *Methodological and conceptual underpinnings*

This paper makes a conceptual contribution. We offer a new and complementary perspective on older technology users, a perspective that we find lacking in existing research on technology, innovation and aging. To develop our argument, we draw on empirical material from a range of studies that we have been involved with earlier, and pull together overarching insights from these previous works. In this sense we present a new reading of our material tailored to the *conceptual implications* we want to emphasize in this paper. In particular, we draw on the following material:

- Section 2 makes use of selected insights from social gerontology. In the broadest sense, social gerontology conceptualizes the lifecourse as being socially constructed: The aging process is an outcome of the interplay of specific and local practices and broader societal institutions and role structures!; in this sense, it is neither an invariable aspect of human nature, nor exclusively the outcome of a biological process (see [7] for an overview and relevance of this approach). But just like many other social sciences [8], social gerontology has sidelined technology as an element in the social construction of later life. Part of the argument we provide below relies on this strand of social gerontology whose insights we bring to bear on our understanding of older technology users. Our selective reading of social gerontology is based on Peine’s and Neven’s broader involvement with this literature that has been the context for the work published in [9-12]. More specifically, for this paper we have scanned 4 key handbooks in the field for the coverage of technology, technology use and consumption [13-16], and also performed a key word search for the terms “technology”, “consumption”, “Gerontechnology” as well as its derivations in the key journals of the field (“*Ageing & Society*”, “*Journal of Aging Studies*”, “*Journal of Gerontology B*”, “*The Gerontologist*”).
- Section 2 briefly uses results from a major foresight attempt in Germany in which Rollwagen has been involved. The methodological underpinnings for this study can be found in [17] and [18].
- Section 4 revisits earlier published empirical studies. 4.1 summarizes the results from a literature study we performed on all issues of the journal *Gerontechnology*. We were interested in empirical papers that have dealt with the attempts of designers or design researchers to understand older persons as technology users. To identify suitable studies, we have read the abstracts of all articles published since the inception of the journal in 2001;<sup>3</sup> a selection of 36 was then analyzed using an open coding scheme to identify ideal-typical modes of conceptualizing older person in relation to technology. The methodology is explained in more detail in [12]. 4.2 revisits a set of ethnographic studies that

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<sup>3</sup> We are grateful to the BSc students at Utrecht University that have helped sorting out these studies.

Neven has conducted on design practices in the field of Ambient Intelligence (AmI). The aim of these studies was to unravel how designers dealt with the input of users during the design and testing of AmI systems. The methodological approach of this study is described in more detail in [19].

## 2. Demographic aging: Basic figures and impact on future consumption

The common understanding of demographic aging is quickly summarized: in industrialized societies the average age of populations grows, and this leads to an increase in the old-age dependency ratio,<sup>4</sup> which puts an increasing pressure on labor, capital and product markets [20,21], and on social and health care systems [22,23]. In this section, we briefly establish some basic figures about demographic aging, and review macro-economic studies about its effects. We demonstrate that, quite contrary to what we feel to be common belief, neither these figures nor the available macro-economic insights warrant an overly pessimistic view on the consequences of aging on future markets and consumption structures. Using insights from social gerontology we establish that, rather than inevitably resulting in more parsimonious forms of technology consumption, demographic aging will have a combined cohort and transitional effect on future consumption structures. This effect will change the way technology is linked to the life of older persons.

Table 1 summarizes the prospective population development until 2050 for Western Europe.<sup>5</sup> More specifically, it depicts the development for different age groups older than 60, both in absolute and in relative terms. The table shows that the fraction of the population aged 60 or over will reach 33% as early as 2030 (up from the current 24.3%). Also, the old-age dependency ratio will increase from the present 28% to 43% in 2030 and 51% in 2050. A quick glance at these numbers alone underpins that older consumers will constitute a significant share of future consumer markets. This becomes even more obvious on the level of households. Indeed, demographic aging affects the average composition of households, and will lead to an increase in households with a household head older than 64. In Germany, for instance, in 2030 about 36% of all households will have a household head older than 64 when only about 28% of the total population will be older than 64 [18]. As consumption baskets are typically measured at the level of households, aging will affect consumption even more strongly than an exclusive focus on population would imply.

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<sup>4</sup> The dependency ratio of a population is defined as the ratio between the non-working (dependent) and the working (productive) fraction of that population. The working population usually comprises those aged 15–64, while those younger than 15 or older than 64 are defined as dependents (dependent on the welfare transfers from the working population). The old-age dependency ratio accordingly describes the fraction of the population older than 64 as a ratio of those aged 15–64.

<sup>5</sup> Our data is based on the UN Population Prospect's (Revisions 2008) median variant. A detailed description of the assumptions underlying this variant can be found at [http://www.un.org/esa/population/publications/wpp2008/-wpp2008\\_highlights.pdf](http://www.un.org/esa/population/publications/wpp2008/-wpp2008_highlights.pdf) (download: 7 December 2012). In the UN World Population Prospects, Western Europe consistently comprises a set of developed countries. We, therefore, chose this level of aggregation to illustrate the basic facts of demographic aging (in particular, because no aggregated data are available for EU 15 countries). Our analyses for other European countries reveal similar results, although, of course, the timing and intensity of demographic aging differ per country. This is in line with the literature that seems to agree that demographic aging affects European countries in quite similar ways [24].

[Insert Table 1 around here.]

These numbers demonstrate that the demographic composition of future marketplaces will undergo marked changes in the near future. But how will this demographic shift translate into changes of consumer behavior? Unfortunately, available foresight data is scarce in this regard. Macro-economic studies into the effects of demographic aging have mostly focused on pension schemes, labor forces, health care systems, capital markets and economic growth, but only partially addressed changes in consumption and on product markets [20,21]. Regarding the latter, retirement is treated as a watershed that allegedly leads to less disposable income and thus to a drop in consumption [25,26].<sup>6</sup> However, a closer look at these studies reveals that they are based on rigid assumption two of which stand out: The studies tend to base conclusions about consumption behavior on highly aggregated expenditure data, which confuses the causality that runs between changes in expenditure and changes in consumption behavior [28,29]. And they tend to interpret alleged changes of consumption behavior as an expression of age rather than cohort thus establishing the current cohort of older persons as a yardstick for assessing future consumption structures [21,30].

Such highly aggregated studies have likely contributed to the overly simplified idea of older persons as parsimonious consumers with fewer means and interest in technology consumption than their younger counterparts [see 31]. On closer inspection, however, they cannot convincingly support this. Indeed, a recent foresight study in Germany, in which one of us (Rollwagen) has been involved, revisited such macro-economic insight in the *direct effects* of demographic aging on product markets, and showed that these effects intersect with a number of broader societal trends [17,32].<sup>7</sup> Such trends – among them more flexible work forms leading to the extension of the retirement phase, the diversification of lifestyles, and the increasing relevance of social networks – provide a context in which demographic aging unfolds its consequences. As a result, aging will affect the *quality* of consumption in different sectors rather than its quantity [18]. These qualitative shifts at the intersection of demographic aging and changing life styles mark “*indirect effects* of aging” on consumption [18: 11, emphasis added]. In other words, demographic aging will not so much lead to predictable shifts in levels of expenditures, but rather to more profound although less predictable changes in the way technology consumption figures in the life of future cohorts of older persons.

This brings into sight the baby boomer cohorts that move into retirement during the next two decades or so. Table 1 shows that already in 2020 the baby boomer cohort will make up all of those aged 60-74, accounting for 17,9% of the total population in the

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<sup>6</sup> In the economic literature, this has become known as the consumption-retirement puzzle: a consumption drop at retirement contradicts the assumption that economically rational individuals would spread their consumption expenditures evenly over the life cycle [27,28]. While considerable efforts have been spent to resolve this puzzle, its basic assumption that there *is* a consumption drop at retirement has remained largely untouched [29].

<sup>7</sup> Trends depict relatively stable, long-term, directed changes in different environments that are the outcome of sustained socio-technical structuration of different actors. These trends have been scutinized as regards their stability/volatility, interdependencies, impact-richness on economic growth and social progress. More details regarding the methodology are discussed in [17].

aging societies of Western Europe. But what do we know about the likely consumption behavior of the baby boomers when they live into and give shape to old age? The scarce gerontological literature that has looked at technology consumptions in later life suggests two effects: First, it confirms that there will indeed be a marked *cohort effect*. The baby boomers are the first cohort that has experienced a lifelong exposure to the fact-paced technological changes after World War II [33], and they have been thoroughly enculturated into post-modern consumerism [34,35]. This means that the expression of life styles, meaning structures and preferences through technology consumption is natural for baby boomers,<sup>8</sup> and with them it will become a constitutive element of later life. Indeed, Gilleard and Higgs have claimed that *active consumption* will become a distinctive characteristic of ageing, when older persons “actively use the purchase of leisure goods and services to frame, change, or expand their identities“ [31: 368]. In this perspective, the use of technology is a meaningful activity on its own terms, not merely a means to otherwise independent ends [34,38-40].

Secondly, the cohort effect is entangled with and will be reinforced by a *transitional effect*. In consumerist lifestyles consumption helps defining identity and meaning for new life stages [41-43], and retirement is no exception in this regard [44,45].<sup>9</sup> Hence, the transition from professional life into retirement is likely to increase the significance of consumption – not in a narrow, functional way, but in the broad way suggested by the notion of active consumption as a domain of everyday practice and culture. Baby boomers are thus well prepared to use technology as a resource, i.e. to actively select, modify and use technology to give meaning and identity to later life. Research from social gerontology has long demonstrated that aging should not (exclusively) be seen as a predetermined biological process but rather as an ongoing and socially constituted course of identity development that includes the whole lifespan [7,47-50]. The combined cohort and transitional effect underpins that for the baby boomers technology consumption will be an inherent part of such identity work, which makes *active consumption* a key feature of their everyday practices with technology.

### 3. Current thinking about the relationship between design and aging users

Technological designers and innovators have long recognized older technology users as an important target group [51,52]. In this section, we explore how technology designers and innovators conceptualize and imagine older persons as target users. We revisit results from two sets of our own empirical research to present a number of implicit ideas about older persons as users of technology that translate into what we call a *paternalistic stance*. Using insights from Science, Technology and Innovation (STI-)

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<sup>8</sup> Of course, this is not to say that the baby boomer cohort is a homogeneous group of consumers. In fact, the contrary has been demonstrated to be true [36]. Rather, consumerist lifestyles are an integral part of identity production that characterize baby boomers across traditional categories of vertical stratification as income, education or status disparities [37].

<sup>9</sup> Schau et al. also emphasize that the study of consumption has also widely neglected retirement as a distinctive phase in life. An early exception is McCracken [46]. For us, it seems symptomatic that this study about the “culture and consumption among the elderly” has remained widely unheard (in fact, according to our Google Scholar search on 11 Dec 2012, it is cited only 27 times since 1987, whereas McCracken’s programmatic essay on “culture and consumption” in general [41] has become a classic with 1346 citations since 1986).

Studies, we distinguish a number of misfits with the trend towards active consumption among older persons, and specify how they limit the potential of current design practices to create technologies that meet the needs of older persons.

### 3.1. *The paternalistic stance in gerontechnology*

Gerontechnology<sup>10</sup> is a relatively recent domain of design research that explores the impact of technology on the quality of older person's life and the process of individual aging [53-55]. A considerable part of this research is dedicated to design processes and methodologies [56], and here a considerable subset deals with methods to involve the "needs" of older technology users in design [57]. This latter subset of studies is an excellent source to explore the often implicit conceptions design researchers in gerontechnology have or create about older technology users. To understand the mechanism that lead to these conceptions, we have conducted a study into the field's core journal *Gerontechnology*. We followed a theoretical sampling approach to identify the relevant subset of studies, and applied an open coding scheme to analyze these studies in depth. Three ideal-typical modes of conceptualizing older technology users and their needs in relation to design have transpired from our analysis<sup>11</sup>:

- **Biomedical approaches and human enhancement:** This mode is straightforward – the image of later life as characterized mainly by physical and mental decline informs design processes. Technological design, then, is about interventions that (partially) compensate for such decline. Interestingly, recent approaches towards computer gaming, obviously a domain strongly associated with leisure and fun, seem to be strongly driven by this mode (for instance [59] and [60]).
- **Usability and Human Factors Engineering:** This mode explores the capacities of older technology users in relation to particular technological environments. This relationship is typically modeled as a set of demands posed by a technological environment on the one hand, and a set of capabilities of the user on the other. If there is a mismatch, i.e. a user's capacities do not allow him or her to live up to the demands of an environment, this is recorded as a usability problem that marks a potential design improvement. The approach characterizes older technology users in terms of their physical and cognitive functions; mismatches with the demands of a technology are positioned as potential sources of errors during operation that might discourage older users from engaging with a technology. Studies following this tradition typically take place in laboratory settings or use closed questionnaires, thus enhancing the scientific credibility of results but also depriving test users of their everyday surroundings. Studies that resemble this mode are [61] and [62].

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<sup>10</sup> Gerontechnology is a portmanteau that combines the words *gerontology* and *technology*. Next to the design research tradition referred to in this section, it is also sometimes used as a general and convenient name for technology targeted at older users.

<sup>11</sup> What we present here is a targeted excerpt of our study. The complete study including a more detailed elaboration of our methodological approach can be found in [12]. The modes constitute ideal-types in a Weberian sense [58]: probably none of the analyzed studies neatly resembles any of the three modes in a pure way, but all studies incorporate elements of these modes.

- Ethnography inspired inquiries into the everyday life of older users: Research that incorporates this mode takes in-depth analyses of older persons' encounters with technology as an input for design. This normally involves qualitative, often ethnography inspired methods to delve into the socio-material context in which technology use by older persons takes place. The goal is not only to unravel specific problems older persons may face, but also to shed light on the full set of ambitions, needs and practices that characterize their lived realities. A pivotal feature of this mode is that it departs from a fine-grained analysis of the patterns of everyday life of which new technology ultimately will become part. These patterns, in turn, form the context for which design adoptions or new designs are conceived. Studies that resemble this mode are [63] and [64].

Our approach allowed us to identify ideal-typical modes of thinking about how the "needs" of older persons should be incorporated in design and design methodologies. What strikes us about this literature is that the different modes all, more or less explicitly, work to position older technology users as being distinct from their younger counterparts. The biomedical approach is straightforward in this regard as it aims at technology that compensates for or helps prevent physical and mental decline. Older technology users' needs follow from their age-induced handicaps. Ergonomic studies take a somewhat different starting point: They consider the characteristics of a technology to be a yardstick to evaluate how effectively a user can cope with the technology. Uses not intended by designers are coded as problems to be solved by design modifications, rather than as a possible source of inspiration. Ethnography inspired research, finally, is subtler in framing older technology users as being different in certain ways. Indeed, it dedicates considerable resources to meticulously understanding the lived realities of older persons, so that new technology fits these realities. However, there is a fine line between taking knowledge about the lived realities of older persons as an inspiration, or taking it as a basis to elicit a set of well-defined "needs" to be met by new technology. According to our reading of the gerontechnology literature, the latter seems to prevail when older technology users are concerned. The ethnography inspired studies that we have looked at tend to separate the lived realities of older persons from the use of technology, thus downplaying technology as a constituting and enriching part of these realities.<sup>12</sup>

What becomes apparent from our analysis is the implicit assumption that older persons' habits, routines and needs pre-exist new technology. Gerontechnology, in order to be successful, has to fit an identifiable set of needs. The more is known about these needs, the better the technology will suit the lives of older persons. While the different approaches explicitly revolve around an extensive concern with user needs, they also implicitly assume a particular division of labor between older technology

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<sup>12</sup> Verganti has pointed out that this is characteristic of many approaches in innovation management in general, where meaning is taken as something to be understood and not to be innovated [65,66]. We have to stress, however, that our particular reading of the ethnography inspired mode is subtle in this regard—it derives from our immersion into the field of Gerontechnology, our reading of the literature, our conversations with designers at conferences, from listening to their talks, and so forth. As a consequence, our concerns about this mode should not be seen as a manifest failure, but rather as a risk that we perceive to be existent in many contemporary design approaches aimed at older persons.

users and gerontechnology designers: The designers have to obtain an extensive understanding of older persons' needs, and then determine how to best meet these needs. In this sense, all three modes leave the authority of designers intact over how to determine and to meet the needs of older technology users. Good gerontechnology, therefore, is not seen as a potential source of playful encounters that might give rise to new practices and “needs”, but rather should fit seamlessly into and support existing practices. A *paternalistic stance* thus prevails in the gerontechnology literature that assumes that what an artifact can and should do in the lives of older persons is something to be designed as an inherent feature of that artifact. Users, then, should follow what a design suggests them to do. This involves an uncomfortable framing of older technology users as passive recipients of technology—recipients that are not expected to go beyond existing preconceived needs, whose playful engagement with technology is positioned within a rhetoric of overburdening and error, and that have to be comforted rather than challenged by new technology.

### 3.2. Representations of later life in design processes

The previous section has relied on a secondary analysis of studies published by design researchers that report on their work with or for older technology users. In this section, we briefly recapitulate results of Neven's empirical work that directly explored the practices of designers in the context of “Ambient Intelligence” (AmI) technologies for older persons.<sup>13</sup> The work was interested in the user representations of older persons, which were analyzed in statements about the future of AmI, a series of tests with an AmI human-interaction robot, and a pilot test of an AmI telecare system. The cases themselves and their methodological underpinnings have been presented from a different theoretical angle elsewhere [11,19]. In what follows, we derive from the findings three user representations of older persons that prevailed, in one form or another, in all the analyzed cases. Again, we have been interested in ideal types rather than the representations in all their details. The idea of user representations is based on Akrich [70] who, in a nutshell, has defined them as those ideas, images and stereotypes about prospective users that inform design decisions.

(i) One way in which AmI designers represented older persons was in terms of illness, dependency and decay. For instance, the analysis of AmI vision statements revealed that in these statements older persons were predominantly addressed in a distinctly (bio-)medicalized way. They were, for example, discussed in terms of biorhythms, melatonin levels or visual impairments. This was in stark opposition to representations of younger users, which were addressed in terms of choice, lifestyle and the enrichment of experience. Furthermore, older persons' physical, cognitive and mental health was often seen as deteriorating. By employing this medicalized language, older persons were positioned as dependent others that have a (medical) “need” for the

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<sup>13</sup> Ambient Intelligence refers to the increasing permeation of the private household and the everyday items it includes with Information and Communication Technologies [67], where it denotes a paradigm that conceives of private households as integrated technological environments rather than as agglomerates of separate technical devices [68]. For this paper, AmI constitutes a particularly interesting case because it is configurational in nature [69, see below], and has received extensive attention in the context of addressing the challenges of an aging society [4].

AmI technologies and services. Moreover, addressing the needs of a group that is positioned as deprived and in need of help was often seen as a “good” thing. Alternate images of older persons as healthy and active individuals were almost completely absent, and a rhetoric based on choice, desire, experience and lifestyle was used barely to discuss older users.

(ii) Older persons were also positioned as users who show an initial reluctance and resistance to new technology, but whose resistance and reluctance can be overcome. In organizing a series of tests for an AmI robot, designers envisaged the robot as an assistant, but also saw it as an intellectual and emotional companion. The designers argued that older people had a “genuine need” for such a robot and would, over time, even bond with it. The overwhelming majority of older test users, however, did not agree. They stated that they did not want nor need such a robot. They felt the robot was for people who were frail and lonely, but they did not see themselves in that way. For them the robot was a technology for somebody else – somebody that was frailer and less socially active, somebody who they saw as “older” than themselves. However, the designers saw these opinions only as “initial” resistance that would soon ebb away. In other words, the resistance of older users was not taken seriously as feedback about the robot, but it was interpreted in the light of more general stereotypes about older persons as rigid, conservative and reluctant to change [71]. Such a representation of older persons as technology-averse allowed the designers to resign themselves to the conviction that the expressed resistance to the robot was “initial” rather than “real”. This logic successfully preserved the authority of designers about *which* user needs and responses should be taken seriously and thus incorporated in further design modifications.

(iii) A third prevalent representation framed older persons straightforwardly as technologically illiterate and ignorant. This became apparent in the case study of an AmI telecare system for older persons struggling with various health issues (including dementia). Although the designers of the system acknowledged that some older people *were* perfectly capable of operating new technologies, they took the image of a user with virtually no technological skills—the lowest common denominator, so to speak—as a proxy for design decisions. The system was deliberately designed without a new user interface. Indeed, the designers felt that in the case of older persons “one button is enough to operate it incorrectly”, and this led to a system that operated virtually autonomously. While the system did not require older persons to learn new skills, and while it reached its goal of allowing older people to remain living at home, it also presupposed passive compliance. Older users had to put up with being monitored, which resulted in a decrease of privacy and changes in their care; they were left with very limited options for resistance or creative use.

A final, but far less prevalent way in which designers discussed older persons was in terms of their diversity. In all cases, it was acknowledged that *some* older technology users are different and do not necessarily match the three representations outlined above. But such instances were framed as exceptions. The designers effectively managed to sidestep the notion that older persons are, first and foremost, diverse, and

the less complex representations outlined above remained decisive for their design decisions. In a nutshell, therefore, the empirical material presented in this section illuminates how older persons, in different shadings and nuances, are generally imagined as frail, dependent, rigid, reluctant and inept users of technology. Indeed, the three representations demonstrate how boundaries are established between “normal” and “older” users, and how in relation to the latter group designers are reluctant to facilitate playful encounters with technology as a design inspiration. In other words, all three representations worked to enable designers retain their authority over how and which “needs” of older persons should be met by the technology in question. Essentially, this supports our findings in the gerontechnology literature (see 3.1) that a distinct feature of designing for older persons is a paternalistic reflex in which creative encounters of older persons with technology are deemed undesirable, and in which they are framed as errors to be prevented.

### *3.3. Active consumption, innovation, and the co-creation of configurational technologies*

Thinking about users and use in design processes is a process of intelligent conceptualization. What is needed is a delicate and workable balance between acknowledging the complexity and diversity of lived realities and prefiguring more abstract ideas about future use and its context [72]; imagining users is a volatile process fueled by many sources of knowledge [73]. The paternalistic stance that we found to permeate the practices of designers should be evaluated as such: a mode of representing later life in relation to technology. Hence, it is not our intention to dismiss it prematurely only because it is an inadequate empirical description of later life. To the contrary, we believe that handicaps and illness are part of ageing, and technology can play a vital part in dealing with them. To the extent that certain technologies are explicitly meant to assist in coping with age related deficits [74], the paternalistic stance might be a helpful representation of later life and help create technologies that successfully support older persons in dealing with relatively well-specified problems (but see [75] for a fine discussion of the limits of “specifiability” of means-ends relations also in the context of chronic conditions). More often than not, however, we argue that the paternalistic stance is also more fundamentally flawed *as a representation*.

Indeed, the paternalistic stance builds on a limited set of ideas about older persons, ideas that are associated with potential overburdening, pre-existing needs – preponderantly those following from age-related physical and cognitive problems –, rudimentary technological literacy, and a general disinterest in technology. This representation of older technology users is deeply at cross-purposes with the patterns of active consumption that is becoming more important as a consequence of the combined cohort and transitional effect. The notion of active consumption underpins that for the baby boomer cohort technology consumption will be an inherent part of creating meaning and significance—be that in relation to life styles more generally, or in relation to age related shortcomings or difficulties. Active consumption thus resembles the kind of comprehensive treatment users and consumers have been given in STI-studies that

have long illuminated the co-creational processes through which users and consumers alter the offerings of designers.<sup>14</sup> Three insights from STI-studies seem particularly important to us that provide the basis for a mode of thinking about older technology users that is complementary to the paternalistic stance:

(i) The recent innovation management literature in particular has seen consumers as active co-creators of value and experience [76-78]: When consumers not only purchase goods, but actually carry out important work in defining meaning and significance for goods, this can hardly be ignored by technology suppliers. Technological designs, rather than having definite identities as goods that can either be purchased or rejected, should be seen as incomplete offerings whose value is completed in consumption [79]. This idea of *co-creation* emphasizes that for technology designers and innovators it is essential to conceive of consumers as co-creators of technology and seek encounters with consumers that encourage their creative inputs [80-83].

(ii) The co-creation framework resonates with earlier work in the semiotic tradition of STI-studies that has highlighted how designer's representation of users and use materialize in technical artifacts [84,85]. The notion of *script*, in particular, has been introduced to capture and explore how technical objects, by being designed in specific ways, suggest certain relations that consumers can entertain with them, while constraining others [86-88]. Hence, where the co-creation literature has treated technical objects as a somewhat neutral backdrop to co-creation processes, the notion of script highlights that designs are not neutral. Scripts incorporate certain ideas about a design's use and users, and these ideas come to pre-structure the co-creation of value and experience. In other words, technological objects, by way of being designed in one way or the other, may enable and invite consumers to enact the role of co-creators, or constrain them in fulfilling this role.

(iii) Recent insights from STI-studies also suggest that there is an ongoing transition in the kind of technologies proliferated to private households. Instead of single devices, technological systems are becoming a focal point of innovation activities where different products and services interoperate in an integrated environment. Prominent examples are already available systems, such as flat-screen televisions that are integrated with internet services as video on demand, or more sophisticated and emerging concepts, such as the Smart Home or Ambient Intelligence [67,68,89]. The distinctive feature of these systems is that they cannot be purchased and used off the shelf. Rather, their definite set-up or configuration depends on the inputs of end-users. Such open-ended systems have been termed *configurational technologies* [90]: A basic idea and a set of components are available, but only the work of users to attune local contingencies and the available components specifies a concrete and operable configuration [91].

Configurational technologies imply new roles for and relations with its users [69,92]: Users not only co-create a concrete and valuable experience, but they also provide the necessary *configurational work* to configure available components into an operating

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<sup>14</sup> This is not the place to discuss the prolific and STI-studies traditions in studying user-technology relations in greater length. We have provided such a discussion elsewhere [73].

system-in-use [see 93]. It is a distinct feature of such work that it combines more traditional ideas about creating an experience with the technological tinkering necessary to realize the experience. This adds yet another refinement to the idea of co-creation: Many recent and emerging technologies in private homes require the configurational work of consumers that provide – either alone, together with other consumers, or through a specialized service provider – the necessary development work to implement a configuration. For industrial goods as information system this has been relatively well explored [94,95]. However, the forms, tools and procedures of configurational work by consumers rather than business or organizational users have remained under-researched [69].

These insights from STI-studies briefly summarize a perspective on user-design relationships that puts flesh to the bones of active consumption. By this we mean a perspective that positions the notion of active consumption in the context of developments in technologies relevant for private homes, where active consumers should first and foremost be addressed as co-creators of configurational technologies. The paternalistic stance systematically downplays this co-creational dimension of contemporary innovation processes. Hence, what emerges from our discussion is a fundamental problem in the way older persons are widely conceptualized in relation to technology: The paternalistic stance is unlikely to yield technology that stimulates and enables the creative impetus of older consumers needed for innovation of configurational technologies. To the contrary, it leads to an attitude where designers both discourage and resist the configurational work of users – as in particular our cases in 3.2 confirm. In a nutshell, therefore, the lopsided perspective we found in the practices of gerontechnology implies a threefold danger: it is unlikely to generate technology that offer cues for meaningful and thus enriching activities in later life, it is likely to produce technologies that is simply unattractive for older persons due to pejorative scripts [see 11], and, most importantly, it is at risk to suppress the co-creational input and configurational work of a growing and particularly active group of future consumers: the aging baby boomers.

#### **4. Discussion: The rise of aging innosumers**

##### *4.1. Defining innosumers*

The trend towards the increased importance of configurational technologies will be particularly pronounced in the household of older persons. Indeed, current policy debates around innovation and aging widely revolve around the importance of Information and Communication Technologies (ICTs) to bring medical and care services into private homes where they blend with existing technological environments of consumer electronics, white goods, cars, telecommunication and the like [4,96]. Discussions around notions as Telecare and eHealth underline that information technologies will considerable transform the households of older persons [5,6,97]. And finally, the domain of Ambient Assisted Living (AAL) explores ICT-supported technological environments that combine health and care related components with the evolving possibilities of Ambient Intelligence [68,89,98]. In short, we argue that older

persons will be at the vanguard of the broader transformation towards ICT-supported technological configurations in private homes [10] where functions associated with health and care blend seamlessly with other more mundane functions. Hence, in order to address older persons as active consumers designers of gerontechnology should explicitly address them as potential co-creators of configurational technologies. This puts center stage the *configurational work of older persons* that we consider to be a key source to generate representations of older technology users that are able to address them simultaneously in the context of enrichment, meaning-creation and playfulness as well as in the context of health, care and assistance.

Older persons are well capable of delivering configurational work. A brief analysis of an online forum in which older persons discuss and exchange ideas about how to configure pedal-electrical bikes (E-bikes) demonstrates this, and outlines the scope of activities this work entails.<sup>15</sup> E-bikes have an auxiliary electric motor, powered by batteries, and they have become increasingly popular among older consumers [99].<sup>16</sup> The auxiliary power of e-bikes allows many (older) consumers to continue to enjoy cycling, and as such e-bikes combine assistive with recreational and fun aspects. However, in order to make e-bikes fit their everyday practices, older consumers carry out a considerable amount of tinkering with available options. For instance, our analysis has revealed that older users of e-bikes modify seats and other parts of the bike to match their bodies (and in some case aches and illnesses). Moreover, they were involved in fine-tuning batteries for optimal range, trying out charging strategies and developing ways of testing batteries to ensure that they work properly (or to have them replaced before the warranty runs out). A particularly important but contentious issue for these e-cyclists is to understand the interplay between various factors such as weather conditions, driving style, gearing, tire pressure, charging strategies and (battery) maintenance, with regard to the range of the bicycle, an issue of obvious importance but also pride. All of this both requires and fosters a fairly intimate understanding of an e-bike and its batteries, and attaining the optimal configuration requires a certain art as well as the exchange of technological knowledge. Given the fact that e-bikes are relatively expensive, it comes as no surprise that the forum revealed lively discussions, including boasting about long ranges and the exchange of tips and tricks. From relearning how to ride a powered bicycle safely up to dealing with the vagaries of lithium-ion batteries, riding an e-bike requires learning and tinkering; it combines material and immaterial work as available options are adjusted to local circumstances.

Configurational work becomes more complex and more essential, of course, in the context of the ICT-supported environments described above. Instead of providing independent functions, such environments are interoperable and can be managed

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<sup>15</sup> The magazine in question is called *Plus Magazine*, which is popular among older persons. E-bikes are a popular topic on Plus Magazine's online forum (see <http://www.plusonline.nl/fora/>, accessed last April 19th 2012). 5 threads of discussions about buying and using e-bikes were analysed, which contained a total of 150 posts. This brief analysis does not claim to give an exhaustive account of older people's use of e-bikes. Instead it serves to highlight that a certain level of configurational work is performed by older persons to successfully domesticate e-bikes.

<sup>16</sup> Also see e.g. "Elektrische fiets is een impuls voor Nederlandse en Duitse markt", Jorg Leijten, NRC Handelsblad, 7 oktober 2011 or <http://nos.nl/artikel/131706-verkoop-elektrische-fietsen-neemt-sterk-toe.html> (accessed April 19th 2012).

through a single device such as a smart phone or a tablet computer [67]. The challenge for consumers is that they have to learn—on the basis of their earlier experience, the available product information, (online) discussions within their social networks, and their technology literacy—to act as a quasi-expert that is in control of configuring his or her everyday technological and information environment [100,101]. This requires consumers to obtain knowledge about and thus evaluate available options and put them into practice against the background of their daily routines [95]. As indicated above (4.3), configurational work is technological work that presupposes a degree of interest in and knowledge about technology. At the same time, it is mundane work that derives from a necessity to complete available options that are not offered as closed off-the-shelf solutions. As such, configurational work does not per se derive from the do-it-yourself enthusiasm of hard-core early adopters evincing a more principle discontent with what designers offer to them [102], but rather from the need to consummate incomplete solutions.

We propose to refer to this emerging type of consumer that provides the configurational work needed to create operable technological environments as *innosumer*.<sup>17</sup> An innosumer is both an average consumer in the sense that he or she evaluates technology as part of everyday culture. At the same time, an innosumer is an innovator, i.e. a technology-literate, intelligent informed and learning consumer that is well capable of *configuring* the technological environments he or she deems desirable. As a distinct feature, therefore, configurational work is not restricted to defeating, renegotiating or altering available scripts, but it completes and intertwines the possibilities of available scripts into a valuable and operable technological environment. Just as the Greek origin of the term consumer suggests, innosumers consummate the offering of designers—and, in contrast to the widespread understanding of a consumer, they do so both on a symbolic *and* functional-technological dimension.

It is this interplay between value and experience on the one hand, and technological functionality, on the other, that sets the role of the innosumer apart from the consumer as treated in established strands in STI-studies: *With the notion of the innosumer we focus on the combined technological and symbolic work of consumers in the light of complex everyday technological environments*. As such, innosumers resemble traits of user innovators [106,107]. But the user innovation literature—where it does focus on consumers rather than industrial users—has highlighted the inputs of especially knowledgeable, enthusiastic and innovative users [108,109,102,110]; innovating consumers are early adopters that develop designs potentially transferable and valuable to other consumers as well [111]. Innosumers are a more mundane variant of user innovators and belong to the early majority rather than the early adopters [see 112].

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<sup>17</sup> This term obviously bears similarity to Toffler's classical notion of the prosumer [103]. In contrast to the Tofflerian prosumer, who is a user who completes design tasks already foreseen by producers of technology [104], in our concept of the innosumer we foresee a more fundamental shift in the distribution of tasks between users and producers, because of more technology-literate consumers. At the same time, an innosumer adds more to technological change than what has been called a *producer*, which basically denotes a consumer that engages in joint content production for different sorts of media [105]. Finally, the notion of the innosumer bears similarities with Berthon et al.'s [82] creative consumers, but more specifically transfers this idea to the context of technological configurations.

Their involvement with technological work is driven by the necessity to complete the incomplete offerings of designers rather than a principle enthusiasm for hacking or tinkering [see 113,114] – although, of course, such enthusiastic early adopters might well be an interesting sub-group of innosumers. As such, innosumers provide a uniquely mundane type of technological work, where material and immaterial knowledge inputs are routinely combined to manage increasingly complex everyday technology.

*[Insert Table 2 around here.]*

Table 2 summarizes the properties of innosumers, and sets this concept apart from other roles of consumers covered in existing literature. What transpires from this overview is that the most important contribution of innosumers to innovation, indeed, is the kind of mundane configurational work that combines material with immaterial knowledge inputs necessary to configure technological components with everyday life. Innosumers are used to considering available options, to evaluating them in terms of how well they might contribute to developing and signaling certain life styles, to learning from repeated experience of embedding technology with everyday life, and to sharing information about all this in their (off- and online) social networks as part of routine communications and chitchat. Hence, their contribution is driven by a generic interest in and knowledge about technology, not as a specialized end in itself, but as a means—comparable to that of literature, art, furniture or clothing—to express oneself, to generate significance and meaning, and to signal these to others. The configurational work of innosumers, just like that of professional or organizational users, is *knowledge intensive* because it presupposes technological competence; but innosumers derive their contribution to innovation from a distinct interest in and understanding of technology as a part of contemporary everyday culture.

It is this entanglement of technological work with more mundane activities and interests that outlines a distinct role for consumers in relation to innovation of configurational technologies, and thus sets apart the relevance of innosumers from more traditionally defined consumers. Aging baby boomers have the potential to play a crucial role in this transformation of consumers into innosumers. They are simply numerous and prosperous enough to leave a decisive mark on future consumption structures. They are likely to be key users in the shift towards ICT-supported living environments that comprise new health and care services. And their enculturation into post-war consumer lifestyles has provided them with a thorough understanding of technology as an element of everyday culture that can be used as a resource. Shifting the dominant mindset from the paternalistic stance towards a more encompassing perspective that conceptualizes older technology users as innosumers, therefore, is necessary to both empower older persons to leave their mark on innovation processes, and enable designers to create technology that suits the lives of older persons. In what follows, we outline how the ideas of active consumption, co-creation and configurational work culminate in such a new perspective on older technology users as innosumers.

#### 4.2. *Re-thinking older technology users as innoconsumers*

The idea of the innoconsumer, we contend, marks a pivotal agenda point for future discussions on the relationship between technology and aging. Our discussions above highlight three pertinent points on which the current agenda should be reconsidered. These points all relate to ideas about older persons as users of technology:

First, the *needs of older persons* in relation to new and existing designs is more complex than the paternalistic stance presumes. User needs do not pre-exist technological designs, they are not “out there” ready to be elicited, and they cannot generally be seen as a starting point for design processes. While this is long recognized in STI-studies, the practices of gerontechnology designers tell us a different story. We found an almost obsessive preoccupation with user needs as an indispensable input to design. This not only misconceives the ontological position of user needs It also bears the exceeding risk of focusing too strongly on age related handicaps and problems, not because they are necessarily dominant in the lives of older persons, but because they can so neatly be translated into needs and then design requirements. The combined cohort and transitional effect underlines that the aging baby boomer cohort is likely to benefit particularly from new technology that invites playful encounters, and thus allows for diverse and meaningful forms of use. A crucial element in reconsidering the relation between technology and aging, therefore, are design practices that acknowledge users needs as what they are – something that, just like technological features, results from a process of co-creation that involves designers and users. For future research in gerontechnology, social gerontology and STI-studies it will thus be crucial to explore more extensively than today how older people live with technology, how technology changes their daily routines, and how they re-define technologies in order to assign them a space in their lived realities. First steps have been undertaken into this direction (see [6] and [115]), and future research on later life and design for later life might benefit from taking on board and pursuing such insights more systematically.

Secondly, the notion of script is an important complement to current research on technology and aging. Indeed, the cases analyzed above have revealed that gerontechnology designers have thus far insufficiently framed technology as a meaningful field of activity, but rather positioned it in an instrumental way [see 75]. As a consequence, current thinking about technology and aging lacks sensitivity towards how well certain technology designs enable or constrain the creation of unforeseen practices and routines during use.<sup>18</sup> Indeed, our case studies have shown how deviant behavior of *older* technology users is habitually framed as signaling technological incompetence and overburdening, as indicating a usability problem or design flaw, as marking a potential risk to health and well-being, and thus, overall, as something to be avoided in future rounds of design. In the light of more active consumption patterns and the diversity of older technology users such a deliberate choice for constraining scripts

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<sup>18</sup> As already indicated above (see 3.3), the notion of script also complements work on co-creation and user involvement that has explored how innovators can seek more creative encounters with users [81,82]. The script concept underlines that encouraging creative encounters is not only a matter of design methodology, but also a matter of the design itself [84].

meant to exclude creative interactions marks a potential pitfall. In other words, technology design for older persons is posed with the challenge to incorporate *enabling* scripts that allow for rich and diverse processes of domestication. In this regard, more research is needed into the competences and technology literature of aging baby boomers, on their diverse biographies of technology use, their forms and practices of domesticating new technologies into their lives, and into the ways they use technology to maintain and develop their social networks. Building representations of later life with technology that incorporates the insights thus gained seems to us crucially important in offering active scripts to older technology users.

Thirdly, the notion of technological configuration highlights that the households of older persons experience an ongoing shift towards more integrated technological environments. Such environments cannot be purchased off the shelf, but are configured by their users. Aging baby boomers, therefore, will not only engage in more active patterns of consumption, but these patterns will also be at the vanguard of the transformation towards ICT-supported technological environments in private homes. The e-bike example already marks how older persons are capable of managing technological resources in the light of their evolving lifestyles with emerging physical and cognitive challenges (see 4.1). E-bikes illustrate an underlying tension in this regard as they seamlessly combine aspects of lifestyle, exercise, assistance, fun, and mobility, and older technology users tinker to balance these different aspects. Hence, while at first sight e-bikes seem to straightforwardly help coping with an age related decline in strength and stamina, the genuine complexity of their use becomes apparent only in the light of biking as a sociable, meaningful *and* physically demanding activity. It is this particular blend that also characterizes technological configurations at the intersection of health devices, pseudo health products and services to increase well-being and fitness, and more traditional consumer electronics and household products.

We conclude, therefore, that addressing older technology users in all their diversity as *innosumers* (see 4.1) is the pivotal agenda point for innovation researchers, gerontechnology designers and policy makers. Indeed, our analysis above amounts to the fact that the near future will see consumption structures among older persons that has the potential to translate into a *rise of the aging innosumer*: an increasing share of older persons will have the willingness and capacity to actively co-create technological configurations in private homes on the basis of their earlier technology experience. Indeed, the very diversity of aging baby boomers, as well as the open nature of technological configurations, whose components indicate a range a possible solutions to be configured in use, mark the central challenges for innovation in aging societies. The notion of the *innosumer* puts both these challenges center stage. *Innosumers*, rather than providing specific designs that might be valuable for technology producers to adopt, probe into the range of valuable, workable, affordable and meaningful configurations. It is the knowledge thus created that constitutes a most important, yet insufficiently understood source of innovation [see 69]. Designers of gerontechnology have to learn to stimulate and to tap into this source.

Not all baby boomers, of course, are equally capable of acting as innosumers, and some may not be able to do so at all. But it is precisely the often mundane nature of configurational work that sets the notion of the innosumer apart from user innovators or even lead users. Innosumers tinker with available technology, but forms of this tinkering can range from quite advanced to rather humble modifications of available technical options. Hence we argue that the configurational work of aging consumers can be traced in a variety of settings including older persons of quite different wealth, education and health conditions. By framing older technology users as innosumers in design processes or research, it is precisely this diversity that will come to shape the range of and knowledge about feasible and valuable configurations. Acknowledging older persons as innosumers, therefore, provides a framework that allows, first and foremost, for tapping into their diversity, for mirroring their inputs across a wide range of domestication settings, for understanding how they communicate, probably even bragging about the solutions they come up with, and thus for learning more specifically about the range of knowledge consumers contribute to the dynamics of technological configurations.

## 5. Conclusions

How can aging societies remain innovative, successfully boost the emerging silver markets, and deliver technology that adds to a “good life” in old age? These questions have been at the heart of the present paper, and answering them, we contend, requires to rethink the position of older technology users in innovation. In this regard, the combined cohort and transitional effect, as well as the trend towards more technological configurations in private households mark a pivotal shift in the history of technology and aging. Indeed, as Coughlin [116] has pointed out, in the early 20<sup>th</sup> century scientific and technological change has contributed greatly to the increase in longevity. The later 20<sup>th</sup> century, then, concentrated its efforts on scientific and technological solutions to tackle the problems of increasing longevity. As a next step, we argue, the near future bears the potential to see older persons (co-)define the very nature of later life through their appropriation and use of technology thus also shaping the future of innovation and consumption in developed economies. Aging baby boomers will actively and deliberately learn about, configure and co-create technology to generate meaning and significance for later life. How well they will be able to do so, however, will depend on whether or not innovators and policy makers will acknowledge their potential as innosumers. This new concept, therefore, marks both a shift in thinking about older technology users and the cornerstones of a research agenda that will lead to a more comprehensive understanding of older persons as users of technology, and thus also to a more sophisticated understanding of technology as a natural part of later life.

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### Figures and Tables

Table 1: Development of the population, age distribution and the amount of baby boomers in Western Europe in thousands. (Source: United Nations World Population Prospects, Revision 2008, medium variants; own calculations)

Table 2: The “innosumer” in the context of existing literature

**Table 1**

<b>Western Europe<sup>a</sup></b>	2010	2015	2020	2025	2030	2035	2040	2050
Population	188,587	189,831	190,585	190,842	190,605	189,867	188,622	184,908
Above 60 <sup>b</sup>	45,081 (24.3%)	49,707 (26.2%)	53,950 (28.3%)	58,918 (30.9%)	63,009 (33.1%)	64,698 (34.1%)	64,893 (34.4%)	65,048 (35.3%)
Above 80 <sup>b</sup>	9,644 (5.1%)	10,832 (5.7%)	12,347 (6.5%)	13,212 (6.9%)	14,739 (7.7%)	16,568 (8.7%)	18,630 (9.9%)	22,676 (12.3%)
60–74 <sup>b</sup>	29,363 (15.6%)	31,121 (16.4%)	34,060 (17.9%)	37,076 (19.4%)	38,839 (20.4%)	37,867 (19.9%)	34,880 (18.5%)	32,538 (17.6%)
Old age dep. ratios	28%	31%	34%	38%	43%	48%	50%	51%
<b>Baby boomers among 60–74<sup>c</sup></b>	<b>11,091 (37.8%)</b>	<b>22,518 (72.4%)</b>	<b>34,060 (100%)</b>	<b>34,246 (92.4%)</b>	<b>22,333 (57.5%)</b>	<b>10,143 (26.8%)</b>	<b>0</b>	<b>0</b>

<sup>a</sup> Including Austria, Belgium, France, Germany, Liechtenstein, Luxembourg, Monaco, the Netherlands and Switzerland.

<sup>b</sup> Percentages in brackets indicate the share of the total population.

<sup>c</sup> Percentages in brackets indicate the share of the population aged 60–74.

**Table 2**

Older technology users (as framed in gerontechnology debates)	Consumers (as described in STI-studies literature)	Innosumers (as we indicate as relevant for configurational innovation)	User Innovators (as described in the STI-studies literature)
<ul style="list-style-type: none"> <li>- Follow the scripts of technological offerings; deviations from these scripts are framed as mistakes</li> <li>- Have well-specified needs</li> <li>- Are passive actors in innovation processes for whom others design</li> <li>- Have low technological literacy and are generally skeptical towards new technology</li> </ul>	<ul style="list-style-type: none"> <li>- Renegotiate the scripts of technology to define meaning, value and experience; deviations from a script are framed as an innovative input</li> <li>- Have implicit and evolving needs</li> <li>- Are active co-creators of technology when they domesticate new technology</li> <li>- Their knowledge inputs are restricted to the non-material aspects of technology</li> <li>- Their technological literacy or traits as technology users have not received explicit attention</li> </ul>	<ul style="list-style-type: none"> <li>- Complete incomplete design scripts</li> <li>- Provide <i>configurational work</i> that combines local and immaterial knowledge with material knowledge [69,90]</li> <li>- Are technology-literate and highly educated and thus able to debug problems systematically and engage in design activities to create and share quasi-codified knowledge</li> <li>- Learn deliberately and enthusiastically about technologies as a part of their everyday culture</li> <li>- Actively seek information from technology suppliers, media and peers about technological options</li> <li>- Are comparably ignorant but demanding, thus inclined to reject technology they do not find appealing or promising</li> <li>- Use technology for conspicuous consumption, i.e. for social differentiation and for impressing their peers.</li> </ul>	<ul style="list-style-type: none"> <li>- Hack into the core of existing technology to alter design scripts</li> <li>- Have implicit and evolving needs that they meet through deliberate and clear-but acts of innovation</li> <li>- Are highly literate and enthusiastic about technology, and (often) the needs they express are ahead of market trends</li> <li>- Alter the material aspects of existing technology, share information about these alterations within existing off- and online networks</li> </ul>