

Trojan technology in the living room? Ethics of the "tipping point" between self-determination and heteronomy

Sonnauer, Franziska; Frewer, Andreas

Veröffentlichungsversion / Published Version

Zeitschriftenartikel / journal article

Empfohlene Zitierung / Suggested Citation:

Sonnauer, F., & Frewer, A. (2023). Trojan technology in the living room? Ethics of the "tipping point" between self-determination and heteronomy. *Ethik in der Medizin*, 35(3), 357-375. <https://doi.org/10.1007/s00481-023-00756-8>

Nutzungsbedingungen:

Dieser Text wird unter einer CC BY Lizenz (Namensnennung) zur Verfügung gestellt. Nähere Auskünfte zu den CC-Lizenzen finden Sie hier:

<https://creativecommons.org/licenses/by/4.0/deed.de>

Terms of use:

This document is made available under a CC BY Licence (Attribution). For more information see:

<https://creativecommons.org/licenses/by/4.0>



Trojan technology in the living room?

Ethics of the “tipping point” between self-determination and heteronomy

Franziska Sonnauer  · Andreas Frewer

Received: 4 September 2022 / Accepted: 19 January 2023 / Published online: 16 March 2023
© The Author(s) 2023

Abstract

Definition of the problem Assistive technologies, including “smart” instruments and artificial intelligence (AI), are increasingly arriving in older adults’ living spaces. Various research has explored risks (“surveillance technology”) and potentials (“independent living”) to people’s self-determination from technology itself and from the increasing complexity of sociotechnical interactions. However, the point at which self-determination of the individual is overridden by external influences has not yet been sufficiently studied. This article aims to shed light on this point of transition and its implications.

Arguments The identification of this “tipping point” could contribute to analysis of familiar issues of conflict between the ethical principles of beneficence and respect for autonomy. When using technology in the living spaces of older adults, relationships, among other factors, may play a crucial role in older adult’s self-determination. We find the tipping point to occur subjectively and variably. To this end, the article combines theoretical ethical considerations with two examples from a qualitative study illustrating the perspective of older adults aged 65–85 years.

The present work was performed in partial fulfillment of the requirements for obtaining the MD degree (‘Dr. med.’) at Friedrich-Alexander-Universität Erlangen-Nürnberg (Germany) under supervision of Prof. Dr. med. Andreas Frewer, M.A.

✉ Franziska Sonnauer, M.Sc. · Prof. Dr. med. Andreas Frewer, M.A.

Professorship for Medical Ethics, Institute for the History of Medicine and Medical Ethics, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Schillerstr. 25, 91054 Erlangen, Germany

E-Mail: franziska.herbig@fau.de

Franziska Sonnauer, M.Sc.

Department of Psychiatry and Psychotherapy, University Hospital Erlangen, 91054 Erlangen, Germany

Conclusion The study of the tipping point underscores the importance of perceiving an older person's perspective. Particularly at the tipping point, this might be the only way to effectively identify whether the individual concerned perceives their self-determination as externally overridden. In conceptualizing the tipping point itself as well as its variability, we might create the basis for a normative call to shift the tipping point to promote self-determination and prevent overriding the will of older adults. We highlight individual, relational, and societal implications of our findings.

Keywords Gerotechnology · Self-determination as a continuum · Home environment · Interpersonal relationships · Coercion

Trojanische Technologie im Wohnzimmer?

Ethik des „Kipp-Punktes“ zwischen Selbst- und Fremdbestimmung

Zusammenfassung

Problemdefinition Datenverarbeitende assistive Technologien und künstliche Intelligenz (KI) werden in den täglichen Lebensräumen älterer Menschen zunehmend präsent. Ein Ziel dieses Technologieeinsatzes ist es, den steigenden gesundheitlichen Unterstützungsbedarf zu adressieren und sowohl akute als auch chronische Gesundheitszustände im häuslichen Setting besser zu behandeln. Auch wenn assistive Technologien und fürsorgliche Beziehungen darauf abzielen, das (objektive) Wohlbefinden und die Gesundheit zu fördern, steht dies nicht immer im Einklang mit selbstbestimmten Entscheidungen älterer Erwachsener. Ausgehend von dem bekannten normativen Spannungsverhältnis zwischen Wohltun und Selbstbestimmung stellen wir uns die Frage, inwiefern eine Einschränkung von Selbstbestimmung – was wir als Fremdbestimmung bezeichnen – bemerkt werden kann. Obwohl Risiken der Fremdbestimmung durch Technik selbst (*Überwachungstechnologie*) und durch komplexere soziotechnische Interaktionen häufig untersucht werden, ist über den Übergang von der Selbstbestimmung zur Fremdbestimmung wenig bekannt. Ziel dieses Artikels ist es, diesen Übergang und die damit verbundenen Implikationen zu beleuchten.

Argumentation Anhand des Konzeptes (relationaler) Autonomie und Charakteristika assistiver Technologien argumentieren wir, dass Fürsorgebeziehungen beim Technologieeinsatz im eigenen Wohnzimmer eine besondere Rolle zukommen könnte. Für die Untersuchung des *Kipp-Punktes* nutzen wir als eine unter weiteren denkbaren Möglichkeiten die psychologische Selbstbestimmungstheorie (SDT) nach Ryan und Deci. Theoretische ethische Überlegungen werden mit zwei Beispielen aus einer qualitativen Studie zur Verdeutlichung der Perspektive älterer Erwachsener (im Alter von 65–85 Jahren) kombiniert.

Schlussfolgerungen Die Fokussierung auf den Kipp-Punkt unterstreicht, wie wichtig es ist, die Perspektive eines älteren Menschen wahrzunehmen. Vor allem am Kipp-Punkt könnte dies die einzige Möglichkeit sein, um effektiv festzustellen, ob Selbstbestimmung durch Fremdbestimmung dominiert wurde. Die Fokussierung auf den Kipp-Punkt ist hilfreich, um Annahmen abzuleiten, inwiefern es zu einer *Verschiebung* kommen kann, das heißt, wie Interventionen zu einer Förderung von

Selbstbestimmung bzw. Vermeidung von Fremdbestimmung beitragen könnten. Anhand unseres gewählten Untersuchungsansatzes mittels SDT könnte theoriegeleitet von einer Förderung der inneren selbstbestimmten Regulation ausgegangen werden, indem eine Internalisierung erfolgt, etwa durch Förderung des Kompetenzerlebens durch die Technologie. Die Annahme einer inneren Veränderlichkeit dieses Kipp-Punktes ist gleichzeitig auch eine Problematisierung daraus potenziell erwachsender Momente der Fremdbestimmung (z. B. ungewollter Technologieeinsatz in der Zukunft als wohlgemeinte *Zwangsmäßnahme*). Auswirkungen auf individueller Ebene, in Beziehungen und auf gesellschaftlicher Ebene werden aufgezeigt, die hilfreich sein können, um die Selbstbestimmung älterer Menschen zu unterstützen.

Schlüsselwörter Gerotechnologie · Selbstbestimmung als Kontinuum · Häusliches Umfeld · Zwischenmenschliche Beziehungen · Zwang

Introduction

The fall of Troy is symbolic for the catastrophe in the ancient world: This war was the apocalyptic scenario for the battle of power and economics, for moral values and not only for the most beautiful woman of Antiquity, Helena. It is likely that, in the years and decades to come, the ongoing development of AI technology will be of significance to older adults' quality of life. (AI) Technology in daily living spaces is one of the "big stories" for a better future of older persons and the society. Assistive technologies such as walking and visual aids have been in use for decades to improve individual's functioning and independence (World Health Organization 2018). Various discursive voices have noted a potentially double-edged impact of AI technologies, underlining their potential to either enable predictive, personalized, preventive, and participatory healthcare for older individuals or act as disruptive technologies, depersonalizing care via standardization and contributing to discrimination, dehumanization, and disciplining (Rubeis 2020). The opportunities associated with these technologies seem to come with equal risks. Digital technologies constitute a potential way of addressing the rise in numbers of older adults needing support and assistance in the wake of societal demographic change (Ho 2020; European Commission et al. 2021).¹ In recent years, intelligent and other data-processing assistive technologies have become increasingly important in health-related settings. Going forward, these assistance systems will prospectively find use not only in inpatient healthcare, but also in the home environment ("daily living spaces") (Haque et al. 2020; Martinez-Martin et al. 2021).

Data-processing assistive technologies have specific characteristics that conventional, non-data-processing assistive technologies do not have. These include contin-

¹ In Western countries, a growing number of people will reach an old or very old age in the coming decades. Projections of life expectancy in the European Union show that the proportion of people aged 80 and over will increase from 5.9% in 2019 to around 13.2% by 2070 (European Commission 2021a). The impact of demographic change and the subsequent increase in the need for assistance in the near future, while only having limited human resources at hand, make the use of assistive technologies for health-related support an obvious next step.

uous processing of “potential symptoms” (such as vital signs and movement) using tools such as sensors or wearables and the subsequent algorithm-based evaluation and interpretation of this data, partly by means of AI. The development and implementation of data-processing assistive technologies in this area may support older adults to live independently in their familiar home environments² for a longer period of time and create better treatment options for acute and chronic health conditions (Al-Shaqi et al. 2016; Baig et al. 2019; Haque et al. 2020), potentially enabling comprehensive continuous “round-the-clock” health monitoring. Alongside these prospective benefits, however, stand concerns about privacy, data processing bias, accountability, and other issues (Martinez-Martin et al. 2021; Murphy et al. 2021). In the context of ethical concerns, the impact on older adults’ relationships, such as social participation and loneliness, are also of relevance when considering the use of technology (Remmers 2019). Hine et al. (2022) make a distinction between “AI ethics” and “care ethics” when considering ethical issues related to technology, especially to AI, in older adults’ living spaces. In so doing, they point to the likely impact on interpersonal relationships from the use of these systems in healthcare. In reference to existing guidelines (Floridi and Cowls 2019; High-Level Expert Group on Artificial Intelligence 2019) that might support the ethically conscious design of these technologies, the authors group ethical issues such as “privacy and security as design priorities” and the “requirement for representative training data” as pertaining to “AI ethics” (Hine et al. 2022, Table 1). Less evidently amenable to practical resolution, but nonetheless of great significance, are ethical issues such as “preservation of human contact and [a] sense of home” and “tensions between reassurance and concern”, among others, which the authors categorize as relating to “care ethics” (Hine et al. 2022, Table 1).

Currently, the use of assistive technologies in older adults’ living spaces is at lower level than might have been expected (Weber 2021). This notwithstanding, AI is expected to evolve into a widespread, “quasi-natural” component of home technologies in the future. We conducted an empirical study on this topic among older adults, some of whom indicated feelings of fear and skepticism toward the ongoing technological revolution. Might the voices of these persons be unheeded prophecies like those of Cassandra? Could (AI) technology in our living rooms—or those of our parents and grandparents—act as “Trojan horses” for commercialization and a loss of self-determination rather than giving older adults greater freedom and autonomy and thus improving their quality of life?

In our theoretical approach to locating the tipping point, we commence by exploring coercion, one way in which another may override an individual’s self-determination, as an example which points to the existence of a threshold at which autonomy may pass into its opposite. We will go on to look at the concept of autonomy, specifically relational autonomy. In doing so, we highlight as one characteristic of the tipping point that the transition from self-determination to external determination occurs within a person. The debate around autonomy in terms of conflicting

² “Aging in place” is favored both by policy makers (World Health Organization 2015) and by many people who wish to grow old at home, particularly in order to maintain sense of connectedness with their loved ones and communities (Wiles et al. 2012; Ahn et al. 2020). See also World Health Organization (2021).

principles and issues engaging autonomy in interpersonal terms, such as paternalism, do not necessarily require us to incorporate an individual's perspective; the "tipping point", by contrast, is what we define as the overriding of self-determination within an individual. Having set out these considerations, we will present a psychological theory as one of several conceivable approaches to exploring the tipping point between self-determination and determination by an external entity. We chose this theory because it seems most appropriate to describe a continuum and the tipping point on an individual level. In our view, the theory can also help to develop an awareness that the tipping point is variable—not only from person to person, but also within an individual—and that it is possible to promote individuals' self-determination via specific interventions. Concluding, we provide illustrative examples to argue that an external point of view alone does not suffice to identify the tipping point and discuss the normative implications of our findings.

Ethics of the "tipping point"

All people—and older adults are obviously no exception—differ in their autonomous health-related choices. Their right to respect for these choices is absolute, even where they may not be ideally conducive to health. This represents a normative conflict with potential for infringements on people's autonomy. In an important opinion addressing this normative tension, the German Ethics Council has set out a concept it calls "benevolent coercion": "'Coercion' denotes the overriding of another person's will. Coercion is called 'benevolent' if it is performed with the intention of preventing the recipient from causing harm to herself [or himself]" (Deutscher Ethikrat 2020, p. 8).³ How can we determine when a person's will is overridden? Would it be conceivable, in some future scenario, that an individual may decide to override their own will? It may be the case that an individual sets out an advance health directive whether and which data-processing assistive technologies they wish to use in a future scenario of care needs. A person could override their future will by own choice if this decision should still hold when their capacity to make decisions for themselves has become limited due to, for example, severe pain or neurodegenerative disease. However, an unintentional overriding of one's own will could be more problematic if the technological developments are more rapid than anticipated and the technologies that will actually be available in the future no longer coincide with one's own ideas about the technologies desired in the future.

³ It should be noted that the opinion of the German Ethics Council which introduces the term focuses on professional caring relationships, specifically on these relationships in psychiatry, child and youth services, and elderly and disability care. The opinion refers to cases of coercion for the presumed benefit of an individual's welfare, not coercion for other reasons, and seeks to consider whether there are circumstances under which benevolent coercion may be justified. The opinion discusses the concept of a fully responsible action (Deutscher Ethikrat 2020, p. 38), suggesting that the demarcation "between actions that are fully responsible and those that are not must be determined by third parties" (Deutscher Ethikrat 2020, p. 27). The original German edition of the opinion is titled "Hilfe durch Zwang? Professionelle Sorgebeziehungen im Spannungsfeld von Wohl und Selbstbestimmung" (Deutscher Ethikrat 2018).

The idea of a will being “overridden” indicates that, rather than there being a binary opposition between self-determination and control by an external entity, there is a point of transition, within a person, from exercising self-determination to have lost or surrendered it. To the best of our knowledge, this tipping point within an individual remains underdescribed and lacks a thorough conceptualization, in contrast to a relative abundance of concepts that describe the overriding of another person’s will within interpersonal relationships.

Autonomy: a relational view

Describing the complexity of older adult’s decision-making process around technology use, Peek et al. (2019) attempt to identify diverse factors influencing these decisions, including life circumstances, characteristics of the technology, and the individual’s health status; interpersonal influences are among these factors. Where one individual in an interpersonal relationship is vulnerable there is a risk of paternalism, a well-known phenomenon that Beauchamp and Childress (2013) define as “the intentional overriding of one person’s preferences or actions by another person, where the person who overrides justifies this action by appeal to the goal of benefiting or of preventing or mitigating harm to the person whose preferences or actions are overridden” (Beauchamp and Childress 2013, p. 208). Paternalistic interventions can be in conflict with respect for the autonomy of the individual, a principle of bioethics alongside nonmaleficence, beneficence, and justice (Beauchamp and Childress 2013). The two authors state that the influence of others may restrict the voluntary character that is key to informed decision-making, which in turn is an integral part of autonomy (Beauchamp and Childress 2013, p. 122ff.). There is some evidence that older adults may be subject to paternalistic influence by others in their daily lives. In a survey conducted in 2017 among 3416 respondents aged 65–85, with a sample representative of the German population at large, 6.8% said that they often felt patronized by others; the finding in a similar survey run in 2014, among 4421 respondents aged 65–85, was 6.3%.⁴ An older individual’s relationships have an influential impact on their decision-making about and during the use of technologies, including AI. An interview study on older adults’ hypothetical use of technology in their living spaces identified a risk that older adults may be “talked into” using these technologies by relatives (Berridge and Wetle 2020). Adult children of older persons living at home, interviewed for this study, underestimated their older relative’s ability to understand the technologies or did not consider it important for their relative to fully comprehend them (Berridge and Wetle 2020). Curnow et al.

⁴ Own calculation. Data are from the public release of the German Ageing Survey (DEAS 2014, 2017), provided by the Research Data Centre of the German Centre of Gerontology (FDZ-DZA). The sample is representative of the German population aged 40 and over living in private households. For descriptive comparison, in the age group 40–64 years, it was 10.6% of the $N=2895$ persons in the year of the survey 2017 and 13.3% of the $N=5321$ persons in the year of the survey 2014 who stated that they were frequently patronized by other persons. In the 85 age group, 6.4% of $N=281$ respondents in the 2017 survey year and 4.5% of $N=242$ respondents in the 2014 survey year reported being frequently patronized by others. In the last survey wave in 2020/2021, this question was not asked.

(2021) used cluster analysis of a sample of 451 persons with dementia to examine which characteristics influence the installation of assistive technologies. They found a greater influence of living situation (alone or with others) and level of caregiver support than of the severity of cognitive impairment or the risk of incidents. The fact that assistive technologies for locating the user found more frequent use with individuals who did not live alone led the authors to surmise that the technologies' use may have the purpose of reducing caregiver anxiety or be indicative of a difference in view between the individual and their caregiver on the former's needs. Other reasons suggested by the authors are that caregivers respond to technology alerts and that caregivers might assist the technology assessment and selection process (Curnow et al. 2021). It may therefore be the case that either the caregiver fails to respect the will of the person concerned or that they have a better understanding of that person than they do themselves and is acting in their best interests. Following the reasoning of Sullivan and Niker (2018), interpersonal influences can be thought of as "acting for the benefit of another person in a way that takes that person's autonomous agency into account, despite no explicit expression of consent or assent being given by the person on whose behalf the decision is made". The authors distinguish this concept of what they call "maternalism", with its consideration of "autonomous agency", from paternalism (Sullivan and Niker 2018).

Leading into a similar concept, researchers have provided a corrective to the potential for an excessively individualistic interpretation of autonomy by accentuating the relationality of the individual. A particular interest in this area appears in work by researchers in the fields of feminists ethics (Mackenzie 2008; Stoljar 2011) and of the ethics of care (Gilligan 1982; Conradi and Vosman 2016). The relational understanding of autonomy—and its curtailment—that emerges here highlights the fact that other people always have an influence on the values and preferences espoused by each of us (Dove et al. 2017). Some positions taken by proponents of relational approaches to autonomy seek to establish a counter-position to traditional bioethical conceptions (Donchin 2001; Osuji 2018). Osuji (2018), a proponent of the concept of relational autonomy, affirms that people develop and express their autonomy in relation to others, and therefore that a relational understanding of autonomy may enable us to perceive decision-making as dynamic and processual in character. Others, by contrast, largely regard relationality simply as an emphasis on factors such as interdependence or interconnectedness in addition to principles conventionally stressed in bioethics (Gómez-Vírveda et al. 2019).

When assistive technologies, including "smart" ones, are used in the living spaces of older adults, interpersonal relationships may expand or restrict a person's autonomy. Paternalistic influences may limit a person's autonomy; this restriction may, however, have the concomitant, balancing benefit of people who are close to the individual providing support for decision-making and technology use. The specificity of relational autonomy can help us to describe the various influencing factors that flow into relationships and to understand that interpersonal influences may result in the individual acquiring an altered perception of their own self-determination. But even if we fully understand the interpersonal influences, it seems that we need to take a closer look at what is going on inside a person to identify and describe the "tipping point" on the continuum between self-determination and external deter-

mination. In our view, additional theoretical considerations, which we will outline below, can further enhance our vantage point in this regard.

Self-determination theory: a potential route to exploring the “tipping point”

Various approaches to exploring this transition are conceivable. We have chosen to use the self-determination theory (SDT) proposed by Ryan and Deci (2000, 2017). There are two key reasons for our choice. First, as an empirical theory, SDT observes a continuum between self-determination (“autonomous motivation”) and non-self-determination (“controlled motivation”) (Ryan and Deci 2000, 2017). Second, as a motivational theory, SDT has the potential to show us routes toward promoting health and self-determination in the use of assistive technologies at home. In addition to these factors, SDT points to potential ways to postponing an assumed tipping point, thus, promoting an individual’s self-determination.

SDT describes a motivational continuum between amotivation, extrinsic motivation and intrinsic motivation. While intrinsic motivation (“out of pleasure”) is always self-determined, extrinsic motivation can either be of self-determined regulation (“integrated regulation = congruence, awareness, synthesis with self”; “identified regulation = personal importance, conscious valuing”) or of non-self-determined origin (“introjected regulation = self-control, ego-involvement, internal rewards and punishments”; “external regulation = compliance, external rewards and punishment”) (Ryan and Deci 2000). The continuum between non-self-determined (“controlled motivation”) and self-determined (“autonomous motivation”) is modifiable insofar as an internalization of extrinsically motivated behavior takes place (Ryan and Deci 2000). SDT sees this internalization as occurring with increasing degrees of fulfillment of three basic psychological needs, relatedness, competence, and autonomy (Ryan and Deci 2000).

We know only of isolated empirical studies that address the motivational continuum of self-determined and non-self-determined regulation in the 65-plus population. Philippe and Vallerand (2008), studying a sample of nursing home residents aged over 65, found that environments supportive of autonomy, such as those with a flexible approach to visiting hours and mealtimes, were positively correlated with self-determined motivation and with psychological adaptability. In our view it would be possible to draw on findings such as these to formulate assumptions as to how assistive technology may help promote older adults’ self-determination. Examples might be the use of such technologies to create greater flexibility in daily routines, or to provide people with an experience of competence in managing their lives, or to make it easier for them to access the world of others. The authors of the initial work on combining SDT with technology design (Peters et al. 2018) target and quantify key psychological needs (relatedness, competence, autonomy) at different stages of technology use (adoption, tasks, behavior among others). In line with SDT, Peters et al. (2018) suggest that the fulfillment of these psychological needs, via, for instance, personalization of technologies for the promotion of autonomy and competence, may have desirable outcomes, including engagement and satisfaction, in the

individuals concerned. There is a need for further empirical research to validate the approach proposed by Peters et al. (2018) and to study its application to technology development in older adults.

Like any other health-related behavior, people's choice to use data-processing assistive technologies for health-related support in their daily living spaces always involves motivational factors (for a heuristic of motivation and healthy aging in general, see Freund et al. 2021). Recent meta-analyses examining the associations between SDT interventions and health-related behaviors have focused predominantly on younger study populations (Gillison et al. 2019; Sheeran et al. 2020). When tested for their effectiveness within a meta-analysis, SDT-based interventions were found to have a positive impact on health behaviors only when the individuals concerned had self-determined motivation or a self-perception as competent, but not when their motivation was non-self-determined motivation (Sheeran et al. 2020).

An empirical evidence base exists for the association between self-determined motivation and health-related outcomes (Deci and Ryan 2017; Gillison et al. 2019; Sheeran et al. 2020), but in the older adult population, particularly in the context of technology, the literature is scarce. The principal purpose of SDT in the context of our considerations is as a theoretical lens.

Ethical considerations on the “tipping point”

In the theoretical context set above, we will now illustrate the point of transition from self-determination to external determination using two illustrative examples from a qualitative interview study we conducted in Germany with research ethics committee approval by the Friedrich-Alexander-Universität Erlangen-Nürnberg. The study focused on the perspectives of older adults around the use of data-processing assistive technologies to support home-based care. The core of the interview was a hypothetical scenario consisting of three assistive technologies (an electronic medication box, a sensor for measuring vital functions, a platform/device for connecting caregivers). Methodologically, the research took place within an explorative qualitative interview study design. We performed content analysis on the qualitative data collected, following the method proposed by Kuckartz (2018, chapter 5). We drew up a system of categories in accordance with the principles of biomedical ethics (Beauchamp and Childress 2013), with subcategories representing the subjective views of the sample of older adults ($N=16$, aged between 65 and 85). Compared to representative surveys of the general German population aged 65–85, the descriptive analysis showed higher internet use and technology affinity in the study population (study population compared to the representative sample of the survey by Generali Deutschland AG (2017), figures 4.17 and 4.21), and interviewees more often rated their standard of living as very good.⁵ The details of the qualitative interview study are published elsewhere (Sonnauer 2021).

⁵ The study population's responses to the question of how they rate their standard of living on a five-point Likert scale were compared with data from the representative sample of the German Ageing Survey (DEAS 2017) for the 65–85 age group (own calculation).

What follows will use excerpts from two interviews⁶ to explore the moment of transition—the “tipping point”—between self-determination and external determination. The theoretical considerations of the tipping point go beyond the empirical significance of the interview study, but the interview excerpts may help to illustrate theoretical considerations. Excerpts 1 and 2 seem particularly appropriate to describe the tipping point. In addition to these two selected excerpts, Table 1 contains paraphrased excerpts from other interviews. The interview excerpts ($N=15$; one interviewee did not give consent for transcription) were taken from a selected part of the interview in which we asked people to assess the extent to which they felt the scenario we presented to them could influence their self-determination or individual freedom. For the sake of compactness, we have chosen to paraphrase and restrict it to this specific part of the interview for presentation in Table 1. The second column of Table 1 contains a keyword list of potential determinants on perceived self-determination. Thus, for interviewees 1–5, it might be of particular importance for perceived self-determination in the use of assistive technologies whether decision-making autonomy is ensured. However, for interviewees 6–8, it might be of particular importance for the perceived self-determination in the use of assistive technologies how the technology is designed or whether sufficient technological competence is available, and so forth. The third column shows our suggestions as to how it might be possible to move the tipping point for this determinant to a later point, thus, promoting an individual’s experience of self-determination or ensuring they do not experience themselves as controlled by an external entity. Two interview excerpts could not be matched to the table.⁷ Table 1 illustrates the theoretical considerations of the present work; further empirical research is needed for validation.

The excerpts from one of these interviews (no. 1) illustrate the conflict referenced above between self-determination and beneficence.

From interview 1:

“So my inner attitude rejects this [scenario involving the use of assistive technologies]. Whether it is beneficial or not is another issue. But my inner attitude says no. I don’t want this.” [...]

“When it comes to it, I would rather die than be constantly monitored. That’s what I’m saying now. It doesn’t mean I’m tired of living, but one could end up [feeling like this]. In a situation like that.” [...]

“I would like to make my own decisions, no matter how good or bad they are.”

⁶ The excerpts from the interviews were adapted and translated from German. We note here that some interviewees spoke positively about the potential use of assistive technologies. Some associated them with the hope of being able to remain living in their homes for longer, which in our view indicates a connotation of the technologies with retention of self-determination. See also Sonnauer (2021) for the study in its entirety and the original German version of the excerpts from interview no. 1 and no. 2.

⁷ From the excerpt taken from the selected part of the interview “Well, do I feel restricted by that? Yes, [or] maybe not. It’s hard to say, actually.” it does not become clear whether this person has a sufficient mental representation of the assistive technology itself, whereby they cannot make a definite statement about the self-determination they would experience. From the excerpt “I would like to see it installed like a fire alarm from a certain age.” it appears that the person might like to have an external guideline on the use of assistive technologies, but the interviewee does not give any information about possible influences on their own self-determination.

Table 1 Interview excerpts and tipping point considerations

Excerpts from interviews (paraphrases)	Possible factors influencing self-determination	Possible interventions to shift the tipping point toward a gain in self-determination	
1 I would like to make my own decisions. I don't want these technologies, and when it comes to it, I would rather die than be constantly monitored	Decision-making autonomy	Tools to support decision-making or advance care planning (for concrete approaches see for example Berridge et al. 2022)	
2 I would not want something like these technologies at first. Until maybe I do see the point of it, or perhaps my son, let's say, forces me for my own good [to accept] that it's better after all			Informed consent True opportunities to change decisions (and low switching costs)
3 So on the one hand I think it's good, but you can take it too far. So maybe you have to leave it up to the individual whether they want to be connected like that or not			
4 I already use such technologies to some extent, but it's hard at the moment to say where the limits are. I think you can't trust all this unconditionally and open the floodgates to it. [We] should be able to choose not to use it			
5 If you use it consciously, then I would not feel restricted. I just have to make the choice for myself and not have it dictated to me by someone else	Technology design and user competence	Ethics by design (for concrete approaches see for example European Commission 2021b) Participatory and personalized technology design	
6 Provided I had access to the data, I would have a very positive view of it. But if I can't see the data changing, but only how the carers or doctor respond to them, then I wouldn't be happy about it			Promotion of digital health literacy and provision of support for the use of technology (especially for those with limited social support and low digital health literacy)
7 If I was feeling unwell, I would think it was a good idea, because the "thing" [the scenario presented] doesn't make decisions about me. What do I have to do to operate the "thing"? Can I manage it or is it quite complicated? Then I wouldn't see it as the right thing to me			
8 I can't even imagine how this is supposed to work. If I need help, perhaps it is appropriate			

This example shows that some older individuals may perceive data-processing assistive technologies in their living space as a significant violation of their personal values and thus as harmful rather than beneficial. This may be the case even where "objective" welfare-related motives, such as the ability to access help more quickly in an emergency, may justify the technology's use. Thus, the individual's self-determination rejects the use of these technologies in accordance with their values, which seek to avoid an anticipated condition of dependency or being subject to

Table 1 (Continued)

Excerpts from interviews (paraphrases)	Possible factors influencing self-determination	Possible interventions to shift the tipping point toward a gain in self-determination
9 I think this [the scenario presented] helps me to stay in control of my life, because I can stay in my home for longer	The opportunity to stay at home for longer	Provide reliable information about which technologies promote aging in place or related outcomes such as Activities of Daily Living (ADLs); authors reviewing this issue partly state that randomized controlled trials in authentic home situations are scarce (Ollevier et al. 2020), others show evidence (Gettel et al. 2021) Create opportunities such as Ambient Assisted Living Labs so that persons get a more real impression
10 I would like to be at home for as long as possible. If this [the scenario presented] is the alternative to a nursing home, then I would definitely prefer it	The opportunity to stay at home for longer	Provide reliable information about which technologies promote aging in place or related outcomes such as Activities of Daily Living (ADLs); authors reviewing this issue partly state that randomized controlled trials in authentic home situations are scarce (Ollevier et al. 2020), others show evidence (Gettel et al. 2021) Create opportunities such as Ambient Assisted Living Labs so that persons get a more real impression
11 As long as I can still make the choice myself, I'm always in favor of those things [the scenario presented] rather than going into some care home	The opportunity to stay at home for longer	Provide reliable information about which technologies promote aging in place or related outcomes such as Activities of Daily Living (ADLs); authors reviewing this issue partly state that randomized controlled trials in authentic home situations are scarce (Ollevier et al. 2020), others show evidence (Gettel et al. 2021) Create opportunities such as Ambient Assisted Living Labs so that persons get a more real impression
12 I would probably have less personal freedom, but that would be necessary depending on [my] health status or other factors. And if it [the scenario presented] is done well, it could also give my quality of life a new boost. I would have to be pretty much 'out of it'; I don't need it before that point	Health status	Technology promotes health in an evidence-based manner Fair access to high standards in health care and prevention
13 I think it depends on my level of mobility. The more limited I am [in that regard], the likelier it is that I will have to use something like this	The opportunity to stay at home for longer	Provide reliable information about which technologies promote aging in place or related outcomes such as Activities of Daily Living (ADLs); authors reviewing this issue partly state that randomized controlled trials in authentic home situations are scarce (Ollevier et al. 2020), others show evidence (Gettel et al. 2021) Create opportunities such as Ambient Assisted Living Labs so that persons get a more real impression

surveillance. We may assume here that the person in question would perceive the use of these technologies in their living spaces as overriding their will.

A further interview (no. 2) provides a noteworthy instance of the influence of relationships with others on perceptions of self-determination or external determination in this context:

From interview 2:

“My son lives some distance away and he can't come visit me all the time. [...] It would be very reassuring for him if he knew it [my health situation] was under control [via the use of these assistive technologies as in the scenario]. So, if he asked me if I wanted it, I would say no at first. Until maybe I do see the point of it, or perhaps he, let's say, forces me for my own good [to accept] that it's better after all.”

We are struck by the ambiguity inherent in the statement “forces me for my own good”, which seems to us to encapsulate the conflict between beneficence and

self-determination that arises when assistive technologies enter our living spaces.⁸ We use SDT here to describe the transition between self-determination (“integrated regulation” or “identified regulation”) and non-self-determination (“external regulation” or “introjected regulation”). In relation to this example from interview 2, we could speak of “integrated regulation” if we read the son’s presumed preferences (desire for control) as a projection or reflection of the interviewee’s own values. We might speak of “identified regulation”, by contrast, if the individual’s prioritization of interpersonal compromise is the guiding motive. Although engagement in relations is often conducive to self-determination and the development of identity, it may also result in the external determined use of data-processing assistive technologies (“external regulation”). This is the case when the other person intentionally uses the interpersonal relation as a means of overriding the individual’s will. They may do so through deploying rewards, such as attention, or punishment, such as exhortations to lead a healthier, more careful lifestyle. “External regulation” could occur here if the individual seriously fears that their refusal to use data-processing assistive technology may have considerable consequences, such as a withdrawal of interpersonal interaction or support (in this case by the son). “Introjected regulation”, in this context, would describe an external determined regulation arising due to internal compulsions. An example might be increasing movement levels when using a movement sensor out of embarrassment at what would otherwise be showing.

Integration experienced in relation to others is somewhat akin to *relational autonomy*, as it describes the act of an individual incorporating relationships with others into their self-determined regulation. *External regulation* experienced in relation is somewhat akin to *overcoming the will* of a person, as it describes an individual’s sense of being controlled by an external entity. However, the difference is that, as in the excerpts from interview 2, we would need access to the point of view of the older person in order to have certainty as to whether the choice in this instance is an expression of self-determination (*integration*) or not (*external regulation*). It is in this context that we have sought to identify the tipping point as within a person and as variable. With technology, including AI, likely to be deployed in the living spaces of older adults, we would make three observations regarding the individual, relational, and societal implications of the tipping point.

First, we will be unable to recognize the tipping point from self-determination to external determination if we do not take account of the views of older adults themselves. While evident internal or external constraints may be easier for observers to understand, the actual point of an individual’s transition from self-determination to external determination is not amenable to “objective judgment”. The ambiguity emerging from the excerpt from interview 2 cited above indicates that it is not necessarily possible for third parties to recognize from the spoken word whether a decision is self-determined or not. Instead, it is an intrapersonal, subjective perception that determines the experience of self-determination or external determination. The assumption that there is a tipping point that cannot be determined solely by objective judgments raises an ongoing research question as to what extent individuals possess

⁸ The German word the interviewee uses is more drastic: “*vergewohltätigt*”, presumably the interviewee’s own creation, a portmanteau of the words *wohl*tätig (benevolent, beneficent) and *vergewaltigen* (to rape).

the necessary introspective ability to identify their tipping point themselves, or what kind of support would be required to do so.

Second, an older adult's relationship may have an impact on their individual tipping point in relation to the use of technologies, including AI technologies. We would note the importance of awareness around the phenomenon of "benevolent coercion" in personal living spaces, in which interpersonal relationships might act as "gates of Troy" to allow the "gift" horse in. Conversely, a caring relationship could also allow older individuals to experience the technology's use as self-determined and therefore beneficial. Expanding the Trojan analogy here, we might regard this as an instance of social relationships acting as Aeneas, the mythological founder of Rome, who carried an older man—his father Anchises—on his shoulders as he left burning Troy and moved toward the establishment of Rome as a new powerful civilization.

Third, societal implications arise from our conceptualization of a tipping point. We will address two different aspects of these implications: first, how an understanding of this tipping point could lead to appropriate societal interventions; second, how moving this tipping point could help older adults retain a higher degree of self-determination.

It is evident, given the nature of demographic change, that "smart" technologies are highly likely to find their way into older adults' living spaces. We assume that it is societally desirable and normatively appropriate to strive for a situation in which older adults use and live with technology in a self-determined manner. Limitations of this demand for the creation of spaces of opportunity for the highest possible degree of self-determination lie in the fact that there may be other values, both societally and individually, that are more significant. In addition, knowledge of a tipping point may result in an imperative for self-determination, although some people may experience the relinquishment of responsibility through external determination as a relief. Future research should therefore further explore these possible adverse effects of concrete knowledge of the tipping point. If we were aware of a specific individual's tipping point, then it will be possible to work with that individual toward moving this tipping point in the direction of a gain in self-determination. The findings detailed in Table 1 suggest that it may be possible to identify some certain factors within the "group" of older adults that are of particularly relevance to the tipping point in this context. Persons like those in Table 1 to whom decision-making autonomy is important would need instruments that support them in retaining this autonomy under all circumstances. For individuals for whom understanding these devices and systems is important, opportunities to acquire skills in using the technologies would need to be available. For the needs of others, reliable data would have to be available on the extent to which the technologies actually delay moving into a care home. Overall, the theoretical and empirical examination of the tipping point between self-determination and heteronomy could contribute to the development of societally appropriate interventions that help people move toward a gain in self-determination.

We chose to use self-determination theory as one among a number of conceivable approaches. According to theoretical considerations from SDT, a possible shift in the tipping point occurs through internalization (Ryan and Deci 2000, 2017). The authors state that internalization leads to experiencing more self-determination

and less external determination. According to the SDT, this is done by fulfilling the three basic psychological needs (*autonomy, competence, relatedness*) (Ryan and Deci 2000, 2017). Such considerations could support the fulfillment of the basic psychological needs set out in Ryan and Deci's work by, for example, providing alternatives to various types of assistance in old age and enabling the adoption of technology to the individual (*autonomy*), promoting health technology literacy among older adults (*competence*), or affording prevention of isolation and the promotion of social connectedness among older adults key places on the agenda of technological development (*relatedness*). These considerations depend largely on the approach chosen to conceptualize the tipping point, with SDT being one conceivable approach, along with others. The focus of this article has been to shed light on the existence of the tipping point theoretically and to suggest initial ways to operationalize it. Future work should also involve applied research on the tipping point and factors affecting its variability. Findings from this area might also be relevant to contexts other than the use of assistive technologies (for example, the question of whether an older person who requests assisted suicide is self-determined in their decision or whether there are factors that have shifted the tipping point towards an externally determined decision). Moreover, there may be a variability of the tipping point both along the individual lifespan and when health deteriorates (as in, for example, neurodegenerative disease or emergency situations). Having decision-making autonomy and valid regulatory instruments such as living wills and advance care planning that consider the use of smart technologies to plan one's own future can potentially contribute to a higher experience of self-determination. This is all the more relevant given the potential for incongruent decisions between the individual and their family members regarding technology use (Berridge and Wetle 2020). The 24/7 round-the-clock monitoring made possible by "smart" assistive technologies carries the danger that incautious use of these devices may cross the line into a coercive practice that overrides consent. In our excerpts from interview 1 presented above, the person concerned would perceive such surveillance as massively interfering with their self-determination ("I would rather die than be constantly monitored."). Other persons, on the other hand, would perhaps be willing to put up with any round-the-clock surveillance and isolation within their own living spaces to be able to stay at home for longer. Perhaps we should consider concluding "Ulysses contracts and stratagems" for our own future to regulate encroachments on personal freedom and privacy through smart technologies. In any case, a better understanding of the tipping point between self-determination and external determination and its variability could help to know the will of affected individuals and the point at which their will is overridden.

Conclusion

Before we enter a new "digital Rome", with its potential benefits to older adults, we should pause for reflection on the technology, particularly instruments incorpo-

rating AI, in our living spaces.⁹ This article sought to contribute to this reflection by conceptualizing a transition—a “tipping point”—between self-determination and external determination. With this, we have examined in more detail what the overriding of the will of a person means and differentiated between interpersonal or “objective” perceptions and intrapersonal or “subjective” perceptions. Through the theoretical lens of self-determination theory, this article has outlined some characteristics that suggest that the tipping point is within a person and is variable. In this light, it is all the more crucial to listen to the voices of older adults and take their views on the use of these technologies seriously. If one follows the argument that the tipping point is variable and thus a promotion of self-determination is possible, our exploration of the tipping point seems to meet an ethical imperative. To respect older persons’ self-determination on a broader scale, awareness of this tipping point may make targeted interventions possible to help shift this moment of transition to heteronomy to as late a stage as possible.

Acknowledgements The present work was performed in partial fulfillment of the requirements for obtaining the MD degree (‘Dr. med.’) at Friedrich-Alexander-Universität Erlangen-Nürnberg (Germany) under supervision of Prof. Dr. med. Andreas Frewer, M.A. We would like to express our sincere thanks to the Josef and Luise Kraft Foundation (Munich) for their important support as well as to the scholarship holders and the supervisors in the Graduate School ‘Human Rights and Ethics in Medicine for Older People’ (Chairs: Prof. Heiner Bielefeldt/Prof. Andreas Frewer) for their manifold support and scientific exchange.

Funding The research was supported by the Josef and Luise Kraft Foundation within the framework of the Graduate School ‘Human Rights and Ethics in Medicine for Older People’ (funding period: 2018–2021, award/grant information: Not applicable.)

Funding Open Access funding enabled and organized by Projekt DEAL.

Declarations

Conflict of interest F. Sonnauer and A. Frewer declare that they have no competing interests.

Ethical standards The referred interview study was approved by the Research Ethics Committee of Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) by vote on 17 September 2019 (No. 319_19 B). Informed consent was obtained from all individual participants included in the study.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article’s Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article’s Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

⁹ For visions on future AI in smart homes in literature and films see the book *Mauersegler* [“hawk swallow”] by Poschenrieder (2015) and the movie *Das Haus* [“The House”] by Ostermann/NDR (Germany, 2021).

References

- Ahn M, Kang J, Kwon HJ (2020) The concept of aging in place as intention. *Gerontologist* 60(1):50–59. <https://doi.org/10.1093/geront/gny167>
- Al-Shaqi R, Mourshed M, Rezgui Y (2016) Progress in ambient assisted systems for independent living by the elderly. *SpringerPlus* 5:624. <https://doi.org/10.1186/s40064-016-2272-8>
- Baig MM, Afifi S, GholamHosseini H, Mirza F (2019) A systematic review of wearable sensors and IoT-based monitoring applications for older adults—a focus on ageing population and independent living. *J Med Syst* 43(8):233. <https://doi.org/10.1007/s10916-019-1365-7>
- Beauchamp TL, Childress JF (2013) *Principles of biomedical ethics*, 7th edn. Oxford University Press, New York
- Berridge C, Wetle TF (2020) Why older adults and their children disagree about in-home surveillance technology, sensors, and tracking. *Gerontologist* 60(5):926–934. <https://doi.org/10.1093/geront/gnz068>
- Berridge C, Turner NR, Liu L, Karras SW, Chen A, Fredriksen-Goldsen K, Demiris G (2022) Advance planning for technology use in dementia care: development, design, and feasibility of a novel self-administered decision-making tool. *JMIR Aging* 5(3):e39335. <https://doi.org/10.2196/39335>
- Conradi E, Vosman F (eds) (2016) *Praxis der Achtsamkeit: Schlüsselbegriffe der Care-Ethik*. Campus, Frankfurt a.M., New York
- Curnow E, Rush R, Gorska S, Forsyth K (2021) Differences in assistive technology installed for people with dementia living at home who have wandering and safety risks. *BMC Geriatr* 21(1):613. <https://doi.org/10.1186/s12877-021-02546-7>
- Deutscher Ethikrat (2018) *Hilfe durch Zwang? Professionelle Sorgebeziehungen im Spannungsfeld von Wohl und Selbstbestimmung*. <https://www.ethikrat.org/fileadmin/Publikationen/Stellungnahmen/deutsch/stellungnahme-hilfe-durch-zwang.pdf>. Accessed 14 Nov 2022
- Deutscher Ethikrat (2020) Benevolent coercion – tensions between welfare and autonomy in professional caring relationships. <https://www.ethikrat.org/fileadmin/Publikationen/Stellungnahmen/englisch/opinion-benevolent-coercion.pdf>. Accessed 25 Aug 2022
- Donchin A (2001) Understanding autonomy relationally: toward a reconfiguration of bioethical principles. *J Med Philos* 26(4):365–386. <https://doi.org/10.1076/jmep.26.4.365.3012>
- Dove ES, Kelly SE, Lucivero F, Machirori M, Dheensa S, Prainsack B (2017) Beyond individualism: Is there a place for relational autonomy in clinical practice and research? *Clin Ethics* 12(3):150–165. <https://doi.org/10.1177/1477750917704156>
- European Commission (2021a) The 2021 ageing report. Economic and budgetary projections for the EU member states (2019–2070). https://ec.europa.eu/info/publications/2021-ageing-report-economic-and-budgetary-projections-eu-member-states-2019-2070_en. Accessed 25 Aug 2022
- European Commission (2021b) *Ethics by design and ethics of use approaches for artificial intelligence*. https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ethics-by-design-and-ethics-of-use-approaches-for-artificial-intelligence_he_en.pdf. Accessed 14 Nov 2022
- European Commission, Joint Research Centre, Belmonte M, Conte A, Ghio D et al (2021) *Health and long-term care workforce: demographic challenges and the potential contribution of migration and digital technology*. EUR 30593 EN. Publications Office of the European Union, Luxembourg <https://doi.org/10.2760/33427>
- Floridi L, Cows J (2019) A unified framework of five principles for AI in society. *Harv Data Sci Rev*. <https://doi.org/10.1162/99608f92.8cd550d1>
- Freund AM, Hennecke M, Brandstätter V et al (2021) Motivation and healthy aging: A heuristic model. *J Gerontol B Psychol Sci Soc Sci* 76(Suppl 2):97–104. <https://doi.org/10.1093/geronb/gbab128>
- Generali Deutschland AG (2017) *Generali Altersstudie 2017: Wie ältere Menschen in Deutschland denken und leben*. Springer, Berlin <https://doi.org/10.1007/978-3-662-50395-9>
- German Ageing Survey (DEAS) (2014) *SUF DEAS 2014. Version 2.0* <https://doi.org/10.5156/DEAS.2014.M.004>
- German Ageing Survey (DEAS) (2017) *SUF DEAS 2017. Version 1.0* <https://doi.org/10.5156/DEAS.2017.M.001>
- Gettel CJ, Chen K, Goldberg EM (2021) Dementia care, fall detection, and ambient-assisted living technologies help older adults age in place: A scoping review. *J Appl Gerontol* 40(12):1893–1902. <https://doi.org/10.1177/07334648211005868>
- Gilligan C (1982) *In a different voice. Psychological theory and women's development*. Harvard University Press, Cambridge

- Gillison FB, Rouse P, Standage M, Sebire SJ, Ryan RM (2019) A meta-analysis of techniques to promote motivation for health behaviour change from a self-determination theory perspective. *Health Psychol Rev* 13(1):110–130. <https://doi.org/10.1080/17437199.2018.1534071>
- Gómez-Virseda C, de Maeseener Y, Gastmans C (2019) Relational autonomy: what does it mean and how is it used in end-of-life care? A systematic review of argument-based ethics literature. *BMC Med Ethics* 20(1):76. <https://doi.org/10.1186/s12910-019-0417-3>
- Haque A, Milstein A, Fei-Fei L (2020) Illuminating the dark spaces of healthcare with ambient intelligence. *Nature* 585:193–202. <https://doi.org/10.1038/s41586-020-2669-y>
- High-Level Expert Group on Artificial Intelligence (2019) Ethics guidelines for trustworthy AI. <https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai>. Accessed 14 Nov 2022
- Hine C, Nilforooshan R, Barnaghi P (2022) Ethical considerations in design and implementation of home-based smart care for dementia. *Nurs Ethics*. <https://doi.org/10.1177/09697330211062980>
- Ho A (2020) Are we ready for artificial intelligence health monitoring in elder care? *BMC Geriatr* 20(1):358. <https://doi.org/10.1186/s12877-020-01764-9>
- Kuckartz U (2018) Qualitative Inhaltsanalyse: Methoden, Praxis, Computerunterstützung, 4th edn. Beltz Juventa, Weinheim
- Mackenzie C (2008) Relational autonomy, normative authority and perfectionism. *J Soc Philos* 39(4): 512–533. <https://doi.org/10.1111/j.1467-9833.2008.00440.x>
- Martínez-Martin N, Luo Z, Kaushal A et al (2021) Ethical issues in using ambient intelligence in health-care settings. *Lancet Digit Health* 3(2):e115–e123. [https://doi.org/10.1016/S2589-7500\(20\)30275-2](https://doi.org/10.1016/S2589-7500(20)30275-2)
- Murphy K, Di Ruggiero E, Upshur R et al (2021) Artificial intelligence for good health: a scoping review of the ethics literature. *BMC Med Ethics* 22(1):14. <https://doi.org/10.1186/s12910-021-00577-8>
- Ollevier A, Aguiar G, Palomino M, Simpelaere IS (2020) How can technology support ageing in place in healthy older adults? A systematic review. *Public Health Rev* 41(1):26. <https://doi.org/10.1186/s40985-020-00143-4>
- Osuji PI (2018) Relational autonomy in informed consent (RAIC) as an ethics of care approach to the concept of informed consent. *Med Health Care Philos* 21(1):101–111. <https://doi.org/10.1007/s11019-017-9789-7>
- Peek STM, Luijkx KG, Vrijhoef HJM et al (2019) Understanding changes and stability in the long-term use of technologies by seniors who are aging in place: a dynamical framework. *BMC Geriatr* 19(1):236. <https://doi.org/10.1186/s12877-019-1241-9>
- Peters D, Calvo RA, Ryan RM (2018) Designing for motivation, engagement and wellbeing in digital experience. *Front Psychol* 9:797. <https://doi.org/10.3389/fpsyg.2018.00797>
- Philippe FL, Vallerand RJ (2008) Actual environments do affect motivation and psychological adjustment: A test of self-determination theory in a natural setting. *Motiv Emot* 32(2):81–89. <https://doi.org/10.1007/s11031-008-9087-z>
- Poschenrieder C (2015) Mauersegler. Diogenes, Zürich
- Remmers H (2019) Pflege und Technik. Stand der Diskussion und zentrale ethische Fragen. *Ethik Med* 31:407–430. <https://doi.org/10.1007/s00481-019-00545-2>
- Rubeis G (2020) The disruptive power of Artificial Intelligence. Ethical aspects of gerontechnology in elderly care. *Arch Gerontol Geriatr* 91:104186. <https://doi.org/10.1016/j.archger.2020.104186>
- Ryan RM, Deci EL (2000) Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol* 55(1):68–78. <https://doi.org/10.1037/0003-066x.55.1.68>
- Ryan RM, Deci EL (2017) Self-determination theory: Basic psychological needs in motivation, development, and wellness. Guilford, New York
- Sheeran P, Wright CE, Avishai A et al (2020) Self-determination theory interventions for health behavior change: Meta-analysis and meta-analytic structural equation modeling of randomized controlled trials. *J Consult Clin Psychol* 88(8):726–737. <https://doi.org/10.1037/ccp0000501>
- Sonnauer F (2021) Technologische Innovationen in häuslicher gesundheitlicher Versorgung: Die Perspektive Älterer und ethische Implikationen. In: Frewer A, Klotz S, Herrler C, Bielefeldt H (eds) Senioren zwischen Selbst- und Fremdbestimmung: Interdisziplinäre Studien zu hohem Alter und Lebensende. Menschenrechte und Ethik in der Medizin für Ältere, vol 3. Königshausen Neumann, Würzburg, pp 21–70
- Stoljar N (2011) Informed consent and relational conceptions of autonomy. *J Med Philos* 36(4):375–384. <https://doi.org/10.1093/jmp/jhr029>
- Sullivan LS, Niker F (2018) Relational autonomy, paternalism, and maternalism. *Ethical Theory Moral Pract* 21:649–667. <https://doi.org/10.1007/s10677-018-9900-z>

- Weber K (2021) Gute Technik für ein gutes Leben?! In: Frommeld D, Scorna U, Haug S, Weber K (eds) *Alter-Kultur-Gesellschaft*, vol 4. transcript, Bielefeld, pp 11–26 <https://doi.org/10.14361/9783839454695>
- Wiles JL, Leibing A, Guberman N, Reeve J, Allen RES (2012) The meaning of “aging in place” to older people. *Gerontologist* 52(3):357–366. <https://doi.org/10.1093/geront/gnr098>
- World Health Organization (2015) The growing need for home health care for the elderly: Home health care for the elderly as an integral part of primary health care services. https://apps.who.int/iris/bitstream/handle/10665/326801/EMROPUB_2015_EN_1901.pdf?sequence=1&isAllowed=y. Accessed 25 Aug 2022
- World Health Organization (2018) Assistive technology. <https://www.who.int/news-room/fact-sheets/detail/assistive-technology>. Accessed 14 Nov 2022
- World Health Organization (2021) Ethics and governance of artificial intelligence for health. <https://www.who.int/news-room/fact-sheets/detail/assistive-technology>. Accessed 14 Nov 2022