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Robots in the Care of Older People

Opinion of the
Bioethics Commission

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Vienna, 2018

Secretariat of the Bioethics Commission

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Preamble

In 2009, the Bioethics Commission published a statement on "Assistive Technologies – Ethical Aspects of the Development and Use of Assistive Technologies with Regard to Older People". In this respect, engagement with the current topic robot use in nursing and care is a logical follow-up in order to raise the necessary ethical, legal and practical questions that arise for society from this technological development.

On 2 May 2016, a public commission meeting on "Of Man and Machine: Robots in Care" was held in the Federal Chancellery with the participation of international experts. In the debate, the ethical implications and social consequences of providing care through machines were discussed, and initial empirical experiences and issues of practical implementation were dealt with.

The Bioethics Commission considers the use of robots that are as human-like as possible to be a political issue. Public debates on this subject are again and again ideological in nature, the assertion being that we will not have enough care personnel for older people in the future, given the ever-increasing longevity of the population in industrialized countries. This is also accompanied by expectations of cost savings in the care sector as a central argument.

The Bioethics Commission therefore considered it an obligation to investigate these allegations and to review the facts. Technological development must be geared to people's needs, technical possibilities must not dictate the areas of application. Although the field of robotics is very broad, the discussion has focused on the care of older people who are no longer able to perform all activities of everyday life independently.

The ethical aspects, above all the notion of autonomy versus control, data security and protection of privacy as well as "machine ethics" form the main focuses of this current discussion beyond the appointment of members for a new term of office of the Bioethics Commission in July 2017. Details of technical developments in the field of robotics as well as the very complex legal framework are deliberately not covered in the statement.

1 Introduction

"The robots are coming!" – Hardly a day goes by without media reports discussing examples of robot use and predicting the future of living with robots. Positions on these questions are far apart. While some believe that robot technology has already advanced to such an extent that machines will largely displace humans from the work process in the near future, others point out that activities that require a high degree of flexibility, sensitivity, creativity and social skills cannot be automated.

While industrial robots are already part of everyday life in many production plants, self-driving cars, robots as reception personnel in a Japanese hotel, "robot nannies" as well as care robots have caused a considerable stir and are the subject of controversial debate. On the one hand, there is the idea that having people cared for and looked after by machines is "inhumane". On the other hand, it is argued that robots are more reliable in some situations, do not tire and are constant in their reactions. As far as the care and nursing of elderly people and people suffering from chronic diseases is concerned, robots could support caregivers in mentally and physically stressful activities.

The use of robots for care tasks is a broad topic that encompasses different thematic strands and discourses. First of all, it must be clarified when a machine is considered a robot. The decisive characteristic of a robot is not necessarily its human-like form, but a greater range of behavioral forms and a higher degree of autonomy compared to a conventional machine (for the fundamental problem of the idea of "autonomous" machines, see 3.2). What distinguishes it from an automatic machine is that it can be programmed for various scenarios and can therefore be used for a variety of tasks. A further feature is that it is equipped with sensors simulating the human senses (vision, hearing, touch). In its "hard" version, robotics aims to develop machines, which act autonomously and develop a conceptual world. They will be able to interact "sensibly" with humans but also with other robots and other artifacts (as part of the "Internet of Things") and make decisions which have not been programmed – this is made possible by methods such as machine learning. Robots "learn" through interaction with their environment and thus continue to program themselves, so to speak. In the end, the foundations and processes of their decision-making may not only no longer be sketched out by people, but may also no longer be visible and comprehensible to people.

This idea, controversial as it may be, is widely discussed: Which aspects of human life and work can and should be robotized? Can and should "genuine" human activities, such as the care of other people, be transferred to a machine? And what are such "genuine" human tasks? What consequences does the transfer of such tasks to machines have for human relations, social contacts and social development? What do the advances in robotics mean for the future of work? The question of technology design also arises: Should everything that is technically feasible actually be developed and used?

The use of robots in nursing is closely related to the debate on the so-called nursing crisis. The enormous sums of money invested in related research and the development of nursing robots are justified by the argument that there is already a lack of nursing staff and that the increasing number of old people in need of care would exacerbate this situation. In this discussion, it should be borne in mind that the term "care robot" covers a wide range of applications: robots which do household chores, robots which help people eat, drink, bathe and use the toilet, lift and move them, and so-called social or "companion" robots, which are primarily intended for the care of people suffering from dementia or patients in palliative care, but also entertain or assist in learning and practicing various activities. PARO, the seal inviting people to pet it, is probably the best known example of a "cuddling robot".

There is a broad discourse on the ethical questions that arise in the context of robotics, especially with the use of “social robots”. Various European and international institutions commissioned studies in this regard, such as the Legal Affairs Committee of the European Parliament (“European Civil Laws in Robotics”, 2016), the Swedish National Council on Medical Ethics (SMER; “Robots and Surveillance in Health Care of the Elderly – Ethical Aspects”; Bert, 2017) and the COMEST (World Commission on the Ethics of Scientific Knowledge and Technology) Working Group of UNESCO (“Report of COMEST on Robotics Ethics”, 2017).

The present opinion of the Bioethics Commission aims to take up this discourse and to discuss the ethical issues arising for society from the development of robotics. Its focus is on the use of robots in the support of elderly people who are no longer able to independently carry out all activities of everyday life and increasingly require nursing and medical care. Special attention is paid to the needs of people suffering from dementia as well as to the core of nursing and care activities: the tasks which combine professional nursing skills with communication, physical closeness, intimacy and trust (see the corresponding definition in the Austrian Federal Act on the Healthcare and Nursing Professions, Sec. 14).

Due to the heterogeneity of older persons and the differences in needs in this phase of life, it is very difficult to define age uniformly. When is someone old? How is age defined? Which dimensions are taken into account? The purely chronological, biological, somatic, psychological, social context determined by individual culture? These questions are central to the investigation of age images. Age images contain general ideas about age, changes expected in the aging process and characteristic attributions to old people. An often cited classification (2003) is used by the WHO to try and grasp age-related differences: 50 – 59 years: aging person; 60 – 64 years: older person; 65 – 74 years: significant break in the regression phase; 75 – 89 years: old person; 90 – 99 years: very old person; 100 – 115 years: long-lived person. The target group for developers and producers of robot applications in nursing and care is defined as people in the “regression phase”. The text refers to this large group and, for the sake of simplicity, will use the term “older people”. The opinion follows a design-oriented approach raising questions for possibilities regarding the interaction of people with assistive technologies in care work, not about replacing human attention and care. While privacy issues are addressed from an ethical perspective, legal issues such as liability and product safety, which also arise for other assistive technologies, have largely been excluded from this opinion.

The ethical discussion focuses on the following questions:

- What images of ageing and the problems and needs of older people underlie technological developments?

- Who “controls” the robots, who is responsible for the actions (and errors) of a robot, and how is the conflict arising in the interplay of care, protection and (authoritarian) disposal resolved? The question of control and responsibility is related to civil and criminal liability issues, which require a thorough discussion. They are not included in the present recommendation, especially as up to now, no widely accepted discussion strands have emerged.

- How can the collection of large amounts of personal data and the increasing interconnectedness of robots with artifacts within and outside the immediate environment be reconciled with the protection of privacy? This question also needs to be reviewed for its links with legal considerations concerning the right of care recipients to refuse assistance and measures to protect privacy by limiting recording and access. The Bioethics Commission will deal with this question in connection with the topic of “Big Data”, so this document will not deal with it any further.

- What view of the human being is the basis for modelling the “social” behavior of robots?

- Which activities or aspects of activities are automated, what are the consequences and how are the interfaces to human actors designed?

2 Robots in elderly care: Motivations, developments

It is a well-known fact that most older people want to remain in their own flat until the end of their lives, even if there is a need for help and care, even if they are affected by physical and cognitive disabilities. There are understandable reasons for this: older people spend more time in their homes than younger people; leisure interests focus more on the home and the immediate living environment. Subjectively speaking, appropriate housing is a prerequisite for central needs, such as social participation and the maintenance of a circle of friends and acquaintances, for retreat possibilities and privacy, for the preservation of personal identity. The apartment is of great importance for life satisfaction and quality of life (Kruse 2017). However, in an opinion on the use of "assistive technologies" (2009), the Bioethics Commission put this finding somewhat into a relative perspective. It is not clear how old people experience the invasion of medical technology in their very personal living area. Moreover, there is a high degree of dependence on integrated care networks, which would now also include technical maintenance services.

Nevertheless, the use of technology is often a prerequisite for the wish to be able to remain in one's own home despite the need for care (Oswald 2014). However, it is problematic when the use of robots and new technologies is seen as the only way to cope with the increase in care tasks in the care and support of elderly people. The development of nursing robots is part of a tendency to look for what are, above all, technical solutions to the "nursing crisis" because these seem more feasible and also more efficient than measures such as making the nursing profession more attractive or testing alternative nursing models.

There are three different areas of application for robotics in the care of elderly people:

- Support for older people (and their caregivers) in day-to-day activities – Assistive Robotics (activities of daily life – ADL);
- Monitoring and surveillance of the behavior of older people and/or health parameters;
- Offering to keep company and provide support in everyday life – "companion robots".

The developments in these three areas are strongly determined by technology. This means that they are primarily driven by the ambitions of researchers and engineers to develop new possibilities of automation up to (quasi) autonomous machines, as well as by a rapidly growing industry with a high investment volume expecting a huge market for its products.

One problem in evaluating the development of robots in the care of older people consists in the fact that they are first developed and then tested for their "usability" in laboratory situations. We know very little about how older people experience and use (social) robots in real-life situations – both in institutions and at home – because there are hardly any studies on this. Thus, many of the reflections on what will happen when social robots move out of the laboratories into our lives are speculation.

Not only are there still relatively few evaluation studies on the use of robots in real care situations. It is argued against the exclusive testing of robots in laboratory situations that they are unable to grasp the complexity and high variability of everyday situations in care. In addition, there is a need to take the entire environment of older people into account in the evaluation, including their formal and informal caregivers (e.g. Frennert and Öslund 2014). Many of the application examples (and studies) come from Japan, where the idea of "companion robots" is also most strongly anchored and the idea that machines could take on tasks that require communication and attention is not met with the same amount of astonishment as is, for example, the case in Europe. In short, our ideas about the use of nursing robots arise from the interaction among researchers, engineers, producers and the media, and they are insufficiently empirically supported.

Like many technologies, nursing robots are advertised on the grounds that they would make considerable cost savings possible in the healthcare sector. But even this cost savings claim is not empirically verified or difficult to verify.

In the multi-faceted ethical debate on the use of robots in elderly care, one question emerges: Are robots being developed to help older people improve their quality of life, or is the focus on reducing the costs and "burden of care" for caregivers?

Some "advantages and disadvantages" to the use of robots can be anticipated, but they need to be discussed more thoroughly. One of the problematic aspects of robotization is the concern that this could contribute to a further reduction in human contacts, accompanied by an impoverishment of older people's social life. It is pointed out that social interactions come with health-protective effects and e.g., positively affect the cognitive functions of older people. Deprivation of social contacts with other people can be interpreted as a form of abuse. Added to this is the fear that the insensitive use of technical aids could reinforce the feeling of being treated as an "object" – i.e., of being "pushed around" by a machine without the asking – and of losing control over the circumstances of one's existence.

However, there are also potential positive aspects to robotics, such as minimizing dependence on the presence of caregivers for everyday activities, which is conducive to the independence of older people. Nevertheless, this would require the persons concerned themselves to be in control of the technology. Observations suggest that some people would rather be supported by a robot than by a human in their intimate care, so using robots in a considerate way could also help to neutralize and thus alleviate difficult situations.

3 Ethical questions of the use of robots in care

The lively debate on the use of robots in care has been reflected in hundreds of scientific publications. Since "autonomous" care robots – learning machines that operate largely independently of human control – are still a project of the future, most of these studies work with fictitious examples. Ethical issues can thus be addressed with foresight. However, it has largely remained open how these questions arise in the everyday reality of older people and their social environment, and which specific solutions are developed so as to deal with robotics.

At the same time, this anticipation of possibilities and problems is an invitation to researchers and engineers to consider ethical questions when designing care robots. Fictitious and existing examples of care robot use can show the complexity of the nursing situations which arise and demonstrate how difficult it can be to find a clear and satisfactory answer and solution.

Relevant literature suggests different approaches to the evaluation of robotics and other assistive technologies. Fundamental human rights (as codified in the UN Charter and in the Declaration of Human Rights) form a basis for ethical considerations; these include, among other things:

- the right to a good standard of living, privacy, family life and (relative) autonomy;
- the right to the absence of torture, degrading treatment and discrimination;
- the right to social interaction (which, despite progress in robotics, is still commonly understood as interaction with other people, not with machines).

It is important to guarantee that robots used in the care of older people primarily create these benefits and that they are not only developed to minimize the burden of care for society. A study commissioned by the European Commission (Butter et al., 2008) on the application of robotics in health care discusses the following ethical problems, which are also relevant for the nursing and care of older people: the argument of "dehumanization", the danger of "social poverty" and lonely death, the use of sick and vulnerable people for experiments, the exploitation of human emotions, the definition of, as well as an intervention in what is considered "human". In "How I learned to love the robot" Mark Coeckelbergh (2012) uses the capabilities proposed by Martha Nussbaum to assess whether an assistive technology improves the quality of life of older people in need of care and respects them as human beings. The core elements of this list include: physical integrity; the possibility of pursuing one's own senses, ideas and thoughts; emotionality; the ability to argue ("practical reason"); connectedness – the possibility of living with, seeing and respecting others; the ability to laugh, play and engage in leisure activities; control over one's own life and environment (see also Nussbaum, 2003). Coeckelbergh proposes to use this list for the evaluation of robot applications in the care of older people:

> For instance, using the capabilities as criteria for evaluation we may ask: Does the technology really enhance the capability of affiliation with others or does it only allow us to "stay connected" while diminishing real human contact? And if intelligent systems were to take over some decisions, would they sufficiently respect people's own capability of practical reason? Would bodily integrity be respected if intelligent nanobots were to "live" in the body? Moreover, since the capabilities approach has always been concerned with issues of justice, one could ask if these technologies will only benefit older people in technologically advanced countries and if that is problematic from a social justice perspective (p. 79f.)

3.1 Images of aging and their influence on the design of robots

Age images – especially images of very old age, i. e., the fastest-growing group of over 80-year-olds – are increasingly dominated by the notion of "frailty". This term refers to a multidimensional syndrome associated with a progressive loss of various functions in the areas of physical independence and cognition. There is also a progressive risk of morbidity and mortality (Fried et al., 2001, Rockwood, 2005). The term adopted from the English language is also used in German as it does more justice to the complexity and multi-dimensionality of the aging process than attempts to describe it with words such as "infirmity, fragility, reduction of abilities and functional autonomy". These terms, which are first often used as synonyms but are only partially applicable in terms of their content, are increasingly coming to be replaced by the sole use of "frailty" in German-language gerontological and geriatric literature. A person who becomes "frail" changes from independence and autonomy to dependence on help and care until the complete erosion of autonomy and independence sets in.

It should be borne in mind that "frailty" is a social construct associated with negative connotations and negative consequences. In public perception, there is often a polarity between "successfully aging" vs. "frail older people".

Images of age and aging still emphasize the deficits – the functional (including cognitive) limitations associated with rising age. They form the basis of the so-called deficit model of aging. This also affects the notions of age or aging and older people; they correspond to a negative age stereotype that determines our perception of older people and our behavior towards them. To a certain extent, it is internalized and thus also influences how we grow old ourselves. The deficit model of aging describes aging as a steady, irreversible process in which physical and cognitive performance degrades and which can only be influenced to a limited extent. From a medical perspective, Kruse (2017) formulates the problem as follows:

> [...] when age is equated with illness and older people are denied physical and cognitive plasticity as well as mental adaptability and potential for self-development – on the basis of age images that generally equate age with a *modus deficiens,* i. e. loss of physical, psychological and mental capabilities (Kruse, 2017, p. 57).

The deficit model of aging is now considered obsolete and is being replaced by more differentiated, more complex models, which also emphasize the potentials and competences in old age in an empirically supported way. More recent findings on plasticity in old age convey an image of very different aging processes in individuals and the differentiated positive development potential in old age.

However, it should not be forgotten that the concept of frailty describes the situation of a large group of older people: as a state of maximum vulnerability to a series of negative incidents such as falls and their consequences, immobility, loss of self-help capacity in daily life activities, dependence on continuous care and nursing. But this also means that the development of robotics and its assessment from an ethical point of view is about a heterogeneous group of older people with very different capabilities (in the sense of Martha Nussbaum's "capability" approach) and care needs.

In this context, the situation of older people with dementia is particularly complex. They are often met with prejudice. They are perceived as tending to be incapable of communicating, and this encourages people to disenfranchise them and take on even simple tasks which they would still be able to accomplish on their own. This is connected with the discussion about the infantilization of older people, such as the concept of doll therapy for patients with dementia. This quasi-therapeutic measure is based on the assumption of retrogenesis (Barry Reisberg), which says that older people regress into childhood. This is a deficit-based care model that can be degrading, depriving, infantilizing and debasing – Tom Kitwood calls it a "malignant way of caring for those with dementia" (Kitwood, 1997). One aspect of this image of people with dementia which has already been mentioned is their "objectification" through technology, for example when they are treated by a machine as if they were insentient or that their cognitive abilities are such that they are no longer in a position to judge situations.

Assistive technologies often reflect this deficit model of aging; it can also be found in robot research, as Frennert and Öslund (2014) critically point out when they ask: "Why are older people and children configured alike by roboticists?" The cuddly toy known as PARO is an example of a robot application used equally in the care of elderly people and children with autism. Furthermore, numerous robot-assisted therapy programs are being developed and tested for adults suffering from anxiety disorders and children with behavioral problems (e.g. Rabitt et al., 2015).

The use of robotic applications tends to disenfranchise the elderly who need care instead of strengthening their cognitive, mental and motor resources that still exist and enabling them to continue pursuing activities independently. The "mastery" concept reflects this skill-building approach (Joshi and Bratteteig 2016). Light et al (2015) have formulated a related guideline for technology development:

- *Enabling*, that is "supporting the ageing person in their ever-evolving coordination of mechanisms for maintaining the status quo";
- *Extending*, that is "lengthening the period of fulfilled and self-managed living and reducing the ailing morbid phase";
- *Blurring*, that is helping to ease the transitions across the aging phases;
- *Adapting*, that is "helping them choose their path, thus acknowledging and supporting the work of managing ageing, as well as the ageing process" (Light et al., 2015, p. 203).

It is a challenge in the development of robotic applications to strike a balance between supporting older people where necessary on the one hand and encouraging them to perform activities independently on the other.

3.2 Control versus autonomy

How autonomous are robots? Who controls their actions? How much will they regulate and restrict the lives of the older people they care for? These are closely interrelated issues.

The robots available in the near future will no longer be fully pre-programmed. They will be able to act flexibly, possibly even in an unexpected way, because they are able to interact with their environment and to "learn" from this. Basically, however, their behavior continues to be determined by the system architecture developed by engineers, the learning algorithms implemented, the values and rules implemented etc. At present, most of the robots described in literature are partly or entirely under human control, much like a puppet (e. g. Lu & Smart 2011). Robots also need a structured environment to function well, allowing their programmers to anticipate possible situations. The typical living environments of many elderly people – small cluttered rooms – are often unsuitable for robots. Therefore, in their current form they are more suited to institutions than for use in a domestic environment (Sparrow 2015).

"Who controls the robots?" – Sharkey and Sharkey (2012) investigate this question using a series of fictitious examples.

A robot could register potential dangers, for example, turning off a hot plate which is still on, preventing an older person from climbing a shaky chair to reach an object, but also simply taking away calorie-rich food from someone or prevent someone from pouring him/herself a third glass of wine if this person should watch his/her weight for health reasons. While the first two examples might seem reasonable to us, the intervention in eating preferences or the desire for alcohol is more problematic. The crucial question here is whether these restrictions are made with the consent of the person concerned and can be controlled, i. e. changed, by him or her.

If this possibility of control is lacking or severely restricted, the question to arise will be for the circumstances under which the safety and health of elderly people could justify a restriction of their personal freedom. The problem is to find a balance between protecting a person from harm on the one hand, and (authoritarian) control and paternalism on the other. Who determines whether this balance is maintained? Would it make a difference if control was not exercised by a robot but by an authoritarian nurse who does not accept any objections? Here, it could be argued that control exercised by a caregiver is at least directly understandable, while technically implemented control is not transparent and understandable, it happens behind the back of the person concerned.

In literature, there are positive examples, too – when persons concerned can control the use of robots and thus gain independence. A "care-on-bot" could quickly serve a glass of milk while the person receiving care would only be able to take the milk out of the refrigerator with great difficulty. A robot wheelchair could take this person to the toilet on demand, so the person concerned would not have to ask for help and wait for a suitable moment to do so. However, even these seemingly simple examples raise questions. Sharkey and Sharkey (2010b) argue that numerous opportunities for social contact are eliminated when such tasks are delegated to a robot. What seems efficient from the angle of saving time and gives the person requiring care more independent, such as automated spoon-feeding, also has a potentially isolating effect. In a cooperation project with older women, Wray (2003) found that they were more interested in interdependence than in independence and wanted to define themselves as active contributors in their relationships with caregivers. This means that independence or autonomy does not necessarily take priority over an opportunity of being involved in a social relationship.

Sharkey and Sharkey (2010) refer to another aspect. The media repeatedly report on care situations, both in institutions and at home, which are characterized by neglect, lack of respect and even abuse, as is the case in this example:

> I went to visit my husband on the first day and he is a very private person, he doesn't like anything to embarrass him and when I went in he was almost in tears, which is not my husband. He said "please, please go and get a bottle I am nearly wetting myself". I rushed out, I got a bottle and I said to him "Well why didn't you just ring the nurse", in my innocence. "I have, for an hour and a half I've been asking for a bottle". Well when I went out [and] told the nurse she said "Oh don't worry we would have changed the sheets". Now his dignity at that stage would have gone out of the window. There was no dignity (p. 15).

This would not happen with a robot trained to behave in a friendly and “respectful” manner (if this is possible for a machine at all) in all situations! However, it should be questioned why a technical solution to this problem should take priority over other solutions addressing the care situation and the caregivers.

In literature, various requirements for robot technology are discussed. The possibility for caregivers and their relatives to refuse the use of care robots is an important point in this context. Clearly, this is easier in a private household than in a care institution. As soon as institutions start using robots extensively, social pressure to open up to this technology will increase. The possibility for the persons concerned to control the robot is a second important point. As experience with available assistive technologies has shown, their configurability, i.e., their easy adaptation to changing needs, continues to represent a major technical challenge, which in many cases has practically remained unsolved.

The issue of responsibility is closely linked to the question of control: who is responsible for errors that occur during human interaction with robots? There are errors with possible negative consequences that can be traced back to the programming or technical design of a robot. Ingram et al (2010) have formulated a code of ethics for the robot community which calls on engineers to assume responsibility for the artificial creatures they develop:

> An ethical robotics engineer cannot prevent all potential hazards and undesired uses of the engineer’s creations, but should do as much as possible to minimize them. This may include adding safety features, making others aware of a danger, or refusing dangerous projects altogether. A robotics engineer must also consider the consequences of a creation’s interaction with its environment (p. 104).

However, there are other scenarios to be considered. If a robot reminds a person suffering from dementia to take his/her medication, who will be responsible for actual compliance? Such a situation will of course only occur if there are no additional checks by human caregivers.

3.3 Data security and protection of privacy

“Privacy” is a central issue in all networked, computer-supported systems. Care robots are not stand-alone solutions, they are integrated into networks of objects, sensors, distributed databases and people (both at close range and remote). Ienca et al (2016) make a useful distinction between:

- Information privacy – the possibility of regulating the disclosure of sensitive or confidential information;
- Physical privacy – the possibility of defining a private space and setting limits;
- “Attentional privacy” – the possibility of evading (unwanted) reminder systems and alarms;
- “Decisional privacy” – the possibility of making decisions autonomously, free of (unwanted or indirect) interference.

The latter is particularly relevant with regard to the therapeutic use of robots when it comes to achieving behavioral changes. These include the much quoted “nudging” (Sunstein and Thaler, 2008) – the act of causing people through small stimuli to take certain actions or decisions.

Most considerations concern the protection of personal information. It can be assumed that a care robot collects information about the person it takes care of around the clock in order to be able to act in a situationally appropriate manner. If one follows the future scenarios for the use of care robots, these will not only continuously record physiological parameters, but also the spatial conditions in the house, preferences and lifestyles, as well as activities that concern eating, sleeping or physical exercise. Some of the data may need to be linked to the electronic medical record.

A robot involved in care of a person suffering from dementia may have access to memories of important persons and events. To remember appointments and people, names, addresses, photos and other information must be stored. When third parties are present, it should also be considered to what extent auditory or visual instructions or memories infringe a person's social privacy (Felzman et al. 2015). Furthermore, a person in robot care who thinks he or she is in his or her private environment may not be aware of the fact that data about his/her behavior is collected on an ongoing basis and that relatives, visitors and other persons are also affected by this data collection. In this context, it is difficult to avoid the recording of information not relevant for the care situation – "ambient information" – (Sedenberg et al. 2016).

To the extent that such information remains in the private environment, problems can be contained. Questions of access may arise: for example, should all children have access to all information concerning their older parents or would selective rules be necessary; should health information first be passed on to the closest relatives who would then decide on communication with external caregivers? Other questions would include the issue of which data are absolutely necessary, how long they should be stored etc. Is it really necessary and justifiable for a person with mild dementia who is able to cope well with everyday life to have 24-hour video surveillance? Not to forget the question as to whether such surveillance is transparent for the persons in care and whether it is possible for them to turn off the video camera?

Additional problems arise when a care robot is connected to a large number of sensors and distributed data sources. Robots designed to support largely independent living in the home will in future interact with smart objects such as refrigerators, televisions, food processors or heating systems as part of the "Internet of Things" (IoT). Experience has shown that IoT networks offer special targets for attacks as commercially available smart objects often come with considerable security gaps.

This situation is aggravated by the use of cloud computing for data storage and sharing (Oliveira 2014). In cloud computing data are usually stored by several providers in different locations. It is not easy to control the extent to which such data are replicated and to which even sensitive information is used for the purpose of data mining or other purposes not known to the data subjects.

Transparency is an important principle discussed in literature. This does not only mean that the users of a technology have an understanding of which of their data are collected and how they are used. It also means that there must be no systems installed "secretly" or undisclosed flows of information.

3.4 Modeling human behavior, anthropomorphism, “machine ethics”

Social robots are not simply machines – they define what is genuinely human and also call this into question. Sparrow and Sparrow (2006), for example, deny that the activities of robots are “genuine care”. This presupposes recognition of the individuality of the recipients of care, respect for them and the desire to understand and meet their needs. Isbister (2004) describes the nursing robot’s underlying human image as reductionistic since it would suggest the idea that friendship and empathy are a consumable service. These are positions worth considering although they assume that humans regard robots as more than just machines. Why should a person expect more from a robot than competent care?

All things considered, the matter is not so easy if one takes the claims of robotics seriously. A widely used definition of social robots was worded by Dautenhahn and Billard (1999) who call them

> embodied agents that are part of a heterogeneous group: a society of robots or humans. They are able to recognize each other and engage in social interactions, they possess histories (perceive and interpret the world in terms of their own experience), and they explicitly communicate with and learn from each other.

The “hard” version of robotics has made it its goal to equip them with an equivalent of the human body and the ability to learn and to enable them in the future to develop real emotions and social behavior. (The moderate version is limited to imitating human behavior.) One example of the “hard” version can be found in “Lucy the Orangutan Robot”, described in Steve Grands book “Growing Up With Lucy: How to Build an Android in Twenty Easy Steps (2003)”. Grand describes Lucy as his “child”, providing her with a family and an environment that promotes learning and growth, including toys, a website etc. Lucy’s ideas of “growing up” in a society are strongly influenced by culture and norms (Castañeda and Suchman, 2014). The ability which will dramatically distinguish Lucy from her robot predecessors is her access to the world of imagination, Grand claims: “She will not be as smart as a human or ape baby of the same age, but she will learn for herself and she will have something that no robot has ever had before – an *imagination*” (p. 107).

Grands’ claim may seem exaggerated, but it is characteristic of the far-reaching ambitions of modern robotics research. It asserts that the development of autonomous, thinking machines makes it possible to better understand human intelligence: the robot as a model of human thought (Alac 2009). The relationship between engineers and their “creatures” is interesting. Weber (2014) argues that a new culture of interaction has developed between engineers and robots. For example, robots learn to systematically recognize and perform specific gestures and other activities in direct interaction with humans or to develop new concepts (e.g. Amershi et al. 2014).

This is closely connected with the question of whether robots should look as human-like as possible. An essay by Mori (1970/2012), “The uncanny valley”, is much quoted in this context: in it, the author uses various examples – an industrial robot, a mask, a Japanese puppet, a realistic hand prosthesis – to argue that a person’s reaction to a human-like robot would abruptly change from “empathy” to disgust as soon as the deception comes to light. He believes that the possibility of recognizing a robot as such would rather strengthen a person’s affinity to it. We are more comfortable interacting with a cartoon-like appearance than with imperfect realism, says Duffy (2006). DiSalvo et al (2002) argue that a certain degree of “robot-ness” is necessary so that people do not develop wrong ideas about the nature of a robot and recognize it as a machine. Conversely, a certain degree of human resemblance is necessary for humans to feel comfortable with a robot, and it must also be recognizable as a product so it is pleasant for humans to use.

These "rules of thumb" refer to the discomfort that people may experience when dealing with a robot. This discomfort is caused by social robots questioning the boundaries between what is human and what is machine-like – a question which Haraway has already critically discussed, firstly in her essay "A Manifesto for Cyborgs" (1990).

From an ethical point of view, the problem already raised is that people who think they are dealing with a real companion, as in the case of PARO, may feel deceived. On the other hand, several empirical studies have shown that people prefer robots which give emotional feedback to those which behave "neutrally", that they feel closer to them and assess interaction with them as more pleasant (Baddoura & Venture 2013). They also found them to be more human-like (Fink 2012). De Graf et al (2015) report that the more and longer their test persons anthropomorphized the robot, a 30cm small hare with movable ears and flashing LED lights in the abdomen, and said positive things about its sociability, the more they perceived it as a "companion". In these cases it was not a matter of deception, but of a human resemblance expected from robots (in contrast to other "faceless" machines), or conversely, people were more willing to interact with a machine if it showed human-like characteristics or behaviors. The entertainment value of social robots should certainly not be underestimated. Overall, these various findings and considerations point to the complexity and ambivalence of human-robot relationships.

The potential for robots of displaying "social behavior" are strongly related to the control systems implemented in them; these can be pre-programmed or variable depending on the situation. Often, the modeling of robots' social and emotional behavior is based on stereotypes of gender, ethnic characteristics and social hierarchy (Weber 2014). For example, Power and Kiesler (2006) found that respondents associated a childlike face ("baby face") with sociability whereas a low-pitched voice was associated with competence. In both cases, respondents were more inclined to accept health-related proposals from a robot. Eyssel and Hegel (2012) confirm the finding that the interactions between humans and robots are strongly determined by the categorization of facial features. This also applies to robots that should read the condition of persons receiving care from their facial expression. Robotics uses a simple scheme of "universal" emotions such as joy, sadness, surprise, fear, anger and revulsion (Ekman 1992).

It is conceivable that there are numerous situations in which the appropriateness of an intervention cannot only be assessed on the basis of clearly identifiable "facts". Sedenberg et al (2016), for example, discuss the fictitious example of a woman suffering from severe depression who, on the advice of her doctor, acquires a therapeutic robot that is also intended to give her feedback outside the therapy sessions. Although she feels better, the robot reports to her on the basis of facial emotional cues that she is not making any progress. She does not understand that the robot judges on the basis of simple rules and is unable to recognize and evaluate nuances. In a completely different context, a nursing robot responsible for several patients at the same time is to identify who is most in need of help in a specific situation. This would not be possible without a control system that supports the evaluation of situations.

Unless one considers machines as moral agents, argues Lichocki (2012), the intention to implement in them the option of judging situations from a moral point of view is also problematic. Moreover, such rules would necessarily be enormously simplified, which is contrary to our view of ethical behavior.

3.5 "Ironies of automation" – what gets automated?

One aspect which is rather neglected in the discussion on ethics is the question for the activities which can actually be automated and which forms of cooperation between humans and robots should specifically be developed.

It is common practice in the development of machines to "split up" complex activities and transform them into tasks that can be easily automated, leaving "residual activities" to human beings.

One example from the care sector is the automated monitoring of a person's physical condition (blood sugar, heart rhythm) or their safety (from fire, water damage, falls). The customary solution is to separate the task of registering defined dangerous states from the social aspects of protecting a person from harm. However, ensuring the safety of an older person in their home environment requires far more than automated monitoring. In an empirical study on the use of a simple telemonitoring system, Mort et al (2009) show that safety and security are the result of cooperation between the persons receiving care and their relatives and caregivers, which may be supported by a system. In fact, however, the surveillance of the older persons was reduced to automated registration and any attempts the older persons made to use the system for social contacts (such as chatting with the people in the monitoring center) were discouraged. In this context, the occurrence of false alarms, which tend to weaken attention to actual risks, is also frequently documented.

The possibilities of automation relate to what could be described as the "ethics of work design". Bainbridge (1983) described these phenomena as "ironies of automation". Using examples, she has shown how transferring easily automated tasks to machines may make the remaining activities more difficult for human beings. In addition, there is a need to deal with the errors caused by the machine (Jones 2015). Bainbridge concludes: "The more advanced a control system is, so the more crucial may be the contribution of the human operator" (p. 775). With regard to the nursing robots of the future, this makes the design of the man-machine interfaces, requiring an optimum combination of various capabilities, a very demanding job.

The weaknesses of technology disregarding the need for careful design of these interfaces are illustrated by the example of a transport robot used in a hospital (Mutlu & Forlizzi, 2008). The robot was perceived as a nuisance wherever patients required a lot of attention – for example when the robot brought food or fresh laundry while nursing staff did not want to or could not interrupt their work. In cases where a sample had to be taken to the laboratory quickly, the robot was often not readily available. There were frequent collisions between the robot and hurrying doctors or nurses, or a wheelchair left standing in a corridor. Certainly, such problems can be solved. The example only goes to show the degree of detail in which workflows and spatial constellations must be observed and how important it is to coordinate automated activities with those of the hospital personnel. These varied considerably in different departments examined.

Another finding of the study concerns the expected savings through the use of transport robots, illustrated by the following quote:

> The package was sold as that it was going to save time and effort. And it has on someone else's end but not from this unit, did not, so yes... Did it save hiring a dietary person to pick up carts? Did it save the linen person to come pick up linen? Yes, it did... Where did that

> land? It landed with my people. And so while it's a nice thing, nobody gave me more because a person wasn't doing that anymore... Well, it didn't save any for me. It cost me, and I didn't get that to replace it. So, yes, I don't like it for that reason. It's not that I dislike the technology (Mutlu & Forlizzi 2008).

Here, too, the facts are far more complex than the hospital management had expected.

In this context a central question has to do with the aspects of care activities that are to be automated. It may seem desirable to many caregivers that unpleasant activities, e.g. those that are physically exacting, will be carried out or supported by robots in the future. On the other hand, the question arises as to why nursing staff should hand over to a robot the very activities at the core of nursing work. Literature on nursing describes these core elements of nursing practice in various ways. Strauss et al (1982) emphasize the normative dimension of care – dealing carefully ("in a caring way") with those receiving care, not exposing them in their vulnerability, respecting their feelings – and the high degree of professionalism which manifests itself in precision in the execution of procedures, in meticulous adherence to safety standards etc. Van Wynsberghe (2013) uses the example of lifting patients to describe this combination of professionalism and care in the form of touching and eye contact. She quotes the example of a HAL (Hybrid Assistive Limb), an exoskeleton worn by the nurse that adapts to her movements and carries large parts of the weight, as an exemplary human-robot combination in which the robot plays an assistive role.

Another problem has to do with the fact that, with the introduction of robots into care, new and additional forms of work emerge; however, these remain largely excluded from the debate about the advantages and disadvantages of robotization (Bratteteig & Wagner 2013). In an essay about Charles Babbage, the 19th century inventor of "thinking" machines, Simon Schaffer (1997) writes:

> The intelligence attributed to machines hinges on the cultural invisibility of the human skills which accompany them. In Babbage's devices, the skills which surrounded automatic mechanization were systematically rendered invisible. Then and only then might any machines seem intelligent. ... If such machines look intelligent because we do not concentrate on where their work is done, then we need to think harder about the work which produces values and who performs it.

The illusion of autonomous operation is also attributed to the new machines. However, experience with modern technology suggests that care robots will be prone to malfunctions and require intensive maintenance. Their integration into the maintenance process will require what Strauss et al. (1985) calls "machine work" and "safety work": maintenance, updating, reprogramming, repairing etc. While these are also activities requiring expertise, making technical artifacts function smoothly in everyday life is one of the "invisible" activities that do not appear in any official job description, which are not recognized or supported (e. g. Oudshoorn 2007). Robertson (2006) has worded an ethical perspective on the design of work that sums up the previous considerations:

> The argument is made that some solutions to design problems are better than others because they enable human interaction in different ways. Some solutions enhance the possibilities for human agency, others diminish it. This means that there can be a moral basis for choosing between alternative interaction design decisions that might otherwise be considered equivalent in terms of the functionality and usability of the technology.

4 Recommendations

In view of the fact that the use of robots in elderly care is currently still a “project of the future”, the recommendations of the Bioethics Commission primarily concern

- research and all those institutions which promote and financially support research in the field of robotics;
- those healthcare facilities which are considering the use of robots in long-term care.

As mentioned at the outset, legal issues relating to safety and liability have been largely excluded from this opinion.

1 *Perception of the diversity of older people and their needs*: Technology development is primarily concerned with replacing the deficit model of aging, which is still prevailing, with differentiated images of various aging processes. From an ethical point of view, two main principles have to be considered in the design of robot applications:

– the development of applications which enable older people to retain their skills for as long as possible and to carry out as many everyday activities as possible independently (with “technical support”);

– avoidance of potential deception and infantilization by robot applications, especially with regard to elderly people with dementia.

2 *Designing robots as part of a complex environment of people and their tasks*: Robots are often first developed in the laboratory and later on tested, again in laboratory situations. However, their use in sensitive and necessarily variable everyday situations requires the careful design of “interfaces” with the environment in which they are used. Robot applications should only be designed as “tandems”, i. e., involving the human caregiver. Some of the central problems to be overcome here include:

– The careful coordination of those aspects of care tasks which a machine could support or partially take over, with the nursing practice by nursing staff and/or relatives;

– The integration of the machine into complex processes so that it adequately supports these – above all, this applies to care institutions which have to ensure that robots actually facilitate work as promised;

– Ensuring the configurability of robot applications so that these can be easily adapted to changing needs, above all also supporting control by users and their caregivers.

3 *Protection of personal information*: When robots are used in the care of older people, sensitive personal data will regularly be transmitted and processed, and this is subject to special protection in accordance with the EU General Data Protection Regulation (GDPR) effective as of 25 May 2018. With the integration of robot applications into networks of objects, sensors and distributed data sources, however, previously unresolved practical technical problems are emerging, giving rise to issues of privacy protection. Important principles for the design of robot applications include transparency – “it’s a good idea to build systems that tell you what they’re doing”, regulations regarding the permissible duration of sensitive data storage, the strict limitation of data registration to what is absolutely necessary for a task and the restriction of access to records. The privacy of care recipients, which includes refusing access to certain data, is essential. In addition, sufficient mechanisms should be provided to allow the recipients of care to express their wishes vis-à-vis robots, for example, when they refuse to accept assistance in certain situations.

4 *The prospects of cost and labor savings held out by the use of robots*: Since these represent a central argument in the development of technology programs requiring considerable resources, both in terms of development and in terms of acquisition and maintenance in everyday life, it would be desirable to have studies review these prospective savings.

5 *International documents on robot use*: There are already some recommendations concerning the use of robots, such as the IEEE Code of Ethics For Robotics Engineers (2010); the European Parliament resolution of 16 February 2017 with recommendations to the Commission on civil law regulations in the field of robotics (2015/2103(INL), or a declaration of the World Economic Forum 2016 ("Top 9 ethical issues in artificial intelligence"). It is desirable for the Austrian government to participate in such initiatives.

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