Universal Design 2016: Learning from the Past, Designing for the Future
H. Petrie et al. (Eds.)

doi:10.3233/978-1-61499-684-2-335

Universal Design and Welfare Technology

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Abstract. The paper presents the background for the increased interest for and use of welfare technology. It discusses current definitions of welfare technology and suggests a typology of this technology based on the different definitions. It compares the definitions with that of assistive technology and endeavors to draw a clearer limit between them, in particular related to possibilities to utilize the principle of universal design on welfare technology. The issue of operationalization requirements of universal design to welfare technology through standardization is also discussed. Finally, the paper suggests what elements should be part of a new definition of welfare technology.

Keywords. Welfare technology, assistive technology, Universal Design, people with disabilities, elderly people

1. Introduction

Welfare technology, which is the common Nordic term for technology used for environmental control, safety and well-being in particular for elderly and disabled people. A similar term is Ambient Assisted Living (AAL) technology[2]. A typical definition is: "Welfare technology is technology that can help and assist users in their daily lives. Examples of welfare technology are intelligent aids such as cleaning robots, sensors in clothes, smart homes, etc." (Wikipedia).

The term of welfare technology is mainly used in the Nordic countries, while in Europe the term Ambient Assisted Living (AAL) is more common. This may reflect the Nordic countries' approach to the welfare state and welfare services and the idea that such technology will be an important integrated part of such services, like today's assistive technology.

At the same time, the discussion on how to understand the term welfare technology has accelerated because of all Nordic government having taken an increased interest in using it. This not the least because of the assumed economic benefits, in particular in the municipalities. This again is rooted in the increased pressure on the Nordic welfare states, combined with an ageing population, new demands etc. In particular, the Danish debate has economic benefits as important aspects, but also in Norway where many municipalities face financial challenges.

The result is what is called the "dilemma of the welfare services": Simultaneously with the societal development and increased prosperity, it is increasingly difficult to fulfil the demand for satisfactory standards. That means that the demands on welfare services increase, at the same time as the costs and the demands on public expense

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2 See for instance https://ec.europa.eu/digital-single-market/en/active-and-assisted-living-joint-programme-aal-jp

steadily increase. It is realistic to expect increased pressure for improved welfare services in the future.

It is the purpose of this paper to see how the definitions of welfare technology reflect one or more aspects that are affected by the use of such technology: welfare political concerns and/or social economical concerns, and the possible consequences thereof.

The paper will discuss the notion of universal design regarding welfare technology, which is a new aspect in this particular field. The following topics are discussed:

- What are the current definitions of «welfare technology» and what impact has the use of terminology for including universal design in the requirements to such technology?
- Whom should welfare technology include? (Elderly vs disabled people of all age groups)
- Where welfare technology should be used? (housing only vs. workplaces, educational facilities, social settings)
- What is the relationship between assistive technology and welfare technology?
- What will be the aspect of universal design in future use of welfare technology?

2. Background

Assistive technology has for a long time been used to compensate for disabilities. Currently, welfare technology solutions is added to such compensatory solutions, and thus the two are interrelated. It is also normal to see a service dimension to welfare technology and thus is furthermore related to service innovation at local level in Norway.

The development of digital solutions yields a possibility to offer long-distance services from public and private service providers. The new smart technologies create possibilities to combine different solutions and functions to create better everyday lives for elderly and disabled people, also combined with smart everyday technology solutions. To a large degree this is about digital solutions like safety technology (alarms, sensors etc.), but also education related technology in schools and smart house solutions. For everyone to benefit from this development, universal design must be an integrated part of the solutions offered.

Standards Norway has produced two reports regarding the topic of universal design and welfare technology. Some important findings were made in the studies behind the reports. The first report [15] focused on topics relating to universal design and standardization in the field of welfare technology. In the report various definitions of the term welfare technology (ambient assisted living) were presented, and the consequences of different definitions regarding, for instance, the understanding of how such solutions are utilized. Thereafter the definition of universal design and this principle regarding welfare technology were discussed. Regarding standardization for technical solutions the report concluded that even if there are ongoing activities in special fields, like social safety alarms and assistive technology, there is a need for standardization of technical solutions. One important reason was to ensure universal design, communication and predictability. The report also concluded that there is a

need for standardization in the field of universal design and accessibility in the fields of care and welfare services.

The second report [16] discussed issues of protection of privacy and the use of ICT solutions in housing. Based on interviews with representatives of selected municipalities, as well as a survey of secondary sources, the report presented the main challenges experienced by the municipalities regarding universal design and welfare technology. Furthermore, the report discussed how requirements to the use of welfare technology in housing related to the condition of houses and the possibility for standardized solutions in order to ensure equal access. Methods for condition survey are described in Norwegian Standard NS 3424 *Condition survey of construction works – Content and execution*, which is a tool to make a survey of conditions in a building according to a given level of reference. In order to ensure functionality and predictability this method can be used for condition surveying both regarding adapting for welfare technological solutions and for universal design.

At the same time the Ministry of Children, Equality and Inclusion Affairs in 2016 launched its new Action Plan on Universal Design, where welfare technology has a prominent place, including standardization. Standards Norway has got funding for launching a standardization project on this project, which is also starting in 2016.

3. Methodology

The main method for finding relevant information for this study has been reviews of literature and interviews, to get an overview of the current status of experiences, understanding of welfare technology and current research in the field.

Our approach was to find what is the current understanding of the term "welfare technology", and related to this, "assistive technology" ("everyday technologies" could also be mentioned here). And last, but not least, how relevant is the aspect of universal design?

The literature survey and the formulation of the issue to be analyzed traditionally are based on four steps, involving balancing between theoretical discussion and empirical analysis.

The methodology that this paper is based on consists of four tasks:

First task is to identify the problem; here defined as focusing on current definitions to develop a typology of assistive technology and welfare technology (and what is often termed everyday technology) – and the their relationship to the principle of universal design. With this as a basis to identify the main elements that should be part of a revised definition of welfare technology.

Second task is to define the rationale behind the issue: the main reason for the present study is the increased importance of the use of welfare technology, smart technologies and other digital solutions. This again is based on the empirical facts, like an increased ageing population in general, and the political objective of enabling more people to spend their old age at home longer in particular. However, the relevance of the study is not only demographically and policy based, but also administrative: Today the Nordic countries have a well-established system for distribution of assistive technologies as part of the welfare state. - However, the emphasis on welfare technologies is currently in more of a probing phase than incorporated in a well defined system of distribution.

The third important step is to limit the problem to be discussed, here including a clear definition of the abovementioned technology types (terminology) and their interrelationship. This is also helpful for the empirical studies needed to get a clearer picture of the relationship between these technologies and the impact on future policy and the application of universal design. At the same time, the topic-related limitation should not be so strict that the survey could exclude important empirical findings.

The final task is for the topic to be operationalized, i.e. to establish clear criteria on how the units, the terms and the connections in the analysis are to be represented through empirical facts. Thus operational definitions should be developed, based on the various elements that constitute the topic concerned.

For instance, "assistive technology" can be operationally defined as "those items catalogued in the International Standard ISO 9999 *Assistive products for persons with disability -- Classification and terminology*. The elements to be surveyed may be defined on both a theoretical and an operational level. The more precise theoretical definition of the items we will discuss, the easier it would be to make good operational definitions.

What data are to be collected, how to analyze them and what conclusions can be made based on the analysis. The empirical data selected for this study are primarily limited to literature on assistive technology, welfare technology (and if relevant, everyday technology), and interviews made with relevant service providers and public authorities.

4. Universal Design and Welfare Technology – Developing a Typology

Based on the findings in the reports, literature studies and interviews, we discuss what is meant by universal design in the context of welfare technology, one of the main points being the effects of different use of definitions and terminology. We divide these into several main topics:

- What are the current definitions of «welfare technology» and assistive technology - and what impact has the use of terminology for including universal design in the requirements to such technology?
- Where should welfare technology be used? (housing only vs. workplaces, educational facilities, social settings).
- What does universal design of welfare technology mean? We want to look into the different kinds of solutions that are today included in the notion of welfare technology, and discuss how universal design will be relevant to include in the design and/or adaptation of these solutions.
- The need for standardization of solutions is another aspect of these issues.

5. What Are the Current Definitions of Welfare Technology and Assistive Technology?

Our studies have shown several different ways of understanding and defining "welfare technology" in the Nordic countries as well as in Europe. The different notions are important in particular as to who should be covered by this kind of technology – mainly elderly people or including disabled people of different ages? This will have effects for

instance on where to use the technology (see below), funding, legal requirements to, for instance housing etc. Table 1 brings together the definitions, see them related to universal design and evaluating possible overlapping between the terms.

Table 1. Typology of welfare technology and assistive technology and their relationship to universal design.

	A) Assistive technology for individual use	**B) Welfare technology**	**C) Universal design**	**Overlap?**
Main purpose	Independent living, equality, participation in society. Compensating for disability. Tool to solve practical challenges as a consequence of disability.	Welfare services are defined as a tool to solve challenges in the demographic development, increased number of elderly people and reduced number of service staff. Also to the benefit of younger people.	Ensure equal access to products and services in society. Ensure equal access to services through physical design. Through good design everyone can use the main solutions, so that society (and the market) functions better, without barriers.	B) and C) for physical products that have a user interface – in order for all to have equal access. General (not individual, like A) solutions.
Definition	Assistive technologies have the direct effect of assisting or replacing or compensating for a defect ability or significant and permanent disability (Norwegian Public pensions act).	Different definitions depending on focus (user, economy, technology, services, narrow (elderly) vs. broad (disabled people in all ages). Functions: Safety, control, participation, mobility. Innovated services.	The basic idea behind universal design is to design society in such a way that as many people as possible may participate actively notwithstanding having a disability or not. The objective is that the main solutions may be used by all. The principle is used when developing products, ICT, the built environment, transport, services, infrastructure etc.	No, but C) constitutes the «framework" surrounding A) and B). A special field are services – they are part of A) (interpreters, secretaries, assistants financed by the Public pensions act); are connected to B) (health care services) but there is a debate whether they also belong to C) or should be defined as "accessibility and adaptation tools".
For whom? (Target groups)	Primarily: Persons with disabilities in all ages. Also assistive technology used by others, like person hoists. Also relevant is employees using such technology	Primarily elderly people, relatives, service providers. Also relevant for persons with disabilities and for service innovations. Also relevant is employees using such technology	Everybody, to the largest possible degree.	B) and C). It is important to note that welfare technology is not only a tool for improving independent living at home or in institutions, but also at work places and

	at work place, education etc.	at work place, education etc.		educational facilities.
Arena –area of use	During the whole life span (if necessary). Used at home, at school, during leisure activities – follows the person.	At home, at institutions (like care homes for elderly), but also at work places. At home the technology assists in providing safety and communication with service providers, as well as self-monitoring of health (eHealth).	All physical design of products and surroundings in society. Also used for software and hardware information and communication technology, information etc.	C) constitutes the physical framework surrounding A) and B) but is also relevant for those parts of B) that have a human-machine interface. For instance regarding ICT systems for communication between user and service providers and between the services.
Financing and distribution system	Governmental financing and distribution through AT distribution centrals, legally based on the Public pensions administration. For temporary needs: the municipalities.	Not established, public and private financing is involved – different models. Focus in the present Governmental Action Plan on UD.	Governmental, municipal and private initiative. Legally based on the Accessibility and antidiscrimination Act, ICT regulation and Public procurement Act, as well as Building and planning Act.	No, but several legal acts are relevant for the B) and C), like the Planning and building Act.
Rights	Individual right in the Public pensions Act. The municipalities are responsible in cases of temporary need for AT.	Not clarified, some of the Public pensions act is relevant, as well as Planning and building Act.	Legal base in Accessibility and antidiscrimination Act and in sectorial legal acts, as well as the Planning and building Act.	No
Dimension	Personal	Personal and general	General	
Responsibility (public/private)	Mainly public	Public and private	Public, partly private (for instance ICT)	

The several definitions of welfare technology reflect the emphasis made on different aspects of their proposed use. The literature study of different definitions of welfare technology has identified that different actors focus upon different aspects:

- Focus on users: The definition is mainly focusing on users as beneficiaries of welfare technologies, for instance followed by a description of what the technology includes.

- Focus on economy: The definition focuses upon the financial challenges that society faces because on pressures on public budgets, the ageing society etc.
- Focus on technology: Focus on what kinds of technology that welfare technology encompasses.
- Broad definitions: Including elderly and disabled people and/or technology, which actually belongs to other areas, like assistive technology for personal use and medical equipment.
- Narrow definitions: Focus on elderly people and technology earmarked for this user group.

Some examples systematized according to type and focus illustrates this:

Table 2. Typology of welfare technology definitions

Type of definition/User	**User focus**	**Economic focus**	**Technology focus**	**Broad (B) or narrow (N)**
Ministry for health and care services	X			B
Directorate for health	X			B
KS	X		X	B
Norwegian State Housing Bank	X		X	B
Norwegian Technology	X		X	N
Sintef	X			B
Swedish Institute for Assistive Technology (Hjälpmedelsinstitutet)		X		N
Nordic Welfare Centre		X		B
EU/AAL		X	X	N

6. The Borderline between Assistive Technology and Welfare Technology

Another issue is to clarify the border between assistive technology (personal equipment) and welfare technology (mainstream equipment that is installed in a building and can be used by all). For instance Wikipedia points out that "Note that Welfare Technology can also be phased as Assisted Technology or Assisted Living Technology" – are there legal, administrative or budgetary consequences of such clarifications?

This aspect is interesting, not the least because of the political implications regarding financing and distribution to users. Assistive technology is usually defined as technology adapted to an individual's need to compensate for his or her disability. The principle of universal design is per definition something that is of benefit to all, so that all without the need for personal adaptation can use the main solution (in this case, the technology concerned). In contrast, assistive technology is something that is adapted to the person individually, according to his or her personal needs. There is no absolute distinction at administrative level today, as items termed welfare technology (mainly digital solutions) can be, and are distributed to individuals under the heading "assistive technology". However, welfare technology solutions often apply existing technology

that are available to all but not designed according to the principles of universal design. If a person moves into a care home, digital solutions, like touch screen control panels installed in every living room, will be inaccessible if she is visually impaired. In order to avoid having to order additional equipment for her to achieve the same degree of environment control and independence, it is better that the mainstream solutions are designed according to the principles of universal design.

The legal, administrative or budgetary consequences of a clear definition of the technologies concerned are several. For instance, should the distribution of welfare technology be a mainly public concern (like assistive technology), or mainly private (like smart house technologies, everyday technologies etc.? On which administrative level should responsibility for welfare technology be placed? The implications of combining the present distribution system of assistive technology and welfare technology for public budgets should be estimated – possibly seen in a cost-benefit analysis related to the benefits of enabling more people to have an independent living.

7. Where Should Welfare Technology Be Used?

Today, welfare technology is first and foremost identified with technology used in housing for elderly people, both at home and in special care housing. However, welfare technology, for instance technology for environment control, alarms etc. can as well be used at work, at educational facilities etc.

This issue is also linked to legal, budgetary and administrative consequences. To what degree should it be required that such technology be installed at work places, public facilities etc.? Who should finance such technology? If the scope is extended from mainly focusing on technology used at home or in care centers, there is a great opportunity to create more accessible work places and educational places thereby yielding increased possibilities for education and employment, with potentially great societal benefits.

What would be the universal design aspects? The technology used will have to follow universal design, in order for all users to have equal access without the need for special solutions and adaptations. This will make distribution and access to the technology for all easier, reduce costs and support a broader area of use for such solutions.

The various definitions of welfare technology reflect the ideas on the purpose to which such solutions are to be used. For instance, while some definitions are user centered, others point to the fact that also care providers will benefit from welfare technology as they will be relieved of some (menial) tasks that may be automated and may concentrate their work on vital work tasks.

8. What Does Universal Design of Welfare Technology Mean?

How is universal design relevant for design and adaptation of what is today defined as welfare technology? It is to an extent agreed that universal design is relevant for welfare technology, viz. its inclusion in the Norwegian Government Action Plan for Universal Design, where welfare technology has a prominent place together with ICT.

To define the scope for universal design, focus can be on technology that has a user interface, (and not for instance focus on technology used for administrative

purposes or machine-to-machine communication); relate welfare technology to inclusive employment and education; define target groups etc.

Digital solutions should follow normal requirements for universal design of software and hardware, self-service automats etc. Other aspects are ensuring standardized design of the solutions to ensure that for instance users with cognitive disabilities may recognize the solutions.

To ensure universal design of welfare technology important steps are to include requirements into public and private procurement specifications, include universal design aspects in education for care service staff and other service providers responsible for using and introducing welfare technology, as well as decision makers in arenas where policy decisions affecting the use of welfare technology are made.

The main objective must be predictability for all.

9. The Need for Standardization of Solutions

Finally, the role of standardization to ensure predictable access to good solutions is important. Many respondents to the surveys preceding the Standards Norway reports focused on the need for standards. Through such normative documents presenting concrete demands to technical solutions predictability for users of welfare technology, notwithstanding where they lived or places they visited can be ensured.

Standards are here understood as a set of functional requirements, not requiring specific technical solutions.

Regarding the focus discussed in this paper the issue of standardization to ensure universal design of welfare technology is of particular interest. Standards for universal design already exist in areas like the built environment, ICT, services, transport and other areas that are relevant for different aspects related to welfare technology and care services, but not on this technology in itself. As part of the Norwegian Government action plan for universal design a project is launched by Standards Norway in the second half of 2016 to survey the needs for standardization in this field and to launch standardization work through a committee.

10. Conclusion – towards a Revised Definition of Welfare Technology

A clear definition of welfare technology is necessary to clarify the border between this and assistive technologies, among others because such a distinction has implications for the implementation of universal design principles and for administrative and financing purposes.

Firstly, the main distinction is, that while assistive technology is a typical (individual) solution for compensating for an person's disability, welfare technology is normally understood as the adaptation of (mainstream) technological solutions in order to ensure safety, control of one's surroundings, as well as smart house technology – normally encompassing mainstream digital solutions.

We suggest that an updated definition of welfare technology should include the following elements:

Scope: Welfare technology is technology that strengthens the users' independence, safety, control of surroundings, independent living and social activities, independent of age and disabilities. The term welfare technology includes safety and security

technology, compensation, comfort related technology, technology for social control and control of surroundings, and care technology, for use at home, work places and educational places.

Societal benefit: Welfare technology strengthens the interaction between technical solutions and welfare related society systems and contributes to continued economic sustainability for care services. Used at educational and work places it will also benefit inclusive work places and may yield increased employment rate among persons with disabilities.

Limits: Welfare technology does not include personal assistive technology, medical equipment or technology supporting administrative systems.

The defined delimitation towards (personal) assistive technology is a basis for defining universal design as a principle for (general) welfare technology. This should be a basis for administrative purposes, like administrative level for distribution, financing on public and/or private levels etc.

As regards universal design this must be included in specifications as part of procurement procedures of welfare technology, to ensure equal access for all and reduce the necessity of special adaptations. An important tool for this would be the development of, and reference to, standards on universal design related to welfare technology.

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