Design for Inclusion
I. Garofolo and G. Bencini (Eds.)

doi:10.3233/SHTI230404

ICT for All: Where Do We Stand?

Barbara CHIARELLI[a,1] and Elisa CACCIAGUERRA[b]
[a] *Department of Engineering and Architecture, University of Trieste*
[b] *Politecnico di Milano*
ORCiD ID: Barbara Chiarelli https://orcid.org/0000-0002-7623-3068

Abstract. Although its importance is undeniable, designing in a more inclusive way is not yet fully adopted in the field of design and planning, whose reference continues to be the standard man. An approach which not only excludes people with disabilities, but also other categories that diverge from the physical and cognitive characteristics of the standard human model, such as women, the elderly, and children. This problem affects different contexts and can be observed especially in the area of Information and Communication Technologies (ICTs), which are often designed without taking into account the peculiarities that distinguish these categories of users. Referring to the categories affected by the digital divide, the article reflects on the need to promote specific methodologies, such as Universal Design and User-centered Design, so that attitudinal and psychological issues related to different categories of users are considered.

Keywords. User Experience, User-centered Design, Universal Design, Digital Divide

1. Introduction

"For all" has become an intrinsic attribute of a way of designing in which the universality of the individual is placed at the centre. Although many currents have developed over time and in different territorial contexts, recent research [1] tends to equate the concepts of Universal Design (UD), Inclusive Design (ID), Accessible Design (AD), and Design for All (DfA). They are not synonymous, since the solutions they tend towards have different natures (for example, UD: trying to satisfy as many people as possible with a single design solution vs. ID: creating designs that do not exclude or marginalise anyone, possibly providing more than one solution). But looking at the deeper significance, these approaches to design are driven by the same intention:

> *The design for human diversity, social inclusion and equality* [2] *focuses on satisfying a wide range of users, including children, older adults, people with disabilities, people of atypical sizes or shapes, people who are ill or injured, and people who find themselves in difficulty due to circumstances* [3].

This goes with the ideal of an inclusive society in which no person should be excluded from the full enjoyment of human rights and fundamental freedoms, as cited by the U.N. Convention on the Rights of Persons with Disabilities [4].

[1] Corresponding Author: Barbara Chiarelli, barbara.chiarelli@dia.units.it

People with disabilities are a category often excluded from the enjoyment of many aspects of social life, and this can be traced back to a way of designing that tends to place a model of the normed individual [5] at its centre. An approach which not only excludes people with disabilities, but also other categories that diverge from the physical and cognitive characteristics of the standard human model, such as women, the elderly, and children. This problem affects different contexts and can be observed especially in the area of Information and Communication Technologies (ICTs), which are often designed without taking into account the peculiarities that distinguish these categories of users.

This article questions the extent to which the “for all” approach is considered in a world where ICTs and digital technologies pervade every aspect of our lives.

2. The Standard Man, a Model No Longer Valid

From the famous references of Vitruvius' man and Le Corbusier's Modulor to the study of anthropometrics, designers are trained to design for a mythical "average" group of people, but this group does not actually exist [3]. Science, medicine, and engineering often take the young, white, able-bodied 70kg male as the norm [6], yet every individual is unique and as a group, the human species is quite diverse.

As far as disability is concerned, the reference that most supports this thesis can be traced back to the *International Classification of Functioning, Disability and Health* (ICF), which for the first time shifted the focus from a reductive view of disability as a physical or mental impairment to the needs of the person's environment, contributing to the definition of disability provided by the *World Health Organization* (WHO) as a part of being human that almost everyone will experience temporarily or permanently at some point in their life [7].

In addition, the constant ageing of the population contributes to the debate on how mistaken it is to focus on a design centred on the average man: the proportion of elderly people is set to double from 11% to 22% of the total population by 2050. In the next five years, for the first time in the history of mankind, the number of individuals aged 65 and over will exceed that of children under five [8].

Another huge distortion is related to the fact that from a gender perspective, the number of women in the world is almost equal to that of men and is set to surpass it [9]. Nevertheless, the model of the average man continues to be held as a reference, bringing to light difficulties that women experience in handling some products or in dealing with some urban spaces or buildings [10]. An investigation by The Guardian in 2019 [11] listed a number of products designed for standard men that have been shown to be ineffective where used or worn by other categories of users, especially by women. “Designers may believe they make products for everyone, but in reality, they make them mostly for men" the article reports.

This general lack of consideration of categories other than 'standard’ for the design of certain products opens reflections to another aspect already investigated in the 1970s by Papanek [12], the so-called reparative design, a design which aims to repair the damage caused by an excluding design. The reconnection of design from a consumer economy to an ecology of needs [13] is what today's society requires, especially in view of the increased awareness of the complexity of human beings and the need to respect diversity.

3. Bringing the Real Person Back to the Centre.

From One-size-fits-all leaves most of us out. The answer to this shortcoming can be found in a change of perspective that sees the emergence of specific methods that put the human-being back at the centre. Below is a summary of the methods most used and for which guidance for their implementation is available in the literature.

Human Factors and Ergonomics (HFE). The terms 'ergonomics' and 'human factors' are often used interchangeably or as a unit (HFE) [14]. The International Ergonomics Association (IEA), dedicated to research and application of HFE, was founded in 1961. HFE participatory design principles and methodologies apply across the design of tasks, jobs, products, environments, industries and types of work. HFE encompasses not only physical safety and health but also the cognitive and psycho-social aspects of living and working. HFE reflects a holistic perspective toward the design of products and systems, considering the interrelatedness of human, technical and environmental components, and the potential effects of system design changes on all parts of the system.

User-Centred Design (UCD). UCD focuses on the active involvement of the user in the design process, trying to obtain a clear understanding of the exact task requirements, involving an iterative design and evaluation process, and utilising a multi-disciplinary approach [15]. The key focus of UCD is that users play a critical role in the design of easy-to-use products throughout the entire development process.

According to the ISO 13407 standard on human-centred design [16] there are five essential processes which should be undertaken to incorporate usability requirements into the product development process.

User Experience Design (UX). UX is a broader conceptual design discipline looking at the entire process even before the user interacts with the system or product. In UX, the focus is more on the user's perception of how the product or system interacts. With the proliferation of workplace computers in the early 1990s, user experience started to become a positive insight for designers. Donald Norman, a professor and researcher in design, usability, and cognitive science, coined the term "user experience" and brought it to a wider audience [17] When the UX study is lacking, we speak of UX debt.

Universal Design (UD). The concept of Universal Design was introduced by combining and drawing from developments in all of the above fields. UD has its roots in architecture, engineering and environmental design and its principles espouse the "design of products, services and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design". Following its seven principles developed in 1997 by a working group of architects, product designers, engineers and environmental design researchers, led by the late Ronald Mace at North Carolina State University, designers have a guidance to better integrate features at the outset that meet the needs of as many users as possible [18].

As stated in extensive research dating back to 2010, to deal with those disciplines and to understand why there are still obstacles to the implantation of this approach in the real world, it is necessary to focus on the term 'usability', a widely recognised critical factor for the success of a system or product. Although the evaluation of usability requirements is part of the HCD process, no precise definition of the concept of usability exists that is widely accepted and applied in practice [19] There are several reasons why it has been so difficult to define this term: usability is not a property of a person or thing, and there is no thermometer-like instrument that can provide an absolute measurement

of the usability of a product [20][21]. Usability is an emergent property that depends on interactions among users, products, tasks, and environments. As expressed by Chapanis [22], although it is not easy to measure "ease of use," it is easy to measure difficulties that people have in using something; difficulties and errors can be identified, classified, counted, and measured. Defining the usability requirements of a product is a rather expensive phase: it is necessary to define effectiveness, namely the degree of success with which users achieve their task goals; efficiency, namely the time it takes to complete specific tasks; satisfaction, namely user comfort and acceptability. Other more detailed usability issues provide more specific design objectives, like understandability (whether users understand what the product or system can do); learnability (the training, time and effort required to learn to use the product or system); operability or supportiveness (supporting the users throughout the interaction and helping them to overcome problems that may occur); flexibility (enabling tasks to be carried out in different ways to suit different situations); attractiveness (encouraging user interest and motivating them to explore the product or system).

The above are a series of suggested steps, which are, however, hardly ever applied.

4. Digital Divide: the Categories Most Ignored and Excluded

In a world pervaded by technology, the usability of products and the experience of the users who use them are increasingly considered by ICT development companies. This is also in view of consumer research and surveys, which show, for example, that the usability of products weighs more heavily than the services offered (33% vs. 12%) [23]. However, even in this specific field, we are facing a problem related to the user being considered, which again tends to be the average man. This exclusion may be linked to the widespread term 'digital divide', which refers to that part of civil society excluded from 'digital knowledge'. Some studies identify the elderly, people with low levels of education, and manual workers as those individuals who, having lower access to the web, are more likely to be unrepresented [24][25]. In addition to the ones mentioned above, other research includes among the groups most threatened by digital exclusion, women who are not employed or in special circumstances ("digital gender divide"), immigrants ("digital cultural-linguistic divide"), people in prison, and, generally those who are unable to use IT tools [26]. When analysing the phenomenon of the digital divide, a distinction must be made between the cognitive dimension, which assumes an individual's lack of minimal IT knowledge, and the infrastructural dimension, which focuses on deficiencies in the availability of the technologies and tools necessary to enable effective navigation. Although these are two clearly distinguishable areas, skills and infrastructure should be seen as complementary and inextricable: the former serves little purpose in the absence of the latter, since digital skills cannot grow without adequate infrastructure endowments. The digitally excluded do not correspond to the consumer-type and are therefore also excluded from usability testing processes: a vicious circle. The need to involve all those who will be affected by ICT developments and potential pitfalls is an issue shared by several expert bodies and research studies[2]. Once

[2] The following are cited as examples: EthiComp (The international computer ethics conference series), IFIP (The International Federation for Information Processing), CEPE (The Computer Ethics, Philosophical Enquiry sponsored by INSEIT the International Society for Ethics and Information Technology) IACAP (The International Association for Computing and Philosophy) communities.

they are identified and characterised, their needs must be represented and addressed. If possible, stakeholders should be invited to work or at least have the opportunity to give some substantial feedback before development can be incorporated into the mainstream, particularly when it regards the most important areas, such as government, public safety, access to labour market, education and healthcare. Nevertheless, the constant involvement of stakeholders and future users of products is not always incorporated into new ICT design processes. Several researchers are discussing this, highlighting how ineffective stakeholders' engagement (inadequate addressing) or lack of relevant support and stakeholder input could be inconvenient and problematic [27].

4.1. Gerontechnology and technological fear

This aspect is addressed, for instance, by a recently new discipline called gerontechnology, which is an interdisciplinary field which combines gerontology and technology. It can be described as "the study of technology and aging for ensuring good health, full social participation, and independent living throughout the entire life span" [5, 6]. Gerontechnology is working on understanding the reasons why older people are reluctant to adopt new technologies, such as the Internet, given their potential to improve their quality of life. There is growing attention to gerontechnolgy due to the ageing population in most industrialised countries, and the higher strain this will put on healthcare facilities [28]. Designing technology for older people is quite a complex task. Older people can experience a multitude of age-related issues, and these must be considered when creating the interfaces that the elderly will interact with. In addition, their lived experiences, and ways they wish technology to fit into their lives, must also be taken into consideration [29].

Experts say that the best way to create technology that the elderly will find useful is to develop it from a 'user demand' perspective, rather than from a technology advancement perspective [30]. Guides on how to design for the elderly are easily accessible for designers and should be followed when implementing systems for this age group [31]. However, it is the 'fit' between the system's demand and the user's capability (demand/capability fit) that determines the user's attitude and acceptance of a system [32]. A good performance does not guarantee that the technology will be accepted, adopted, and used by the intended user group if the system is not created to suit the users and how they live their lives.

One characteristic aspect to be considered among the elderly is also the so-called technological fear/anxiety [33]. A different way to conceptualise this anxiety is to term it as confidence or self-efficacy. Prior studies have shown that self-efficacy, or a person's self-belief that they can use a technology, is critical to using an ICT, while feelings of mistrust and worries about privacy and information security decrease use [34][35]. ICT self-efficacy is a potentially important factor in efforts to close the digital divide that separates experienced ICT users from novices [36], not only regarding the elderly but also considering the other digitally excluded categories.

4.2. Future effects to worry about

In addition to causing current exclusionary situations, improper ICT design may lead to future risks, especially for certain categories of users, in view of different age groups,

maturity, technology comprehension, ability and propensity to connect with the World Wide Web.

One of the biggest areas of concern is the effects of digital technology on children. Members of the Alpha generation are part of the larger category of digital natives[3], those who grew up with increased confidence in the technology that they were encircled and engulfed by. Among those who speak of a new evolution of the human race (Homo sapiens digital) [37], and those who state that digital natives do not actually possess any digital competence but are simply consumers unaware of the 'world' behind the functioning of the technological tools they use all the time, what is worrying is the fact that children's brains are still developing and may be more sensitive to the effects of technology and its overuse than adult brains. A 2018 review of various studies noted the possible adverse effects of children overusing technologies, including lack of attention, delays in language development, delays in social and emotional development, risk of depression, poor sleep quality, aggressive behaviours, addiction to technologies [38]. The research also noted the importance of teaching children to interact with these technologies in healthful ways: families as well as the education system are called upon to supervise and accompany the learning process and the interaction that children establish with technologies. However, it can happen that it is families and teachers who first have difficulties in using ICTs, and so children are left alone. Still Prensky states that education is the biggest problem facing the digital world, as digital immigrant teachers, who speak an outdated language (that of the pre-digital era), are struggling to teach a population that speaks an entirely new language. Over the past 20 years, technology training for teachers has been at the forefront of policy [39]. However, immigrants suffer from complications in teaching natives how to understand an environment that is 'native' to them and foreign to immigrants.

We are wandering into unknown territory as generations past have never had this same kind of constant technological immersion. Better research is needed in this area.

4.3. European digital policies

By 2030, every person should have safe and affordable access to the Internet, including meaningful use of digitally enabled services in line with the Sustainable Development Goals. [40]

To follow the two macro-themes analysed in this chapter: how to prevent technologies from excluding? How to lower the digital divide?

Regarding accessibility, the first significant step taken to ensure web content accessibility can be referred to the Web Accessibility Initiative (WAI) by the World Wide Web Consortium (W3C), an international non-governmental organisation which has published several updated versions of the Guidelines for Web Content Accessibility. There has been criticism of the W3C process, claiming that they do not put the user sufficiently at the centre of the process. Looking at the European context, mention must be made of the European Telecommunications Standards Institute (ETSI) initiative in using both UD and UCD as primary concepts for the development of guidelines for ICT products and services [41], and the Web Accessibility Directive [42] which has been in force since 2016 and provides people with disabilities with better access to websites and

[3] 'Alpha generatiion' i.e. those born after 2012. 'Digital natives' belong to the generation that grew up in the 'digital age', which mainly concerns individuals born after 1980.

public service mobile apps. The latest and most significant initiative by the European Union can be traced back to 2020, in the midst of the Ovid pandemic, namely the ICT accessibility assessment for the Europe region which has reinforced the importance of ICT accessibility [43].

Regarding the digital divide, for several years, the European Union has been systematically working to ensure that all its citizens can acquire the digital competences necessary to be citizens of the 21st century. DigComp, the Reference Framework for the Digital Competence of Citizens, developed by the European Commission, fits into this context, identifying the areas of digital competence needed to use digital technologies in a critical manner. In its most up-to-date version, the DigComp framework is divided into 5 dimensions. Starting with 5 competence areas, the competences and titles of each area are described and the levels of mastery of each competence are specified. This then lists the applicable knowledge, skills and attitudes for each area, finally adding examples of use for different purposes [44].

For both challenges, the path to be taken is neither simple nor short, requiring the joint intervention of public and private institutions, of training organisations as well as companies to provide all citizens with equal opportunities to increase their digital skills, while also making use of lifelong learning methods and tools.

5. A Field of Research that Has Just Begun.

Critical issues such as defining the term 'usability,' or iteratively repeating UX tests during design processes are elements that generally do not allow broad application of disciplines focused on human-beings and their complex characteristics. Over the years, many theories have developed around the UD design philosophy, and several countries have taken up the challenge of putting its principles into practice and testing its effectiveness. Despite this, as stated by a study investigating whether UD can be described as a critical theory [45], to date a lot of the information is fragmentary and therefore its theory cannot be defined as adequately developed. The second edition of the Universal Design Handbook [46] stated that “Universal design concepts hold the promise not only to impact the design disciplines but also to influence local and international policies and attitudes”. This is starting to occur thanks to the introduction of the term "Universal design" and the reference to its principles in various regulatory instruments in several countries. However, the transition from the repeal of a law to its implementation is not immediate, and the effects will only be measured in the coming years.

The rapid growth and proliferation of ICTs in today's society raises several issues related to the degree of acceptance of new tools or services, leaving the so-called digitally excluded behind. So-called techno-optimists tend to celebrate ICT for the impact they have on society, considering above all their incredible exponential growth, from which they derive ever improved performance at ever lower prices, thus in fact making them more accessible to more people. Economic accessibility is certainly important, but not sufficient to ensure that a certain technology is truly accessible - or easy usable - to all [47].

To make technologies usable for all and to lower the digital divide, disciplines such as HCD, UX, UD and gerontechnology become essential, also considering an integration of them [48].

Finally, the introduction of new ICTs must be handled with great care and respect for the commitment required of citizens who are unfamiliar with the technology; the lack of communication, notice, and phasing is at risk of creating significant disruptions that further alienate those already unwilling to use new technologies.

References

[1] Persson H., Ahman H., Yngling A.A., Gulliksen J., *Universal design, inclusive design, accessible design, design for all: different concepts—one goal? On the concept of accessibility - historical, methodological and philosophical aspects*, Springer; 2014. DOI 10.1007/s10209-014-0358-z

[2] EIDD Stockholm Declaration, 2004. Available on https://dfaeurope.eu/what-is-dfa/dfa-documents/the-eidd-stockholm-declaration-2004/.

[3] Story M. F., Mueller J. L., Mace R. L., *The Universal Design File. Designing for People of All Ages and Abilities,* NC State University, The Center for Universal Design, 1998.

[4] United Nations. Convention on the Rights of Persons with Disabilities; 2006. Available from: https://social.desa.un.org/issues/disability/crpd/convention-on-the-rights-of-persons-with-disabilities-crpd.

[5] Holmes K., *Mismatch. How Inclusion Shapes Design*. The MIT Press, 2020

[6] Rethinking Standards and Reference Models, Gendered Innovations in Science, Health & Medicine, Engineering, and Environment available on http://genderedinnovations.stanford.edu/methods/standards.html

[7] World Health Organization. International Classification of functioning, disability and health: ICF. Geneva: World Health Organization; 2001; 2014) Available from: https://www.who.int/classifications/international-classification-of-functioning-disability-and-health.

[8] Galluzzo L., Gandin C., Ghirini S., Scafato E., L'invecchiamento della popolazione: opportunità o sfida? Istituto Superiore di Sanità, Roma 2019.

[9] Carey I. W., Hackett C., *Global population skews male, but UN projects parity between sexes by 2050,* Pew Research Center, August 2022. Available on https://www.pewresearch.org/fact-tank/2022/08/31/global-population-skews-male-but-un-projects-parity-between-sexes-by-2050/

[10] Perez C. C., Invisible Women: Exposing Data Bias in a World Designed for Men, Vintage Publishing, 2019.

[11] Perez C. C., The deadly truth about a world built for men – from stab vests to car crashes, The Guardian, 2019. Available on https://www.theguardian.com/lifeandstyle/2019/feb/23/truth-world-built-for-men-car-crashes

[12] Papanek V., *Design for the real world. Human Ecology and Social Change*. Academy Chicago Pub, Second Edition, 2005

[13] Quinz E., Introduction *Design per il mondo reale di Viktor Papanek*, Quodlibet, 2022.

[14] Definition and application of 'ergonomics', International Ergonomics Association https://iea.cc/about/what-is-ergonomics/.

[15] K. Vredenburg, S. Isensee, C. Righi, *User-centered design. An Integrated Approach*, Software Quality Institute Series, 2002

[16] ISO 13407:1999, Human-centred design processes for interactive systems

[17] Norman D., Nielsen J., The Definition of User Experience (UX) Available on https://www.nngroup.com/articles/definition-user-experience/

[18] The Center for Universal Design – Principles, NC State University. Available on http://www.design.ncsu.edu/cud/univ_design/princ_overview.htm

[19] Alonso D., Vazquez-Garcia A., Mosqueira-Rey E., Moret-Bonillo V., *Usability: A Critical Analysis and a Taxonomy*, International Journal of Human-Computer Interaction, Volume 26, Taylor & Francis Online, 2009. https://doi.org/10.1080/10447310903025552

[20] Dumas, J. S. (2003). User-based evaluations. In J. A. Jacko and A. Sears (Eds.), *The Human-Computer Interaction Handbook* (pp. 1093-1117). Mahwah, NJ: Lawrence Erlbaum.

[21] Lewis J. R., Usability Testing, IBM Software Group, 2006

[22] Chapanis, A. (1981). *Evaluating ease of use*. Unpublished manuscript prepared for IBM, available from J. R. Lewis *Usability Testing*, IBM Software Group, 2006

[23] Meduri A., Rapporto aziende italiane e UX: gli ultimi dati e i benefici rilevati, UNGUESS 2021. Available on https://blog.unguess.io/it/rapporto-aziende-italiane-e-ux-tra-dati-e-benefici-rilevati
[24] Manzetti, V. (2018). *Il "dibattito pubblico" nel nuovo codice dei contratti*. Federalismi.It. www.aipda.it
[25] Van Dijk J., *The Digital Divide*, Wiley, 2019
[26] Alù A., & Longo A. (2020). Cos'è il digital divide, nuova discriminazione sociale (e culturale). https://www.agendadigitale.eu/cultura-digitale/il-digital-divide-culturale-e-una-nuova-discriminazione-sociale/
[27] Plotka M. A*., ICT with or against society – what can happen when (interest of) some key stakeholders are omitted?* International workshop on Innovation in Information and Communication Science and Technology, IICST 2014, Elsevier 2014
[28] Bjering H., Curry J., Maeder A., *Gerontechnology: The importance of user participation in ICT development for older adults*. Investing in E-Health: People, Knowledge and Technology for a Healthy Future, H. Grain et al. (eds), 2014
[29] Charness N., Boot W. R., *Aging and Information Technology Use. Potential and Barriers*, Current directions in psychological science, Florida State University, Volume 18 Number 5, 2009
[30] Ghorayeb A., Comber R., Gooberman-Hill R., *Older adults' perspectives of smart home technology: Are we developing the technology that older people want?* International Journal of Human-Computer Studies, volume 147, 2021
[31] Farage M., Miller K. W., Ajayi F., Hutchins D., *Design Principles to Accommodate Older Adults*, Global J Health Sci. 2012, doi: 10.5539/gjhs.v4n2p2
[32] Schlomann A., Even C., Hammann T., *How Older Adults Learn ICT – Guided and Self-Regulated Learning in Individuals With and Without Disabilities*, Frontiers in Computer Science, Volume 3, 2022
[33] Nimrod G., *Technostress: measuring a new threat to well-being in later life*, Aging Ment. Health, 22, 2018
[34] Golant S.M., *A theoretical model to explain the smart technology adoption behaviors of elder consumers (Elderadopt*), Journal of Aging Studies, 42, 2017
[35] Yusif & Hafeez-Baig, *Older people, assistive technologies, and the barriers to adoption: a systematic review*, International Journal of Medical Informatics, 94. 2016. DOI:10.1016/j.ijmedinf.2016.07.004
[36] Eastin M. S., LaRose R., Internet Self-Efficacy and the Psychology of the Digital Divide, Journal of Computer-mediated communication, Wiley Online Library, 2006. https://doi.org/10.1111/j.1083-6101.2000.tb00110.x
[37] Prensky M., *Digital Wisdom and Homo Sapiens Digital*, in Deconstructing Digital Natives, edited by Thomas M., Routledge, 2011
[38] Gottschalk F., *Impacts of Technology use on children: exploring literature on the brain, cognition and well-being*, OECD Education Working Paper n.195, 2019
[39] Haleem A., Javaid M., Qadri M. A., Suman R., *Understanding the role of digital technologies in education: A review*, Sustainable Operations and Computers, Volume 3, 2022
[40] United Nations Lead Agency, Sustainable Development Goals, Department of Economic and Social AffairsSustainable Development. Available on https://sdgs.un.org/goals
[41] ETSI TR 102 612 V1.1.1, Human Factors (HF); European accessibility requirements for public procurement of products and services in the ICT domain (European Commission Mandate M 376, Phase 1)
[42] Directive (EU) 2016/2102 of the European Parliament and of the Council of 26 October 2016 on the accessibility of the websites and mobile applications of public sector bodies
[43] International Telecommunication Union – ITU report, *ICT accessibility assessment for the Europe region*, 2021 ITU Publications Europe, ISBN 978-92-61-33371-3 (Paper version)
[44] DigiComp, available on https://joint-research-centre.ec.europa.eu/digcomp_en
[45] N. D'souza, *Is Universal Design a Critical Theory?* in Designing a More Inclusive World, edited by Keates S., Clarkson J., Langdon P., Robinson P., Springer 2001
[46] Preiser W., Smith K. H., Universal Design Handbook, 2nd Edition, Mc Graw Hill ed., 2020
[47] Rotman D., Una visione super ottimistica del futuro, MIT Technology Review, 2021. Available on https://www.technologyreview.it/una-visione-super-ottimistica-del-futuro/
[48] Astbrink G., Beekhuyzen J., *The Synergies between Universal Design and User-Centred Design*, 10th International Conference on Human-Computer Interaction, 2003