Towards the Use of Social Computing for Social Inclusion: An Overview of the Literature

Vaso Constantinou[1(✉)], Panagiotis Kosmas[1(✉)], Antigoni Parmaxi[1(✉)], Andri Ioannou[1(✉)], Iosif Klironomos[2(✉)], Margherita Antona[2(✉)], Constantine Stephanidis[2,3(✉)], and Panayiotis Zaphiris[1(✉)]

[1] Department of Multimedia and Graphic Arts, Cyprus University of Technology, 30 Archiebisopou Kyprianou Street, 3036 Limassol, Cyprus
va.constantinou@edu.cut.ac.cy, {panayiotis.kosmas, antigoni.parmaxi, andri.i.ioannou, panayiotis.zaphiris}@cut.ac.cy

[2] Institute of Computer Science, Foundation for Research and Technology – Hellas (FORTH), N. Plastira 100, Vassilika Vouton, 70013 Heraklion, Crete, Greece
{iosif, antona, cs}@ics.forth.gr

[3] Department of Computer Science, University of Crete, Heraklion, Greece

Abstract. Social computing constitutes a new computing paradigm in an interdisciplinary research community which will strongly influence informatics systems and applications in the years to come. Indeed, from a social perspective, considerable interest in examining the influences of Social Computing (SC) for Social Inclusion (SI) arises from researchers and designers. This paper addresses the existing literature on the use of SC for SI. Previous studies have been reviewed to report affordances of SC design in five different areas: (a) for the elderly, (b) for people with disabilities, (c) for gender studies, (d) for societal change, and (e) for the preservation of cultural heritage. Results from the literature overview provide some examples of applications of new technologies that were designed to reduce social exclusion. Our review further shows that the use of different tools used by different groups of people has a positive impact for those people who are either socially included or excluded from their use. However, further research is needed in these five directions, which are analysed in this document and direct research into the gaps identified.

Keywords: Social computing · Social inclusion · Social exclusion
Assistive technologies · Disabilities · Elderly · Gender inequalities
Educational technology · Peace

1 Introduction

With the advance of Computing, Informatics and Web technologies, the accessibility of computing resources and mobile devices, the massive use of media, and the world's changes, social computing applications have evolved quickly over the past decade.

P. Zaphiris and A. Ioannou (Eds.): LCT 2018, LNCS 10924, pp. 376–387, 2018.
https://doi.org/10.1007/978-3-319-91743-6_28

Nowadays, the general aim of Social Computing (SC) has expanded greatly influencing many aspects of computing practice and research. Wang et al. (2007) define SC as a "computational facilitation of social studies and human social dynamics as well as the design and use of ICT technologies that consider social context" (p. 79) [14]. Social Exclusion (SE) is further characterized as a broad, complex and longstanding social problem which exists and has existed regardless the progress of ICTs. Levitas et al. (2007) offered the following definition: "Social exclusion is a complex and multi-dimensional process. It involves the lack or denial of resources, rights, goods and services, and the inability to participate in the normal relationships and activities, available to the majority of people in society, whether in economic, social, cultural, or political arenas. It affects both the quality of life of individuals and the equity and cohesion of society as a whole" (p. 9) [28].

Additionally, the idea of SE has the same characteristics with the idea of Social Inclusion (SI). According to Hayes, Gray, and Edwards (2008), the concepts of SE and SI are closely related, and it is difficult to separate them as two different theories or frameworks [17]. SE cannot be discussed without also discussing SI. Throughout this study, we report and discuss social exclusion and inclusion as two ends of a single dimension.

In recent days, besides the negative examples of technologies that endorse SE, there are a lot of different positive examples of applications of new technologies that were designed to reduce SE. From this perspective, our overarching aim is to gather the recent most essential SC initiatives regarding SE/SI. In particular, in this manuscript, we discuss the use of different technologies used by different groups of people who are either socially included or excluded from their use. Five main research directions, regarding the use of SC, were generated:

(a) Design in SC for the elderly,
(b) Design in SC for people with disabilities,
(c) The use of SC to fill the gender gap in the computer science field,
(d) The use of SC for societal change, and
(e) The use of SC to preserve cultural heritage.

In the sections below, we first state the related work that has been implemented in the field of SC for SE/SI in the abovementioned five different areas of interest. Subsequently, the closing remarks and future implications in the field are described.

2 SC for SE/SI

2.1 SC Research and Design for the Elderly

It is a fact that the elderly may face different types of health issues (e.g. difficulty in breathing), mobility problems (e.g. they cannot walk) and diseases, chronic or not (e.g. cancer, heart problems, weak cognitive functioning, etc.). In our days, the focus on Ambient Assisted Living (AAL) is important and obvious [44]. Pieper et al. (2011, p. 19) stated that the roots of AAL are in traditional Assistive Technologies for people with disabilities, Design for All approaches to accessibility, usability and ultimately

acceptability of interactive technologies, as well as in the emerging computing paradigm of Ambient Intelligence, which offers new possibility of providing intelligent, unobtrusive and ubiquitous forms of assistance to older people and to citizens in general. AAL can be best understood as age-based assistance systems to address a healthy and independent life [42]. Furthermore, AAL is concerned with people in their living environment; offering different types of user-friendly equipment in the home and outside, considering at the same time that many older people have mobility, vision, hearing problems or dexterity [42]. The development of AAL products and services should be focused on enhancing the quality of life, reducing at the same time the health costs [55]. AAL systems can be developed with the combination of ubiquitous computing and context awareness. For example, the activity of elderly at home could be tracked through the sensors placed in their house [6, 55]. They could also reduce the stress of the elderly and their families, creating at the same time the feeling of safety as they will stop thinking that if something terrible happens to them, nobody will notice. Some examples of different AAL products are mobile wearable sensors, home sensors, smart fabrics, health applications and assistive robots [45]. One practical example to demonstrate the usefulness of AAL products and services is the creation of a robotic platform and a smart environment (connected to the robot) that provides healthcare management services to the elderly with the goal to improve their independent living [5].

It is also necessary for the elderly to be able to find correct information about a health problem that they may face on the Internet. Therefore, the need for reliable healthcare websites, blogs and online communities is important, as is the need for web-based platforms that are built with the consideration of Universal design and access. Besides the web platforms for supporting the elderly about their health issues, it is important to allow these people to be socially involved in the world of social networks and give them the opportunity to meet online communication technologies such as Facebook. Norval et al. (2014) investigated possible measures to make Social Networking Sites (SNS) more inclusive for the elderly. The study explored the positive and negative aspects of SNS usage, and provided recommendations for developers to avoid common barriers that make older adults avoid using SNS [35].

Social networks can also be used to maintain and enhance the cognitive function of elderly persons. Various studies have indicated that the elderly who have a better cognitive function are those who are socially active and cognitively engaged, in contrast to the elderly who are isolated and disengaged [34]. Myhre et al. (2016) examined the effect of learning through the use of the social network Facebook, on maintaining or enhancing the cognitive function of the elderly. Moreover, many researchers have carried out extensive research in HCI issues related to the analysis, the design and the evaluation of interactive systems for the elderly [34]. Zaphiris et al. (2008) focused on inclusive design for web navigation and online support communities for the elderly [60]. With regards to the online support communities, researchers emphasized on the importance of message sequences in the sustainability of an online support community for the elderly [41], the social network patterns within an empathic online community for older people [38], the elderly perceptions and experiences of online social support [40], the existence of social roles for the elderly in an online support community [39], and the challenges and opportunities of the elderly on the web [59]. Besides the online support communities for the elderly, Kurniawan and Zaphiris (2003) described an

efficient information architecture for web-based health information for the elderly. Further, researchers focused on the computer-based learning for senior citizens by examining the opportunities and challenges within this field [26]. Moreover, Siriaraya et al. (2013) examined the supporting social interaction for the older users in game-like 3D virtual worlds [53]. Last, Lanitis and Tsapatsoulis (2011) have focused on the quantitative evaluation of the effect of ageing on biometric templates [27].

2.2 Design and Inclusion of People with Disabilities

In the last few years, many researchers in the HCI field have tried to examine different technologies for learning goals and social inclusion for students with special needs. A number of studies in SC and Educational Technology have been conducted to support both children and adults with different health problems and impairments. Many technologies, under the field of game-based learning, such as motion-based interactive games, appear to enhance the academic, cognitive and motor skills of children with disabilities [24, 25]. The study of Constantinou et al. (2016), examined the personal tour of cultural heritage for deaf museum visitors through a mobile application. The findings showed high levels of user satisfaction and usefulness of the application in allowing deaf museum visitors to have a fun tour, using their mobile devices as the only means of support [11]. Furthermore, in another study, a system was developed for hearing impaired users, for immediate access to emergency services via a mobile application [9]. Moreover, researchers investigated the use of virtual reality to train designers to develop friendly interfaces for achromatic vision patients [10].

In the study conducted by Henderson et al. (2013) with students with disabilities ranging from learning difficulties, social/communication impairment, mental health conditions to physically impaired students or students with mobility issues, blind or partially sighted, and deaf or hearing-impaired students. The study focused on the above students and the use of technology to improve their experience in learning and studying, making use of different applications on iPads (e.g. iBooks, MindNode, Speak it, AudioNote, PDfReader, Stanzain) in a higher education context [18]. Another study [51] focused on the inclusion of children and youths with disabilities regarding advancing their computer skills and using ICT for social leisure. Results showed that participants improved considerably in most of their computer skills. Access to ICT increased the rate of participants' engagement in a variety of activities involving ICT use. Additionally, the study showed that the computer serves in various ways, mainly in their social, academic, and leisure activities. Moreover, the younger participants focused mostly on leisure activities and games where the older ones used the computer for improving academic achievements, retrieving information, shopping, dealing with authorities, and connecting with friends.

Along the same lines, many studies have focused on design for different groups of people with disabilities, ranging from autistic, people with dementia to people with dyslexia, students with special needs, hearing impairment and visual impairment. In the recent study of Kosmas et al. (2017), the use of motion-based technology in classroom facilitates children with disabilities motor skills and emotional engagement [24]. Also, Ioannou et al. (2015) studied the effect of participation of the humanoid robot NAO in therapeutic conferences in children with autism [21]. Also, Polycarpou et al. (2016)

investigated the potential of using the humanoid robot, NAO, as a playful tool for assessing the listening and speaking skills of seven hearing impaired students who use cochlear implant(s) and sign language as their main communication modality [43].

Furthermore, Loizides et al. (2015) described the project entitled "Minority Language Applications" in which with the use of interactive multimedia, they studied the application's effect in children with autism in a multilingual environment [30]. In regard to studies related to dementia, Savitch and Zaphiris (2005) investigated the accessibility of web-based information for people with dementia [48], and explored the navigation design needs when developing a website for people with dementia [49]. Further, Savitch et al. (2006) explored the participation of people with dementia in the development of a web-forum [50]. Moreover, Al-Wabil et al. (2008) examined the visual attention with the use of eye tracking in navigation structures on six different websites for people with and without dyslexia. In the particular study, the authors provided information on how to apply eye tracking to evaluate the usability [2]. Based on people with hearing impairment, Yeratziotis and Zaphiris (2015) described the development of research in HCI, with the focus on accessibility for the deaf users [58]. Finally, Michailidou et al. (2012) carried out a web accessibility evaluation based on the websites of different Cypriot universities, and they have found that all the websites have accessibility issues which make it hard for the students with disabilities to use [32].

2.3 SC Research for Filling the Gender Gap in the Computer Science Field

Another group of people who are discriminated from an important field of study are women. Many studies [13, 33, 47] indicated that women are under-represented in the Computer Science (CS) education. Further, different research studies have displayed the unbalanced participation between male and female students in CS degrees [1, 15, 31].

Nowadays, there is an increased research interest in exploring why girls or women do not enter CS education and why they do not advance or remain in the field [57]. Researchers also explore the view of female and male students regarding computer culture [54]. In addition, few studies have been conducted with the focus on the university level to explore gender differences within an introductory module in programming [47]. Different studies have stated that male university students can program more easily, and they may also have higher intention to program than female students [54, 57]. Male students and in general the male IT professionals and programmers are assumed to be more competent in programming and the IT sector. This increases the "fear" of women to enter this field and study CS or other IT degrees.

In general, female students in society are not supported to study CS/IT in the same level as male individuals [33], and a negative message that women are not capable enough to enter the field is promoted within our society. Paloheimo and Stenman (2006, p. 14) explained that "the society does not actually prevent girls from accessing computers, but it has failed to introduce computer science as a viable option for them" and therefore it is promoted that the CS field is a men's field [36]. Although besides the men's stereotype in the CS/IT fields there are women who have showed that female can also be equally capable and successful in the fields of CS/IT, such as Ginni Rometty, the president and CEO of IBM [19] and Marissa Mayer, president and CEO of Yahoo [23].

According to Varma (2010), many students believe that the two main reasons that explain why fewer women than men select to study CS/IT are the gendered socialisation and technical anxiety [56]. Vitores and Gil-Juárez (2015) specified that during the middle school years the terms "exclusion" and "disaffection" about the CS field are promoted and by high school the gender differences in CS are very well established, and therefore girls have limited interest in CS or IT [57].

In this direction, some recent research provides an active engagement in the area of enhancing gender equality, mainly through the implementation of the Womenpower platform. WomenPower is an online platform that looks at online mentoring for allowing women to fight discrimination and rise to the upper ranks of the corporate ladder. It has the intention to link women mentors and mentees from different fields such as technology, academia, business and healthcare [37]. Finally, it is important to consider CS as important as math and physics, and therefore it would be good if nations were including in their educational curriculum, even from primary education the CS concept. In this way, female students will be involved in CS from a very young age, and therefore they would not follow a negative stereotype. The UK (since 2014) has imposed CS in primary school through their STEM (Science, Technology, Engineering, Mathematics) education which indicates remarkable progress [23]. External non-profit international organisations such as Robogals aims to increase female participation (primary and secondary school) in Technology, Engineering and Science through the use of programmable robots which it is also an essential step towards the support of female students in the CS field [46].

2.4 SC for Societal Change

How could social networks help in reaching social change? How could we take advantage and use new technologies such as computer-based simulations or serious games, in the direction of conflict management and peace promotion? Carmichael and Norvang (2014) carried out a pedagogical pilot study supported by the annual Nobel Peace Prize Forum (NPPF) in which students using technology and social media are brought together (SI-connecting people) to engage learning practices through a global dialogue on important issues [7].

Several studies explored the use of different technologies to reduce conflicts and promote peace between different people from various nations. Cuhadar and Kampf (2014) evaluated the use of the game "PeaceMaker" as a pedagogical tool in teaching about conflict and its resolution. Participants included 39 American, 38 Turkish, 50 Israeli-Jewish, and 20 Israeli-Palestinian students. All students played the game that simulates the Israeli-Palestinian conflict in both Israeli and Palestinian decision-maker roles. The results showed that after playing the game, American students got closer to thinking that both Israeli and Palestinian sides were equally right when they had a more pro-Israeli view before playing the game. Similarly, results show that Turkish students got closer to thinking that both sides were equally right when they had a more pro-Palestinian view before playing the game. In contrast, Israeli & Palestinian students did not change their perspective regarding the rightness of their side. The game affects students (Turkish and American) with less salient and weaker attitudes concerning the conflict, as opposed to Palestinian and Jewish participants who have stronger and more salient attitudes. Results

showed that further studies are necessary to investigate under which conditions technology can be used as an effective conflict resolution intervention [12].

Various studies have explored over the past years, various technological aspects that led to societal change. Specifically, some researchers have investigated how the use of different technologies could promote different forms of peacemaking. For example, Ioannou et al. (2013) designed a collocated brainstorming tabletop activity to facilitate dialogue and consensus decision making in groups of college students discussing sensitive and controversial topics, including peace-building in a country of long-term ethnic conflict. The authors found that discussion around the tabletop was fluent with no evidence of tension, anxiety or strong disagreement among the participants [22]. Moreover, Ioannou and Antoniou (2016) conducted an empirical investigation of technology enhanced peacemaking in a conflict-stressed school environment. The peacemaking intervention required students in conflict-laden groups to collaborate on various game-like learning activities on a multitouch interactive tabletop, over the span of three weeks. Students' interviews and video observations provided evidence that tabletops can become a means of communication and collaboration giving a chance for students in conflict to share a common space, shifting attitudes and improving their relationships. The results showed that the use of the tabletops can increase cooperation between students in conflict and it can change attitudes and improves the students' relationships [20].

2.5 SC for SE/SI and Cultural Heritage

Hansen, Postmes et al. (2012, p. 223) stated that "Culture is not a stable set of beliefs or values that reside inside individuals. Instead, it is located in society, in patterns of practices, ideas, institutions, products, and artefacts" [16]. Different studies have been conducted with the aim to preserve the cultural heritage of various countries with the use of technology, indicating the importance of presenting to the new generation the cultural heritage of their country. Different types of technologies ranging from websites, archaeological databases, touch screens with interactive applications to virtual environments, virtual reality, augmented reality, serious games for cultural heritage, commercial, historical games and pervasive cultural heritage serious games have been used to illustrate the cultural heritage of different countries. These technologies are often placed in museums and archaeological sites and monuments visited by schools and other visitors [3, 8, 52].

In recent days, Virtual Reality (VR) has been used in many cases to present the cultural heritage of a country. Different projects were based on virtual reconstructions to educate and train their users. Some examples of virtual reconstructions systems are "Roma Nova: the Rome Reborn project", "Ancient Pompeii" and "Parthenon project" [3]. Other VR systems are being used in different museums. Bergamasco et al. (2002) presented a VR system called "Museum of Pure Form" that allows the user to interact through sight and touch with digital models of 3D art forms and sculptures [4]. Loizides et al. (2014) carried out a user evaluation of two virtual museums where items of the Cypriot cultural heritage were placed. Visitors were able to use a stereoscopic Powerwall projection or a Head Mounted Display to experience 3D immersion [29]. Furthermore, different interactive virtual exhibitions that can be visited in real-world

museums are facilitating games technologies in order to provide a digital representation of cultural heritage playfully and educationally to engage better the students and other visitors who visit the museums. Some examples of serious games in the context of cultural heritage, specifically designed for educational purposes are the "Virtual Egyptian Temple" and "Revolution" [3]. Pervasive cultural heritage serious games are also being used in some museums. Coenen et al. (2013) described a case study on MuseUs pervasive cultural heritage serious game. This game is used in museums exhibitions where visitors can use their smartphone to download its app. During their visit to the museum, players are guided to create their exposition, and this application aims to provide learning outcomes during the visit in a museum exhibition [8].

3 Discussion and Future Implications

This paper has highlighted some of the essential theoretical and practical implications of SC in the concept of SE or SI. It has summarized both the applications and achievements of SC applications over the past years. Thus, the overall goal of this paper is to address the state of the art of SC for SE/SI aiming to contribute, support, and facilitate the future application and adoption of the principles of Design for All and Universal Access in the context of the Information Society. SC research can serve as an opportunity to help people to engage in social activities and the community without any issues. Future efforts could include the development and evolution of methodologies, techniques and tools supporting the application of Design for All in HCI or the development of interaction techniques for specific target user groups, supported through user interface development toolkits. In that respect, future research in this area should focus on five research directions as described in the following.

1. Design in SC for the elderly.

This research direction could investigate the use of several technology initiatives designed to improve the quality of life of the elderly. Consequently, two main research questions in this direction are: (1) "How can SC based solutions (including products, systems, or services) enhance older adults' quality of life?" and, (2) "How can technology (e.g. health technologies, virtual communities, etc.) promote, facilitate and sustain SI for specific populations such as the elderly)?"; specifically, this research direction could focus on online support communities, social communities and healthcare communities and examine their usability in terms of standards of the universal web design and accessibility. In addition, this research direction could also examine the use of various AAL systems as well as the use of Internet of things at home.

2. Design in SC for people with disabilities.

The second research direction deals with the technological initiatives aiming to improve the quality of life of people with disabilities. It should focus on supportive equipment, Universal web design and accessibility, online healthcare communities and online support communities. The main research question of this RT is "How can technology (e.g. health technologies, virtual communities, applications, etc.) promote, facilitate and sustain SI for specific populations such as people with disabilities?";

3. The use of SC to fill the gender gap in the Computer Science field.

Gender issues in the field of CS and the use of SC could focus on the discrimination that women often face in the CS field. It will further examine ways to fill the gap between men and women in the CS field by (i) adopting innovative methods to inspire female computer scientists and, (ii) by creating online platforms/communities and face-to-face workshops for mentoring and supporting women in CS.

3. The use of SC for societal change.

This research direction should focus on several aspects that negatively affect our society. Specifically, it could explore the use of different technological tools to address conflict management, antisocial behavior, peace-making and bringing people together.

5. The use of SC to preserve cultural heritage.

For cultural heritage, SC should focus on the awareness and promotion awareness of cultural heritage through the use of different technologies. This research direction could examine the use different innovative technologies with the aim to engage young children in an environment designed to inform them about their country's cultural heritage.

Closing, this paper discusses the literature on the use of SC for SI and SE. Results from previous theoretical and empirical studies in the area revealed affordances and implications for SC design in five different areas, which are (a) the elderly, (b) people with disabilities, (c) gender studies, (d) societal change, and (e) the preservation of cultural heritage. The literature overview shows that the use of different technological tools used by different groups of people has a positive impact for those people who either socially included or excluded from their use. However, further research is needed in these five directions, which are analysed in this document and direct research into the gaps identified.

Acknowledgments. The authors would like to acknowledge travel funding from the European Union's Horizon 2020 Framework Programme through NOTRE project (H2020-TWINN-2015, Grant Agreement Number: 692058).

References

1. Adam, A.: Gender, Ethics and Information Technology. Springer, Heidelberg (2005)
2. Al-Wabil, A., Zaphiris, P., Wilson, S.: Examining visual attention of dyslexics on web navigation structures with eye tracking. In: International Conference on Innovations in Information Technology, IIT 2008, pp. 717–721. IEEE, December 2008
3. Anderson, E.F., McLoughlin, L., Liarokapis, F., Peters, C., Petridis, P., de Freitas, S.: Developing serious games for cultural heritage: a state-of-the-art review. Virtual Reality **14**(4), 255–275 (2010)
4. Bergamasco, M., Frisoli, A., Barbagli, F.: Haptics technologies and cultural heritage applications. In: Proceedings of Computer Animation, pp. 25–32. IEEE (2002)

5. Bonaccorsi, M., Fiorini, L., Cavallo, F., Esposito, R., Dario, P.: Design of cloud robotic services for senior citizens to improve independent living and personal health management. In: Andò, B., Siciliano, P., Marletta, V., Monteriù, A. (eds.) Ambient Assisted Living. Biosystems & Biorobotics, vol. 11, pp. 465–475. Springer, Cham (2015). https://doi.org/10.1007/978-3-319-18374-9_43
6. Botia, J.A., Villa, A., Palma, J.: Ambient assisted living system for in-home monitoring of healthy independent elders. Expert Syst. Appl. **39**(9), 8136–8148 (2012)
7. Carmichael, T., Norvang, R.: A global dialogue on peace: creating an international learning community through social media. Int. J. Teach. Learn. High. Educ. **26**(3), 445–452 (2014)
8. Coenen, T., Mostmans, L., Naessens, K.: MuseUs: case study of a pervasive cultural heritage serious game. J. Comput. Cult. Heritage (JOCCH) **6**(2), 8 (2013)
9. Constantinou, V., Ioannou, A., Diaz, P.: Inclusive access to emergency services: an action research project focused on hearing-impaired citizens. Univ. Access Inf. Soc. **16**(4), 929–937 (2017)
10. Constantinou, V., Lanitis, A., Ioannou, A.: Using virtual reality to train designers to develop friendly interfaces for achromatic vision patients. In: Proceedings of the 22nd International Conference on Intelligent User Interfaces Companion, pp. 77–80. ACM, March 2017
11. Constantinou, V., Loizides, F., Ioannou, A.: A personal tour of cultural heritage for deaf museum visitors. In: Ioannides, M., Fink, E., Moropoulou, A., Hagedorn-Saupe, M., Fresa, A., Liestøl, G., Rajcic, V., Grussenmeyer, P. (eds.) EuroMed 2016, Part II. LNCS, vol. 10059, pp. 214–221. Springer, Cham (2016). https://doi.org/10.1007/978-3-319-48974-2_24
12. Cuhadar, E., Kampf, R.: Learning about conflict and negotiations through computer simulations: The case of PeaceMaker. Int. Stud. Perspect. **15**(4), 509–524 (2014)
13. DuBow, W.: Attracting and Retaining Women in Computing. Computer **47**(10), 90–93 (2014)
14. Wang, F.Y., Carley, K.M., Zeng, D., Mao, W.: Social computing: from social informatics to social intelligence. IEEE Intell. Syst. **22**(2), 79–83 (2007)
15. Farmer, L.: Teen girls and technology: what's the problem, what's the solution? ALA Editions. American Library Association, Chicago (2008)
16. Hansen, N., Postmes, T., van der Vinne, N., van Thiel, W.: Information and communication technology and cultural change. Soc. Psychol. **43**(4), 222–231 (2012)
17. Hayes, A., Gray, M., Edwards, B.: Social inclusion: origins, concepts and key themes, Social inclusion, Social Inclusion Unit, Canberra (2008). http://pandora.nla.gov.au/pan/142909/20130920-1300/www.socialinclusion.gov.au/sites/default/files/publications/pdf/si-origins-concepts-themes.pdf. Accessed 01 Feb 2018
18. Henderson, K., Gibson, C., Gibb, F.: The impact of tablet computers on students with disabilities in a Higher Education setting. Technol. Disabil. **25**(2), 61–76 (2013)
19. IBM (2016). http://www.ibm.com/ibm/ginni/speeches.html
20. Ioannou, A., Antoniou, C.: Tabletops for peace: technology enhanced peacemaking in school contexts. Educ. Technol. Soc. **19**(2) (2016)
21. Ioannou, A., Kartapanis, I., Zaphiris, P.: Social robots as co-therapists in autism therapy sessions: a single-case study. In: Tapus, A., André, E., Martin, J.C., Ferland, F., Ammi, M. (eds.) Social Robotics, ICSR 2015. LNCS, vol. 9388. Springer, Cham (2015)
22. Ioannou, A., Zaphiris, P., Loizides, F., Vasiliou, C.: Let's talk about technology for peace: a systematic assessment of problem-based group collaboration around an interactive tabletop. In: Interacting with Computers, iwt061 (2013)
23. Kermarrec, A.M.: Computer science: too young to fall into the gender gap. IEEE Internet Comput. **3**, 4–6 (2014)

24. Kosmas, P., Ioannou, A., Retalis, S.: Using embodied learning technology to advance motor performance of children with special educational needs and motor impairments. In: Lavoué, É., Drachsler, H., Verbert, K., Broisin, J., Pérez-Sanagustín, M. (eds.) Data Driven Approaches in Digital Education (2017)
25. Kosmas, P., Ioannou, A., Retalis, S.: Moving bodies to moving minds: a study of motion-based games in Special Education. J. Tech Trends. (2017, accepted)
26. Kurniawan, S.H., Zaphiris, P.: Web health information architecture for older users. IT Soc. **1**(3), 42–63 (2003)
27. Lanitis, A., Tsapatsoulis, N.: Quantitative evaluation of the effects of aging on biometric templates. Comput. Vis. IET **5**(6), 338–347 (2011)
28. Levitas, R., Pantazis, C., Fahmy, E., Gordon, D., Lloyd, E., Patsios, D.: The multi-dimensional analysis of social exclusion (2007)
29. Loizides, F., El Kater, A., Terlikas, C., Lanitis, A., Michael, D.: Presenting cypriot cultural heritage in virtual reality: a user evaluation. In: Ioannides, M., Magnenat-Thalmann, N., Fink, E., Žarnić, R., Yen, A.-Y., Quak, E. (eds.) EuroMed 2014. LNCS, vol. 8740, pp. 572–579. Springer, Cham (2014). https://doi.org/10.1007/978-3-319-13695-0_57
30. Loizides, F., Kartapanis, I., Sella, F., Papadima-Sophocleous, S.: Mi.L.A: multilingual and multifaceted mobile interactive applications for children with autism. In: Critical CALL–Proceedings of the 2015 EUROCALL Conference, Padova, Italy, p. 368. Research-Publishing.Net, December 2015
31. Margolis, J., Fisher, A.: Unlocking the Clubhouse: Women in Computing. MIT press, Cambridge (2003)
32. Michailidou, E., Mavrou, K., Zaphiris, P.: eInclusion@ cyprus universities: provision and web accessibility. In: CHI 2012 Extended Abstracts on Human Factors in Computing Systems, pp. 1637–1642. ACM, May 2012
33. Mirjana, I., Zoran, P., Anja, S., Zoran, B.: The IT gender gap: experience, motivation and differences in undergraduate studies of computer science. Turk. Online J. Distance Educ. **12**(2), 170–186 (2011)
34. Myhre, J.W., Mehl, M.R., Glisky, E.L.: Cognitive benefits of online social networking for healthy older adults. J. Gerontol. Ser. B Psychol. Sci. Soc. Sci. **72**(5), 752–760 (2016). gbw025
35. Norval, C., Arnott, J.L., Hanson, V.L.: What's on your mind? Investigating recommendations for inclusive social networking and older adults. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 3923–3932. ACM, April 2014
36. Paloheimo, A., Stenman, J.: Gender, communication and comfort level in higher level computer science education-case study. In: 36th Annual Frontiers in Education Conference, pp. 13–18. IEEE, October 2006
37. Parmaxi, A., Vasiliou, C.: Communities of interest for enhancing social creativity: the case of Womenpower platform. In: Proceedings of INTED 2015 Conference, pp. 2838–2847 (2015)
38. Pfeil, U., Zaphiris, P.: Investigating social network patterns within an empathic online community for older people. Comput. Hum. Behav. **25**(5), 1139–1155 (2009)
39. Pfeil, U., Svangstu, K., Ang, C.S., Zaphiris, P.: Social roles in an online support community for older people. Int. J. Hum. Comput. Interact. **27**(4), 323–347 (2011)
40. Pfeil, U., Zaphiris, P., Wilson, S.: Older adults' perceptions and experiences of online social support. Int. Comput. **21**(3), 159–172 (2009)
41. Pfeil, U., Zaphiris, P., Wilson, S.: The role of message-sequences in the sustainability of an online support community for older people. J. Comput. Mediated Commun. **15**(2), 336–363 (2010)
42. Pieper, M., Antona, M., Cortés, U.: Ambient assisted living. In: ERCIM News, vol. 87 (2011)

43. Polycarpou, P., Andreeva, A., Ioannou, A., Zaphiris, P.: Don't read my lips: assessing listening and speaking skills through play with a humanoid robot. In: Stephanidis, C. (ed.) HCI 2016. CCIS, vol. 618, pp. 255–260. Springer, Cham (2016). https://doi.org/10.1007/978-3-319-40542-1_41
44. Queirós, A., Silva, A., Alvarelhão, J., Rocha, N.P., Teixeira, A.: Usability, accessibility and ambient-assisted living: a systematic literature review. Univ. Access Inf. Soc. **14**(1), 57–66 (2015)
45. Rashidi, P., Mihailidis, A.: A survey on ambient-assisted living tools for older adults. IEEE J. Biomed. Health Inform. **17**(3), 579–590 (2013)
46. Robogals (2016). http://www.robogals.org
47. Rubio, M.A., Romero-Zaliz, R., Mañoso, C., Angel, P.: Closing the gender gap in an introductory programming course. Comput. Educ. **82**, 409–420 (2015)
48. Savitch, N., Zaphiris, P.: An investigation into the accessibility of web-based information for people with Dementia. In: 11th International Conference on Human-Computer Interaction, Las Vegas, July 2005
49. Savitch, N., Zaphiris, P.: Accessible websites for people with Dementia: a preliminary investigation into information architecture. In: Miesenberger, K., Klaus, J., Zagler, W.L., Karshmer, A.I. (eds.) ICCHP 2006. LNCS, vol. 4061, pp. 144–151. Springer, Heidelberg (2006). https://doi.org/10.1007/11788713_22
50. Savitch, N., Zaphiris, P., Smith, M., Litherland, R., Aggarwal, N., Potier, E.: Involving people with dementia in the development of a discussion forum: a community-centred approach. In: Designing Accessible Technology, pp. 237–247. Springer, London (2006). https://doi.org/10.1007/1-84628-365-5_24
51. Schreuer, N., Keter, A., Sachs, D.: Accessibility to information and communications technology for the social participation of youths with disabilities: a two-way street. Behav. Sci. Law **32**(1), 76–93 (2014)
52. Silberman, N.A.: Beyond Theme Parks and Digitized Data: What Can Cultural Heritage Technologies Contribute to the Public Understanding of the Past? (2005)
53. Siriaraya, P., Zaphiris, P., Ang, C.S.: Supporting social interaction for older users in game-like 3D virtual worlds (2013)
54. Stoilescu, D., Egodawatte, G.: Gender differences in the use of computers, programming, and peer interactions in computer science classrooms. Comput. Sci. Educ. **20**(4), 283–300 (2010)
55. van den Broek, G., Cavallo, F., Wehrmann, C.: AALIANCE Ambient Assisted Living Roadmap, vol. 6. IOS press, Amsterdam (2010)
56. Varma, R.: Why so few women enroll in computing? Gender and ethnic differences in students' perception. Comput. Sci. Educ. **20**(4), 301–316 (2010)
57. Vitores, A., Gil-Juárez, A.: The trouble with 'women in computing': a critical examination of the deployment of research on the gender gap in computer science. J. Gender Stud. **25**(6), 1–15 (2015)
58. Yeratziotis, A., Zaphiris, P.: Interactive software technology for deaf users: mapping the HCI research landscape that focuses on accessibility. In: Antona, M., Stephanidis, C. (eds.) UAHCI 2015, Part I. LNCS, vol. 9175, pp. 253–264. Springer, Cham (2015). https://doi.org/10.1007/978-3-319-20678-3_25
59. Zaphiris, P., Kurniawan, S., Ellis, R.D.: Web and aging: challenges and opportunities. Univ. Access Inf. Soc. **4**(1), 1–2 (2005)
60. Zaphiris, P., Sustar, H., Pfeil, U.: Inclusive Design for Older People. Centre for HCI Design City University London (2008)