

**Enhancing the Accessibility of the Internet for Elderly People: Socio-Technical  
Approach**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this  
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## **Introduction**

The internet, which seems designed for the younger generation, is ironically more crucial for the older demographic. According to Zhang's research, "The Internet plays an increasingly important role in connecting older adults to news and information, government services, health resources, and opportunities for social support" (2015, pg. 1). Older adults need more help than before because society is designed based on the internet and people are expected to do their daily tasks online. However, elderly people cannot benefit from the Internet because the Internet is not easily accessible to them.

Engineers have approached the problem from the technical side for so long, but this approach has not resolved the fundamental challenges. Despite advancements in technology and user interface designs, older adults still encounter challenges when using the internet. This persistent issue causes their exclusion from the digital society and aggravates the social division between younger and older people.

In this research paper, I aim to underscore the importance of the Internet for the elderly, and the challenges faced by older individuals in accessing the Internet. My research explains how a socio-technical approach can uncover different aspects of the internet accessibility of older people that go beyond just technical solutions. I studied what's being done to help and what social factors still make it hard for the elderly to use the Internet efficiently by using a socio-technical approach. This approach highlights the importance of understanding the social aspects of the problem which are as crucial as the technical ones.

## **Problem Definition**

Elderly people get disregarded by developers in developing and designing internet applications. Therefore, elderly people have a hard time accessing the resources provided by the

internet. Inaccessible online resources for older users lead to consequences, including hindering online experiences, causing social isolation, and creating healthcare barriers. Moreover, ignoring the elderly population in designing internet applications causes them to feel isolated from the younger generation of society, and this situation negatively impacts the age gap in the digital environment. Poorly designed websites make online experiences for older users difficult and frustrating, separating them from the digital world.

The internet has become a primary way of accessing information, and social interactions as the world becomes more digital. When older people struggle to navigate websites, they are less likely to participate in online social activities like their younger generation. Zhang (2015) says “The Internet has become a means by which older adults can maintain offline relationships with family and friends and develop new social networks. Social engagement plays an important role in later life. Staying socially active can help older adults maintain physical and cognitive health. Social capital is also important for older adults’ mental health and well-being. (pg. 1)”. The internet has become a primary tool for the younger generation leading older adults to feel disregarded and this affects older adults’ health negatively.

As technology improves, it will be inevitable to do our daily tasks without the Internet which will marginalize the elderly population from the digital society. The research criticizing technology for older people supports this argument by stating that, “The impact of this mismatch will be intensified over time as society transitions to increased use of technology (e.g., health care technologies, information, and communication technologies) which leaves older adults further behind from a technology-enabled world. “(Charlene, 2022, pg. 949). Therefore, ensuring that older adults access the internet easily is important to prevent their exclusion from the digital world.

Considering the benefits of the internet in older people's lives, older people should adapt to using the digital environment more than the young generation. The internet is a great source of information, and older individuals can greatly benefit from it. They can access educational materials, news, and cultural resources, which can help their daily lives and personal improvements. Despite all the opportunities that the digital environment provides to older people, the young generation benefits from these opportunities more compared to older adults.

In the article, about the inclusion of older adults in digital technology, the author Ittay Mannheim emphasizes that "There seems to be the missed opportunity for DT (digital technology) to substantially improve the quality of life of older adults who are living longer and who are experiencing multiple life changes and social isolation with the resultant negative consequences of depression and ill-health". (2019, pg. 5). Therefore, older people should be freely accessing the internet to benefit from online health resources or to connect with their friends, relatives, and families because as internet usage increases for daily activities, older people will face getting isolated in society.

Since older people cannot access online resources and services, both parties struggle to figure out the problems related to the accessibility of the online resource. Many customer service representatives spend excessive time instructing elderly users on website navigation, leading to longer wait times for other customers. Therefore, both workers and customers expect a digital environment serving every part of society, and software engineers have been working to generate more user-friendly websites for older people by implementing better features on websites.

Website developers try to fix the problem on a technical side in response to older people’s neglect in the digital society. Developers create a more user-friendly, and accessible Internet environment considering older people’s lack of knowledge. They have improved the website usability, but elderly people still cannot benefit from the Internet as young people. According to the research conveyed by Nielsen Norman Group, there is a slight improvement in senior people using the internet, but the result is not satisfactory. People over the age of 65 can complete the tasks faster but the success rate is still 50% and it is not an adequate result compared to the young age group which is a 75% success rate. This shows that websites have improved for seniors from 2002 to 2013 but remain significantly more challenging compared to younger users so seniors still struggle to use the internet efficiently (Nielsen, 2013, Clear Gains—and Room to Improve Section).

	Seniors (2002)	Seniors (2013)	Users Aged 21–55 (2013)
Success rate	52.5%	55.3%	74.5%
Time on task (min:sec)	9:58	7:49	5:28
Errors	4.6	2.4	1.1
Subjective rating (1–7, 7 best)	3.7	4.1	4.6

**Figure 1:** Improvement in Internet Usability for older people from 2002 to 2013, there is not a significant improvement (Nielsen, 2013, Clear Gains—and Room to Improve Section).

Regardless of UI development for years, senior adults still have issues using the internet efficiently. In a recent study about Internet use and health in 2022, authors indicate that “While younger adults are near-universal Internet users in the United States, older adults (i.e., those 65 and older) have consistently lagged behind. A significant proportion of older adults still do not use the Internet despite its ubiquity, with a 2019 Pew Research study indicating about 25% of older adults are non-users.”(Wan, 2022, pg. 1). It is a very disappointing situation

because the engineers' technical approach toward creating a user-friendly digital environment has not significantly helped older adults to use the internet more.

Websites do not satisfy older adults' expectations, so they do not prefer using the internet to handle their tasks. People still prefer voice calls and wait in line for hours to deal with their hospital bills, parking tickets, shopping refunds, etc., when it is so easy and fast to complete these tasks online with the help of the internet. In a supporting article, Author Wan highlights that "The age-related gap in Internet use creates barriers to the delivery of beneficial online services for older adults. Such benefits include faster means of communication and information retrieval, as well as the convenience of online shopping, telehealth, and online banking." (2022, pg. 1). It emphasizes the necessity of the internet for older adults, but they still cannot benefit from the internet.

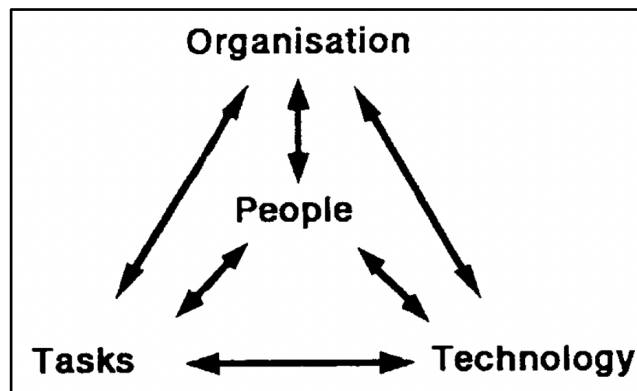
Despite all the technical efforts of engineers, they still struggle to bridge the digital divide between older and younger internet users through user interface design. Improved UI design helps older people use the internet more efficiently but the disproportion in internet usage between these age groups persists. By allowing this divide to continue, society risks marginalizing a significant portion of the population, limiting their access to health resources, and communication tools, and hindering their opportunities for self-development. Therefore, in this project, I seek to understand the social dimensions of the problem and address the problem through the social-technical systems approach.

### **Research Approach**

To efficiently comprehend the reasons why older people cannot get the same benefits from the internet as young people do, we should understand both the technological and the social aspects of the problem. Engineers state the technical dimensions of the digital gap, and they look

for solutions to improve the user interface of the internet or implement helper tools for older people. However, this has not solved the problem for years because the problem has crucial social dimensions too. At this point, the socio-technical framework helps to analyze the problem from a social perspective.

The socio-technical framework can help engineers uncover ongoing digital gap issues between older and younger people by approaching the problem from both social and technological perspectives. The article “A socio-technical framework for Internet-of-Things Design” says that “A socio-technical perspective can provide an integrative and comprehensive framework, to reflect diverse human-technology interaction in the IoT (Internet of Things)” (Shin, 2014, Introduction). A socio-technical framework for Internet-of-Things design: A human-centered design for the Internet of Things. *Telematics and Informatics*, 31(4), 519-531.). There is an inevitable interaction between humans and technology and a socio-technical approach can guide us in understanding the reason behind the disregard of the older population on the internet.

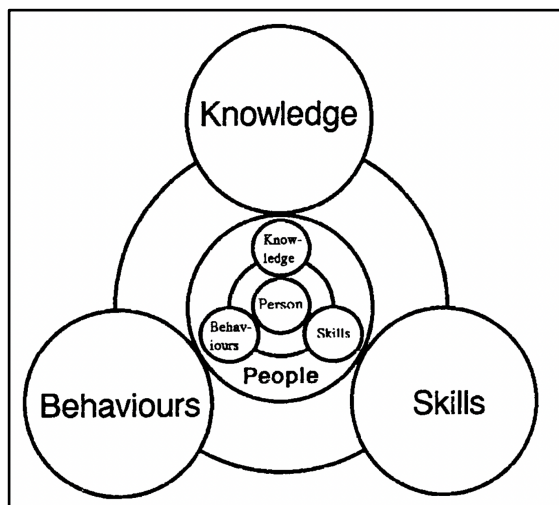


**Figure 2:** Key Domains of Socio-Technical System redrawn to emphasize the centrality of the people component (Sutton, 1990, pg. 123).

As we can see in Figure 2, in every technological task and organization, people play a central role so we cannot evaluate technology-related issues by ignoring societal factors. In my research paper, the Internet environment refers to the organization, and using the Internet refers

to the job/task and the socio-technical framework connects the relationship between these components. In his article, author Sutton explains how the socio-technical system works, stating that “The harmony/discord existing between people and tasks, is not only governed by how the people feel about the jobs they do, it also depends on the relationship they have with their organization and with the technology they use. The harmony/discord between people and the technology they use will be affected by the way those people relate to the organization to which they belong and to the jobs they do.” (Sutton, 1990, pg. 123). This shows how the people factor impacts the technology, task, and organization relationship.

In a socio-technical approach, understanding people's circumstances is crucial when designing new products in a technological environment. There is the same issue in creating an accessible digital environment for older people. Engineers have been trying to close the age gap on the internet without considering older people’s circumstances, so the problem continues. Despite all the technical improvements and enhancements, older people still face challenges in participating in the digital environment. Therefore, it is important to understand how the skills, knowledge, and behaviors of elderly people play a significant role.



**Figure 3:** Key Components of The People Domain (Sutton, 1990, pg. 123).



Evaluation of the people factor in the socio-technical framework enables us to approach the problem from a non-technical perspective. Older people's behavior, skills, and knowledge are important components to reveal why elderly people cannot benefit from the internet compared to young people (Figure 3). Even though developers design the best user interface and develop an easy-to-access website, they will not be able to change older people's physical and cognitive health which occurs as a main problem for older people in the digital environment.

Some elderly people do not prefer using internet applications because of individual factors like fear and physical functioning problems. An article observing the reasons behind these problems shares the interviews, and some senior internet users say "My hands aren't steady enough to press the little button to send messages..", (Wilson, 2023, pg. 234) or "When I had the computer, I was really sort of nervous. I was thinking it would all crash or cease up or something would go terribly wrong with it." (Wilson, 2023, pg. 229). These factors are beyond the technical side of the internet, and human factors play a big role in why older adults cannot participate in the digital environment efficiently.

## **Results**

The social aspect of the problem that older people cannot participate in the digital environment is greater than the technical aspect. Developing a more usable and accessible internet does not entirely help older adults to engage in a digital environment because older adult's cognitive and physical abilities cannot compete with young people. Elderly people's technological knowledge and skills are not good enough to catch the fast-paced technology, so they struggle to the internet efficiently. Even though the website is designed well, older adults will not be comfortable learning how to navigate the website because of their skills, cognitive health, and previous experiences using the internet.

It is important to understand how physical and cognitive issues that older people face using the internet. The several key factors that compound the challenges faced by older individuals are divided into different factors in the research conveyed at the University of Newcastle (Figure 4). Researchers identify three higher-level challenges related to physical issues, computer experience, and cognitive issues (Dodd, 2017, pg. 5).

	<i>Interface and Control Design</i>	<i>Input Controls</i>	<i>Natural Language</i>	<i>Cognitive Evaluation</i>
<b>Physical Issues</b>	11	9	5	3
<b>Computer Experience</b>	7	7	7	3
<b>Cognitive Issues</b>	7	3	9	5
<b>Total</b>	25	19	21	11

**Figure 4:** Factors that affect older people using the Internet efficiently and the number of studies that address solutions for specific challenges (Dodd, 2017, pg. 5).

Figure 4 illustrates how internet-related issues are associated with the knowledge, skills, and behavioral responses of older individuals. These issues coincide with the human aspect in socio-technical systems as emphasized in the research approach part (Figure 3). These 3 main challenges prevent older people from using the Internet regardless of its design and accessibility. Therefore, it is important to understand these issues and how they escalate older people’s accessibility to the Internet.

As people age, their physical wellness declines, leading to reduced mobility and interaction with technological devices so they cannot respond effectively to the activities on the internet. Dodd says that. “The most apparent issues when designing for the elderly is those caused by deteriorating physical condition. Reading text and listening to audio becomes increasingly difficult with age, and precise movements are often unreliable” (2017, pg. 5). Therefore, older people cannot be expected to use the internet as efficiently as young people.

Another issue is the older people's previous computer experiences. The Internet became popular in the early 2000s and elderly people didn't have exposure to the Internet during their younger years, missing out on the natural learning process, experienced at young ages. Older people do not feel confident using the internet efficiently because the provided technology does not align well with their level of experience. Conducted socio-technical research about how to design a user-friendly communication tool for older people indicates that the assumptions about computer experience make the technology less accessible for older people. The author Peter Bagnal states that "Many participants expressed concern that they would not be able to use any system unless it was very simple since many of them had no computer knowledge and were technophobic." (2006, pg. 2). It shows that the presumption regarding older people's technological knowledge and skills is a crucial mistake. Some older adults cannot even turn on the computer so they will not be able to use the internet regardless of its usability unless someone teaches them.

The third challenge is the cognitive issues the elderly people face using the internet. They lose attention and struggle remembering things for a long time so they cannot interact with technological systems easily. Dodd states how cognitive issues affect using the internet in his article "The reduced capacity in working memory and attention manifests in difficulty remembering the steps taken to complete a task, and trouble chaining together more than 3 actions to complete a task" (2017, pg. 6). Since working memory and attention capacities decrease, older people often find it difficult to remember the steps needed to complete different tasks at the same time.

Integrating the user interface for older adults will not eliminate the problem unless we embrace their physical and cognitive capabilities and support them in learning how to use the

internet. Developing a new internet tool and waiting for elderly people to learn that technology will not help close the age gap in digital environment. Therefore, society plays a big role in this outwardly technological problem. In a recent study, researchers asked elderly people how they feel about learning a new technology and they reported that.

“Older adults also noted some challenges to technology use. Nearly half the sample reported that technology is hard to learn and takes too much time to learn. A larger proportion of people said that technology is too expensive, too complicated and that it was difficult to keep up with changes in technology. Nevertheless, when asked how difficult technology was to use after they had learned how, 77.2% of older adults said that using technology was either not very difficult or not difficult at all.” (Chopik, 2016, pg 553).

This shows that older people do not prefer using the internet because of the hardness but previous experiences, lack of knowledge, skills, fears, etc. All of these issues are caused by personal and societal factors rather than technical issues. However, if they are taught to learn using the internet, the result becomes satisfactory with 77.2% positive feedback. It might be challenging to get complete satisfaction under current social and technological conditions, but the result suggests that by understanding older people's circumstances and providing them with proper guidance, they can adapt to using technology more effectively.

### **Conclusion**

My research about the digital divide facing older adults reveals that technological improvements alone are not sufficient to enhance internet usability for older people. Their struggles to use the internet efficiently involve more than technology. Socio-technical framework proves that the age gap in the internet environment is also caused by physical problems,

cognitive issues, and limited experiences of older adults. This means we also need to know the social dimensions of the problem of why older people cannot benefit from the internet, not just the technical dimensions.

Solving this problem involves more than just developing a better web environment and making technological advancements. Since the Internet is a socio-technical system, social factors also play a big role related to the accessibility of the Internet. If older adults are given the right social help and support, most of them can learn the technology well with the current user interface and the internet tools. Therefore, it is important to understand the social and physical circumstances of older adults to create a more inclusive digital environment that minimizes disregard for older individuals.

## REFERENCES

- Bagnall, P., Onditi, V., Rouncefield, M., & Sommerville, I. (2006). Older people, technology and design: A socio-technical approach. *Gerontechnology*, 5(1), 46-50.
- Chopik WJ. The Benefits of Social Technology Use Among Older Adults Are Mediated by Reduced Loneliness. *Cyberpsychol Behav Soc Netw*. 2016 Sep;19(9):551-6. doi: 10.1089/cyber.2016.0151. Epub 2016 Aug 19. PMID: 27541746; PMCID: PMC5312603.
- Dodd, Connor & Athauda, Rukshan & Adam, Marc. (2017). Designing User Interfaces for the Elderly: A Systematic Literature Review.
- Mannheim, I., Schwartz, E., Xi, W., Buttigieg, S. C., McDonnell-Naughton, M., Wouters, E. J., & Van Zaalén, Y. (2019). Inclusion of older adults in the research and design of digital technology. *International journal of environmental research and public health*, 16(19), 3718.
- Manor, S., & Herscovici, A. (2021). Digital ageism: A new kind of discrimination. *Human Behavior and Emerging Technologies*, 3(5), 1084-1093.
- Nielsen, J. (2013, May 28). Usability for Senior Citizens: Improved, But Still Lacking. Nielsen Norman Group. <https://www.nngroup.com/articles/usability-seniors-improvements/>
- Sanchiz, M., Amadiou, F., Paubel, P. V., & Chevalier, A. (2020). User-friendly search interface for older adults: supporting search goal refreshing in working memory to improve information search strategies. *Behaviour & Information Technology*, 39(10), 1094-1109
- Scacchi, W. (2004). Socio-technical design. *The encyclopedia of human-computer interaction*, 1, 656-659.
- Shin, D. (2014). A socio-technical framework for Internet-of-Things design: A human-centered design for the Internet of Things. *Telematics and Informatics*, 31(4), 519-531.
- Sutton, D., & Sutton, M. (1990). Wheels within wheels: A development of traditional socio-technical thinking. *Management Education and Development*, 21(2), 122-132.
- Szabó, B., & Hercegfí, K. (2023). User-centered approaches in software development processes: Qualitative research into the practice of Hungarian companies. *Journal of Software: Evolution and Process*, 35(2), e2501.
- Vaportzis, E., Giatsi Clausen, M., & Gow, A. J. (2017). Older adults perceptions of technology and barriers to interacting with tablet computers: a focus group study. *Frontiers in psychology*, 8, 1687.
- Wan, X., Lighthall, N. R., & Paulson, D. (2022). Subjective markers of successful aging and change in Internet use among older adults: The distinctive role of subjective health. *Computers in Human Behavior*, 127, 107064.
- Wilson, G., Gates, J. R., Vijaykumar, S., & Morgan, D. J. (2023). Understanding older adults' use of social technology and the factors influencing use. *Ageing & Society*, 43(1), 222-245.
- Zhang, F., & Kaufman, D. (2015). Social and emotional impacts of internet use on older adults. *European Scientific Journal*, 11(17).