

The Role of Design Thinking in the Development of Assistive Technologies, Case Study of Morphic Auto-personalization

Anna Szopa¹ and Gregg Vanderheiden²

¹Rollins College Winter Park, FL 32789, USA

²University of Maryland College Park, MD 20742, USA

ABSTRACT

In this article, we present case study research where design thinking methodology is used to develop accessible technology- Morphic auto-personalization. Morphic is a tool that helps to discover features in computers that make them easier to use, allows anyone to make frequently used features and functions easily available, and allows accessibility settings to follow users to other computers (Morphic, 2022). Through this case study, we identify how the use of design thinking methodology supports the development of IT accessible technology. The design thinking approach helped to develop a holistic understanding of the problems that users deal with when they use computers. Thanks to this project research participants were provided a grounded basis on assistive technologies built into the computers. The research revealed a knowledge gap that the development of assistive technology should enhance the voice of participants and consider their ideas, desires, and needs.

Keywords: Design thinking, Morphic auto personalization, Accessible technology, ICT, Computer features

INTRODUCTION

The concept of design thinking was for the first time comprehensively described by Peter G. Rowe in the book *Design Thinking*. Rowe in his book defined the process of designing in architecture and urban planning and examined theoretical positions (Rowe, 1986). Since then, many models of design thinking have emerged and have been used across sectors to solve complex challenges, reframing them in a human-centered way. Design Thinking is helpful in tackling problems that are not clear or unknown, and involves ongoing experimentation such as sketching, prototyping, testing, and trying out concepts and ideas. According to design thinking methodology, the process has five stages: 1. Empathize—research users' needs, 2. Define—state users' needs and the problems, 3. Ideate—challenge assumptions and create ideas, 4. Prototype—start to create solutions, 5. Test—try solutions (Kelley, Kelley, 2013). The stages are not always sequential. They do not follow the order and can often occur in parallel and repeat iteratively and contribute to an innovative project (Brown, 2019). Design thinking methodology is very

rich and includes different kinds of tools and methods to collect information and data that information related to user needs and creative ideas. This interactive, creative, experimental, collaborative, and explorative method plays important role in designing assistive technologies.

Accessible technologies refer to a set of achievements (products, environmental modifications, services, and processes) useful to overcome limitations and/or improve function for individuals (Cook, Polgar, 2014). Daily tasks undertaken at work and school require access to and the skills in using technology and not being able to access and use ICT prevents people from full and equal participation in social and organizational activities (Fuglerud, Solheim, 2008). Furthermore, digital technologies assist disabled people in knowledge building and distribution and an inclusive environment enforce their engagement. According to Microsoft research, 57% of people are likely to benefit from the use of accessible technology (Microsoft, 2004). Unfortunately, most users do not know that computers can be adapted to better meet their needs using features built into operating systems or with additional applications. Even if they know that adaptations can be made, they will also need to know what application(s) to use, which feature(s) to enable, which setting(s) to change, how to enable and change everything, and then how to reverse everything for the next person who likely needs a different configuration. This can be challenging even for users who are relative technology experts (Szopa et al. 2019). Nowadays accessible technologies are built-in every operating system and every device, and software companies race to make them more useful and flexible. In most cases, accessibility is companies core consideration from the earliest stages of product design through release (Szopa et al. 2021). In this paper we will present how through the design thinking process development team created the technology that makes computers easier to use. Morphic was designed by the team from the Trace Research and Development Center and is a part of the Global Public Inclusive Infrastructure initiative (GPII). It allows adjusting computers' settings to users' needs and preferences. It also helps to discover setting options available to make the computer more accessible. Preferences are saved in the cloud and can be used on any device where Morphic is installed. Furthermore, Morphic can run on the various types of operating systems, browsers, and devices that the users have. In this manner, people can have computers instantly set up for them without having to know how to do it themselves (Morphic, 2022).

DEVELOPING ASSISTIVE TECHNOLOGY THROUGH DESIGN THINKING

The research was conducted in Northern Virginia Community College – Manassas campus, Hollywood Work source Center, Orange County Library System – Chickasaw branch, Osceola Library System – Buenaventura Lakes Library, Richmond Public Library – Broad Rock branch. To offer a new point of view, research team members had diverse backgrounds, experiences, and come from different cultures. The team conducted ethnographic and qualitative research methods; collected multiple forms of data across multiple instances with each participant, giving both a robust qualitative dataset and

a strong tacit understanding of users' everyday practices. The field work was analyzed and discussed during weekly events. The team also articulated the tasks necessary to meet users' needs.

Design Thinking Supportive Framework

Based on identified problems that users were experiencing when they were interacting with computers the research team divided them into two groups: people with disabilities including seniors, and users whose English is not the first language. Such selection helped the team to identify users' needs and the ICT features that should be implemented to make computers easier to use. Collected data showed that all research participants deal with problems when they use computers. Face-to-face communication with users and conducting user experience experiments allowed the team to identify features that should be implemented and modified. Research team members met at least once a week to analyze and synthesize insight from their fieldwork.

The main research question was: How can Morpnic make computers easier to use? And when the team started to create the concept of Morpnic, new "how may we" questions were raised. The team asked hundreds of how may we questions, here are some of the examples: How may we make Morpnic more useful to non-English speakers? How may we design the MorpnicBar so seniors are more independent when they use computers? How may we modify the MorpnicBar to make it more accessible for people with vision problems? etc. For users with disabilities, the team divided features into four categories depending on the type of disability: hearing, vision, cognitive, and mobility.

The 'how may we' questions opened a broader range of possible solutions. During the meetings the team was sketching ideas, looking at them critically, altering them and very often, taking a step back again to improve Morpnic. The design process was complicated by the fact that the software needed to work on different operating systems, browsers, and devices, - yet work the same across them. Some features were technically difficult to implement on one system or another. Also, due to the project nature, it was hard to plan and control, since the process was a mix of problem-solving activities and constantly changing conditions and requirements in the various test sites. Therefore, the team had to ask frequently what the top priorities were, and what was desired and working at the different sites. Then the development team built prototypes which were first tested internally and after that tested at each of the pilot sites with user feedback obtained at every stage of product development. Once the team embraced the idea small experiments (user-experience) were a source of new knowledge.

To keep this project on track, all the activities were continuously evaluated. Critical for Morpnic development was support network and advisory boards. For example, when the research was conducted in libraries that are frequently attended by seniors and users who do not speak English, feedback from libraries' staff members was essential. The staff deals with patrons' problems every day, and over a long period of time observe patrons' behaviors. Therefore, in addition, the team analyzed feedback from various stakeholders and

experts as well as research on assistive technologies. The cumulative effort led to Morphic auto-personalization crystallization.

Morphic is open-source and available free for both individual users as well as organizations. It helps users discover features in computers that make them easier to use, allow to easily control it and use it on different devices. Morphic Enterprise options help organizations more easily accommodate people with all levels of ability. And because a universal design was implemented during software creation and development it can make computers simpler and more efficient for everyone (Morphic, 2022).

CONCLUSION

Design thinking is a process based on a set of tools that encourage innovation and is advocated to be used to solve abstract and complex problems (Brown, 2019). It is a human-centered approach to innovation, the concept is based on understanding customers' needs (IDEO, 2022). In presenter research, the team implemented a protocol of guidelines developed by a group of experts in disability research, information technologies, design, and management. The team conducted five phases of design thinking: 1. Empathize—research users' needs, 2. Define—state users' needs and the problems, 3. Ideate—challenge assumptions and create ideas, 4. Prototype—start to create solutions, 5. Test—try solutions. The research started with the empathy of the stakeholders it led the team to the identification of problems that users deal with when they use computers as well as finding their needs. Then at the ideation stage, the team was seeking potential solutions. At the next stage, these solutions were built and then tested.

The design thinking model provided a useful lens for designing new assistive technologies. It allowed evaluating the model via practice-based research. From this study, two features emerged as particularly important. Empathy helped the team to identify Morphic features and consequent build new versions of Morphic. Presented research shows that the design thinking approach can develop a holistic understanding of the problems that users deal with when they use computers.

REFERENCES

- Brown, T. (2019) *Change by Design, Revised and Updated: How Design Thinking Transforms Organizations and Inspires Innovation*. Harper Business.
- Cook, A, Polgar, J. (2014) *Assistive Technologies: Principles and Practice*, 4th Ed. Elsevier.
- Fuglerud, K.S., Solheim, I. (2008) *Synshemmedes IKT-barrierer. Universal Access in Human-Computer Interaction*.
- Global Public Inclusive Infrastructure (GPII). (2022). Retrieved from <https://gpII.net/>
- Ideo. (2022). Retrieved from <https://www.ideo.com/>
- Kelley, T, Kelley D., (2013) *Creative Confidence: Unleashing the Creative Potential Within Us All*. Currency.
- Microsoft, (2022). *Accessible Technology in Computing—Examining Awareness, Use, and Future Potential*. <http://download.microsoft.com/download/0/1/f/01f506eb-2d1e-42a6-c7b1f33d25fd40f/ResearchReport-Phase2.doc>
- Morphic. (2022). Retrieved from <https://morphic.org/>

-
- Rowe, P. (1987). *Design thinking*. Cambridge, MA: MIT Press.
- Szopa, A, Jordan, B, Folmar, D, Vanderheiden, G. The Auto-Personalization Computing Project in Libraries.
- Szopa, A. (2021). International Standards in Information and Communication Technology (ICT) Accessibility and their Application in Operating Systems, in *Handbook of Standards and Guidelines in Human Factors and Ergonomics*
- Szopa, A., Vanderheiden, G. (2020). The Importance of Computer Auto Personalization. *Advances in Usability, User Experience, Wearable and Assistive Technology*. Proceedings of the AHFE 2020 Virtual Conferences on Usability and User Experience, Human Factors and Assistive Technology, Human Factors and Wearable Technologies, and Virtual Environments and Game Design, July 16-20, 2020, USA.