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Article

Increasing Participation of Persons With Intellectual Disabilities With Smart Socio-Technical Arrangements

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Abstract
"Smart devices" and "smart applications" open up a wide range of opportunities for the individual. Today, the vast majority of the population in Europe uses electronic devices with a multitude of "smart applications" as an aid in everyday life. One part of society that could arguably benefit more from these types of technology is that part comprised of persons with disabilities. Statistics show that persons with disabilities, especially those with intellectual disabilities, own and use fewer electronic devices than other parts of the population. Several authors have addressed this issue, referring to it as the "digital divide." In this argumentative article, we advocate a social-relational understanding of disability and conceptualise "smartness" as an attribute for situations (and neither for devices and applications nor for people). Through what we call "smart socio-technical arrangements," persons with intellectual disabilities potentially gain a higher level of activity and more independence. It appears that an individualised technology environment can contribute to the enablement and increase of participation of each person. The article links up with an applied research project analysing the establishment of socio-technical arrangements not only for, but also with persons with intellectual disabilities. Our main question here is how to adequately conceptualise the "smartness" of situations for persons with intellectual disabilities. We argue that the use of devices as components of socio-technical arrangements can optimally lead to smart situations in which persons with intellectual disabilities are more active and less restricted in their activities and participation. "Smartness" then is a synonym for functioning and an antonym of disability.

Keywords
intellectual disabilities; participation; smart applications; smart devices; smart situations; smart socio-technical arrangements; smartness; technology use

Issue
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1. Introduction

"Smart devices" (Silverio-Fernández et al., 2018, p. 8) such as smartphones, tablets, or digital voice assistants, as well as "smart applications" (Kornyshova et al., 2022, p. 2), are constantly evolving and supposedly becoming increasingly "smarter." The purpose behind these devices and the huge number of corresponding applications is to enhance the user's life as much as possible and to outsource time-consuming routine or annoying tasks. The majority of people choose to use a variety of "smart devices and applications" to facilitate their daily life, e.g., for becoming oriented in a city (Ahad et al., 2020), getting assistance at home (e.g., for saving energy see Kadam et al., 2015; for security issues see Batalla et al., 2017; for indoor planting see Lee & Park, 2020), or for health tracking (Distefano et al., 2017). Voice assistants such as the SIRI by Apple, Microsoft's personal productivity assistant Cortana or Amazon's cloud-based voice service Alexa are by now developed as "entities" rather than just tools.

They support the user as "artificial companions" (Hepp, 2020) that take on a variety of assignments, thereby in principle making everyday life considerably easier.

One part of the population that could benefit immensely from "smart devices" are persons with disabilities. Paradoxically, however, those persons, especially those with intellectual disabilities (ID), tend to own and use fewer electronic devices than most other parts of the population (Boot et al., 2018; Chadwick et al., 2022). Several authors have dealt with this issue, referring to it as the "digital divide" (Sachdeva et al., 2015; see also Dobransky & Hargittai, 2016; Scanlan, 2022). In order to address this as a global social problem, a background paper for the 2016 World Development report *Digital Dividends* provides us with a useful overview of how technology can help enhance the participation of people with disabilities (Raja, 2016). However, on a personal scale, the underlying causes for the digital divide do not seem to be individual (e.g., preference for analogue interaction or lack of motivation to use technology) but rather socio-economic (Chadwick et al., 2013). After conducting 11 focus groups of 50 people with ID, Heitplatz (2020) reports (for the case of Germany) that the participants expressed their wish to enhance their digital skills but that frequently they do not feel supported by their caregivers (see also Heitplatz et al., 2019, 2022). According to one study by Johansson et al. (2020), the largest groups of people who do not have access to technology and do not feel included in the "digital society" (in Sweden) are students who attend special education schools for students with ID, as well as people living in institutional settings. Having little opportunity to participate online can be associated with efforts to reduce online risks (Livingstone et al., 2015). While "smart technology" offers many potential benefits for persons with ID, there are also serious potential risks in relation to personal data or privacy issues that need to be addressed (Chadwick et al., 2017; Seale & Chadwick, 2017). Several studies in cyberpsychology consider the fact that certain persons with ID are especially at risk of falling victim to cyberbullying or phishing attacks. Seale and Chadwick (2017) present evidence that many persons with ID and/or the people in their environment are aware of these risks and have found strategies to deal with them. Some scholars, e.g., Seale and Chadwick (2017, p. 7), claim that a weighing of interests between risk and normalcy can potentially account for the fact that engaging in risky behaviour might lead to positive outcomes in terms of "development of knowledge, skills, independence and resilience."

In line with a systemic view on social inclusion regarding the digital divide, this article focuses on the use of technology by persons with ID as an opportunity to increase participation. We start from the premise that "smart devices" and "smart applications" become part of a socio-technical arrangement connecting users with their immediate environment in particular situations (e.g., in the city, at home, in health care), and thereby help increase their activity and enable greater participation.

The article links up with an applied research project analysing the establishment of socio-technical arrangements not only for, but with persons with ID (see Section 3). Our main question here is how to adequately conceptualise the "smartness" of situations persons with ID are immersed in. Our understanding of disability in general, as well as of ID in particular, is rooted in social-relational models (Callus, 2021; Reindal, 2008), drawing on biological, psychological as well as social aspects as explanatory factors. With its bio-psycho-social model, developed in the International Classification of Functioning, Disability and Health (ICF; arguably the most well-known social-relational model of disability) the World Health Organization (WHO) provides us with a tool to understand and describe the interaction between the different components of health in the "process of functioning and disability" (WHO, 2001, p. 18). Accordingly, rather than understanding disabilities as attributes of persons, the "units of classification are situations, not people" (WHO, 2001, p. 11). In the ICF, the components "body functions and structures" and "activities and participation" interact with each other as well as with the components associated with contextual barriers and resources such as "environmental factors" and "personal factors" that influence the complex interrelation between functioning and disability. A change in one component can, and likely will, have an impact on all the other components and the individual's functioning. We use the term "person with intellectual disabilities" in the plural, as it is our understanding that a person can face varying disabling conditions in different areas of life. Thus, the concept of disability refers to contingent scenarios and, in line with the bio-psycho-social model, to be understood as a complex interaction between different "components of health" (WHO, 2001) in various situations. Following a social-relational understanding of disability, the term "intellectual" is not to be understood as an attribute of persons either, but rather as a social aspect as well. This means, in line with the ICF model, that if certain adjustments are made (e.g., concerning communication use of plain language) the functioning of people may be increased, and consequently, the level of disability may be lowered.

2. Smart Socio-Technical Arrangements

To describe the complex interaction between technical and social components and to adequately conceptualise the "smartness" of situations in which persons with ID are immersed in, we borrow the notion of "socio-technical arrangements" (Callon, 2004; see also, e.g., Lösch et al., 2019). A socio-technical arrangement in our analytical focus encompasses the technology used (in terms of devices, applications, and functions), the users (with or without ID), the activity to be supported (e.g., shopping, listening to music, online communication),

and the environmental factors (e.g., internet access, social environment, socio-economic factors) as shown in Figure 1. A particular socio-technical arrangement is composed of these components:

As described above, we do not consider disabilities as attributes of persons, but rather, as per social-relational models, as "a construct between the individual and the environment" (Heitplatz et al., 2019, p. 112). Nor do we consider "smartness" as a characteristic that is attributed to either persons or electronic devices and applications as entities of analysis. Rather, "smartness" is from our perspective, like functioning, understood as a social-relational construct that can be used as a positive umbrella term for complex situations in which the socio-technical arrangement between the user, a device with its corresponding applications and functions, and the environment lead to a higher level of "functioning" (Nierling et al., 2021). Lower levels of functioning, and thus of "smartness," correlate with a higher degree of disability, understood as a "negative umbrella term for impairments, activity limitations and participation restrictions" (Sykes et al., 2021, p. 2). Accordingly, devices that are well adapted to the needs of the user contribute to "smart" situations, rather than being smart or making the user smart. Relating to the concept of socio-technical arrangements, we attribute the category of "smartness" to situations in which all parts of the socio-technical arrangement function together in a way that facilitates a situation. The person immersed in a smart socio-technical arrangement experiences an increase in activity and, consequently, in that person's participation.

Hence, in order to make a situation smart, and thereby contribute to a higher level of "functioning," by increasing both activity and participation, one has to look at all the different components of the socio-technical arrangement and make sure each component is set up in a way that it can interplay to facilitate the situation. A "smart device" with a "smart application" only contributes to a smart situation if it can be deployed accordingly. For example, downloading an application on a smartphone is not per se contributing to making the situations that its user will be in any smarter. Vice versa, the individual person's ability will not change simply on account of the technical advancement that the application eventually provides. A calendar function on a mobile phone that recalls its user's appointments only *seems* to be smart when reminding the person sufficiently in advance so that there is time to prepare before an appointment. However, not only do such kinds of matches between purposes and means require a particular electronic setting, carried out by a (third) person with good technical knowledge, but also when thinking of persons with ID as users of the phone, further considerations arise, e.g., individual understanding of time and individual orientation to time.

The smart socio-technical arrangement approach shares certain features with other models that conceptualise the use of (assistive) technology in connection with human activity. While, for example, the human activity assistive technology (HAAT) model (Cook & Hussey, 1995), as well as various accounts in the field of activity theory (see, e.g., Kaptelinin & Nardi, 2006), or the "learning by expanding" approach (Engeström, 2015), focus primarily on how humans use technology, we are mainly interested in understanding (and improving) the process of *participation*, in our case of persons with ID, in different areas of society. Through what we call smart socio-technical arrangements, persons with ID potentially gain not only a higher level of activity

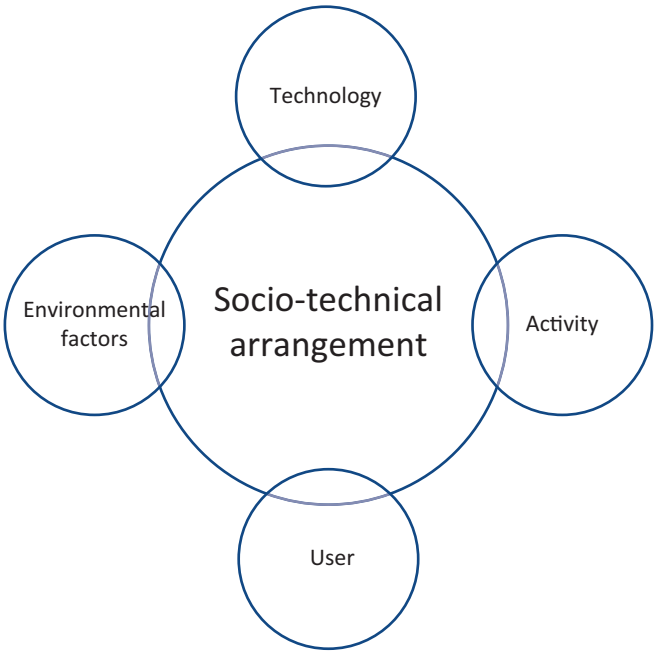

Figure 1. Components of a socio-technical arrangement.

but more independence since an individualised technology environment can contribute to the enablement of each person.

3. Experiences From a Research Project

For the last few years, we have been part of a research project in which the socio-technical arrangement approach was applied in case studies of persons with ID. The aim of this applied research project was to identify potential disabling situations and then to establish an appropriate socio-technical arrangement in conjunction with the researchers, the persons with ID, and their support staff. During that process, we observed many recurring factors influencing the decisions for persons with ID regarding socio-technical arrangements, but also many individual factors. In the following paragraphs, we discuss these observations in light of both the existing body of literature and the conceptualisation of the "smartness" of situations (provided in Section 2). In Section 4, we illustrate an individual smart socio-technical arrangement developed during the research project.

"Social and interpersonal well-being" is dependent, arguably during the Covid-19 pandemic in particular, on "interpersonal relationships and social inclusion with friends, family and others through digital inclusion" (Chadwick et al., 2022, p. 246). According to Cobigo et al. (2012), social inclusion is considered a process in which persons have opportunities to interact with others, participate in activities, and have a sense of belonging. All these liberties were restricted during the pandemic, as people in many countries were forced, albeit temporarily, to live in states of seclusion and solitude. According to Reisdorf and Rhinesmith (2020), "this need for social isolation has led to renewed discussions about the now starkly visible digital inequalities and inequities…that have existed all along" (Reisdorf & Rhinesmith, 2020, p. 133). Accordingly, and in order to eliminate the risks of (further) digital divide, social inclusion measures do not only need to focus on the improvement of digital skills of people with ID but moreover to tackle the barriers preventing caregivers "from supporting their clients in achieving digital literacy" (Reisdorf & Rhinesmith, 2020, p. 134).

Figuring out which devices and applications are suitable for a person is not always easy. As we set out above, it is interconnected with all the components in the socio-technical arrangement. Ideally, when thinking about the use of technology, one should first consider the situation and then determine which "situational solutions" (compare See et al., 2022, p. 3) can be found and established together with the person. To figure out how to make the situation "smart," the different components of the socio-technical arrangements have to be addressed. In the following paragraphs, we introduce the components of a socio-technical arrangement in relation to persons with ID.

3.1. Activity

One first step in adjusting a smart socio-technical arrangement is to identify activities the socio-technical arrangement could encompass. Increasing the activity levels of persons with ID in domains with low levels of activity can, according to the understanding of the bio-psycho-social model of the ICF, help increase participation. Thus, the approach of looking for domains with low levels of activity can assist with identifying disabling situations. Involving persons with ID in the decision-making process is crucial as they most likely know best which situations disable them and which are the ones in which they would like to see change (see, e.g., Wigham et al., 2008). However, for people living in an institutionalised setting, this can be a difficult task as they sometimes cannot imagine life scripts or activities outside of their accustomed settings (see, e.g., Trescher, 2017). They might need assistance with this task. It could be that even personnel in these institutions might not be able to imagine activities that are situated outside the existing routine. This is on account of their being involved in existing practices; changing them would mean changing the institutionalised practices. The ICF and its different activities and participation domains might be able to assist with identification of blind spots and with the dismantling of disabling institutionalised practices. Changing these practices is a desirable and, concerning participation possibilities, an indispensable goal. However, on account of limited resources and underlying political circumstances, there are only limited possibilities (see Trescher, 2017, pp. 47–51).

3.2. Technology

In addition to mainstream technology, there is an additional sector of assistive technologies. Assistive technologies are designed specifically for people with disabilities to use (Boot et al., 2018) and are mostly designed for one specific impairment-compensating function, e.g., special communication devices (Crowe et al., 2022) or assistive technology for cognition (Sohlberg, 2011). They are often very expensive as they are generally developed solely for a small group of anticipated consumers. Critics, especially from the disability studies community, complain that the development and use of special devices increase discrimination, as the stigma of needing a special device is individually attributed and connected to the assumption that disability results from a physical limitation for which there is a technical solution (Mills, 2015; Mitchell & Snyder, 1997, p. 8).

In 2002, Ott (2002, p. 21) criticised the term "assistive technology" in an essay titled "The Modern Histories of Prosthetics," and posed the questions as to how and when a device can be labelled as "assistive":

> Since all useful technology is assistive, it is peculiar that we stipulate that some devices are assistive

> while others need no qualification….The designation creates a technological ghetto at the margins of consumer and political culture.

At the same time, mainstream technology is criticised for not considering the needs of persons with disabilities (Mills, 2015). According to the "social construction of technology," the design and development of a technological artifact is shaped by the concepts of the social group designing it (Bijker & Pinch, 1987). However, people with disabilities are rarely included in the development process of mainstream technology. Mainstream technology, in comparison to "assistive technology," is often much cheaper and easier to purchase (see, e.g., Smith et al., 2022). Directive (EU) 2019/882 of the European Parliament (2019) intends to guarantee accessibility to all products and services in the EU as of 2025. Therefore, manufacturers are forced to consider the needs of persons with disabilities. Commonly, this is realised in the form of an "inclusive" or "universal design" (Clarkson et al., 2003; Pullin, 2009). Pullin (2009) challenges the idea of the universal design as it has to accommodate a multitude of features for different needs which makes a device complex and very likely rather complicated to use. We argue that this could especially be a challenge for persons with ID who might be looking for a simple design without many different functionalities to choose from. For instance, during our research project, we supported several persons with ID who had different accessibility features (e.g., screen readers or captions) on their devices, but were neither aware of these features, nor, after learning about them, knew how to use them. In addition, devices with a lot of complex software need to be updated regularly in order to keep functioning properly. Updating a device is a task that also tends to be complex. When it comes to design, according to Pullin (2009, p. 69), there is a "trade-off between simplicity and universality." This means that either the design of a technological device is very simple, with only a few functions that are easy to understand. In this case, the device will very likely not be accessible for everybody. If the design of a device is universal, one has many different accessibility options with the result that it's not simple anymore. A good example of a simple design given by Pullin is the iPod from Apple. It had only a few buttons and its only function was to play music. However, with its slim buttons and small icons, it surely was not accessible to everyone. With the emergence of smartphones which included a music player in their range of functions, more accessibility options to navigate the music player became available. However, the navigation of the device became more complicated too. So, the smartphone, commonly considered a "smarter" device, might, due to its complex functions, not contribute to the smartest solution for persons with ID. It seems that there is no easy way to resolve the conundrum surrounding universality and simplicity. Pullin (2009, p. 93) proposes:

> [A] *resonant design* for a design intended to address the needs of some people with a particular disability and other people without that disability but perhaps finding themselves in particular circumstances. So this is neither design just for able-bodied people nor design for the whole population; nor even does it assume that everyone with a particular disability will have the same needs. It is something between these extremes, not as a compromise, but as a fundamental aspiration.

For example, screen readers can be helpful for people with visual impairments as well as for people who are unable to read. However, screen readers can be helpful for people who do not want to look at the screen all day and prefer to let the device read a text for them. Good examples are speech assistants such as Amazon's Alexa or Apple's SIRI that are used by many people with sight impairments while also being widely used by the general population.

The idea of *resonant design* is in line with our smart socio-technical arrangements approach. With reference to Ott (2002), we assume that all technology is assistive and that placing the focus on particular impairments is illogical as using technology always compensates for functional limitations (no matter who is the user). Placing the socio-technical arrangement at the centre of attention could help to undo certain preconceived ideas or hasty (although well-meant) conclusions we might have about certain technology that is to be used when having a certain impairment. Maybe the device or application that first comes to mind is not the best, or if so, will need to be adjusted when considering the situation in which it is to be used.

3.3. Users

Assistive technology devices often focus in their design on certain impairments and do not consider other factors like age or culture (Pullin, 2009). Users are not only very heterogeneous in their abilities but also differ in taste and priorities (see, e.g., Mavrou et al., 2017). That is why the socio-technical arrangement has to consider the abilities and preferences of every user individually, including the embeddedness of socio-technical arrangements in various situations. Ravneberg (2012, p. 259) points out (and considers this as "practical implications" of her study on "prerequisites for a qualitative good life for people who are users of signalling devices") that crucial to the acceptance of the technology is "the aesthetical side of design, identity and user satisfaction." This also needs to be considered in order to avoid abandonment of the device (see also Kaleshtari et al., 2016). One reason for the "digital divide," as presented by Sachdeva et al. (2015), is the financial factor. As persons with disabilities are often impacted by unemployment or are dependent on social welfare, resulting in a lack of money, they often have fewer means to purchase (expensive)

devices or applications (Lussier-Desrochers et al., 2017). This might have an impact on both the choice of a particular device or application and, consequently, the socio-technical arrangement. Deciding on which kind of device or application is the right one for the user is not an easy task, especially for people who have had little previous experience with technology and perhaps have little knowledge about the potential of a given technology. As stated by Chadwick et al. (2013), as well as Ramsten et al. (2020), to be able to choose the use of something, one has to know about its existence and possibilities. According to the ICF, "an activity must be available to enable participation" (Ramsten et al., 2020, p. 15). Not knowing about the possibilities of technology means not having access to its full potential. Rarely is there sufficient support, training, and education regarding technology and its opportunities for persons with ID (Khanlou et al., 2021). They often depend on environmental factors such as support staff or family members who might not be sufficiently trained themselves (Chadwick et al., 2013).

3.4. Environmental Factors

Access to devices, the internet, and digital literacy depend largely on environmental factors, especially for people with disabilities who live in designated residential facilities and who often lack (reliable) access to the internet (Alfredsson Ågren, 2020; Heitplatz & Sube, 2020) and suitable devices (Chadwick et al., 2013). Moreover, there are still institutions that do not offer internet access to their clients, e.g., on account of legal reasons such as data protection (Heitplatz & Sube, 2020). Support staff and carers often play the crucial role as gatekeepers to internet access, devices, applications and education (Chadwick et al., 2013; Ramsten et al., 2019). Their decision-making can be impacted by their own knowledge and beliefs about technology as well as by demands from parents and the requirements of the service providers (Heitplatz et al., 2019; Ramsten et al., 2019). Therefore, ensuring that staff members have or obtain competences in digital literacy is necessary to help them make proper and informed decisions, especially together with their clients (Heitplatz, 2020). Furthermore, persons with ID seldom have access to education programs on digital literacy themselves, and that lack of information and qualification often places them in positions of dependency (Khanlou et al., 2021). As mentioned above, if people have had little experience with technology, they depend on the support and expertise of those helping them to choose and purchase the devices and applications that seem right to those helpers. Several studies document the wish and need of persons with ID to have access to technology and corresponding education and training themselves (Chadwick et al., 2013; Heitplatz, 2020; Heitplatz et al., 2022). Next to often non-existent training for persons with ID, support staff frequently have limited time resources available to accompany the acquisition of required technological skills (Heitplatz, 2020). In some cases, setting up an arrangement might mean increased or altered support needs as the person with ID is more active. Moreover, technologies might reproduce already existing dependencies or could be used by the environment to do so (Mankoff et al., 2010). Nevertheless, it can in some cases also help to reduce the support requirements of persons with ID as their autonomy increases. This, in turn, can result in the support staff having more time available for other activities (see Section 4 for an example). Ramsten et al. (2019) indicate that the openness of an institution and its support for the staff regarding technology use play an important part in fostering technology use by persons with ID. Heitplatz (2020) emphasises how important a positive statement about technology use from an institution is and how important it is to include the employees in this step.

4. Illustration of a Smart Socio-Technical Arrangement

In this section, we illustrate an exemplary setup of a smart socio-technical arrangement that was experienced in the above-mentioned research project. One user who we accompanied and who lived alone was always dependent on his support worker to call him when he had an appointment. As he had no concept of time, he was dependent on her to call him in sufficient time in advance, so that he knew when to get ready and to leave the house. The user stated that he was stressed by constantly having to answer the phone. His wish was to be able to manage this situation independently. He is unable to read and write. Now he uses the calendar and the alarm clock on his phone with speech output and ring tones to remind him. He sets it up once a week together with his support worker for all his upcoming appointments. Hence, his support worker does not constantly need to call him to tell him to get ready. At the same time, his activity level in carrying out his daily routine increased as he gained more independence on a daily basis and could handle things himself. He also gained more time to do other things, as previously he had tended to get himself ready and appear at appointments too early as he was concerned about being late. Figure 2 illustrates his individual circumstances regarding the different components that led to the establishment of this particular arrangement.

5. Conclusion

We have illustrated how the establishment of smart socio-technological arrangements for persons with ID can contribute to smart situations in which an increase in activity leads to an increase in participation which in turn is likely to lead to an increase in functioning. This is a dynamic process that is associated with a potential decrease in disabilities in different areas of life which in turn is the foundation for social inclusion. The emphasis

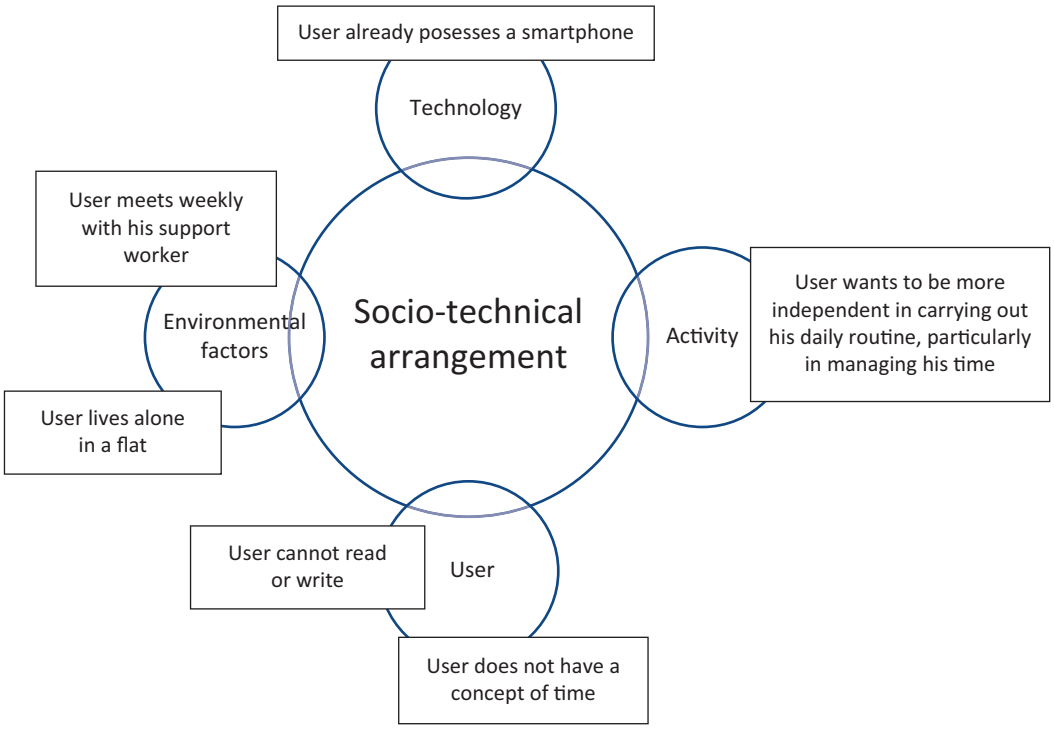

Figure 2. Illustration of individual components to be considered in a user's smart socio-technical arrangement.

of the social-relational approach we have taken here lies in shifting the attention from the "smartness" of a device, application, or a person, to the "smartness" of socio-technical arrangements and situations. We started with the basic premise that persons with ID tend to face many obstacles when it comes to the use of technological devices. We outlined that as consumers, users, and recipients of social services, their needs and preferences—with the provision of assistive technology devices—are either generalised and projected onto all persons with ID (as if we are thinking about "one size fits all" solutions for an entire group) or they are commonly overlooked and excluded from the discourse on technology use. We stated that figuring out which devices and applications are suitable for a person is not always easy, and we described as an ideal that, when thinking about the use of technology, one should first consider the situation and then determine which "situational solutions" (compare See et al., 2022, p. 3) can be found and established together with the person with ID. We argue that the smart situation approach can help overcome the "digital divide." It can be one component contributing to the improvement of a person's access to suitable electronic devices and applications, as well as achieving a higher degree of participation in the "digital society." This approach helps to shift the focus away from technological questions to broader questions of what a person with ID needs for a sustainable and successful use of technology. Smart socio-technical arrangements can be seen as opportunities for the increase in both their activity level and participation, and in the end, help to contribute to social inclusion.

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Conflict of Interests

The authors declare no conflict of interests.

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