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Assistive activity technology as symbolic expressions of the self

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Keywords: Assistive technology, self-expression, participation, physical activity, qualitative study

Abstract.

BACKGROUND: Different types of assistive technologies can support participation for people with disability; nonetheless, technology can break with people's self-image, sometimes resulting in technology abandonment.

OBJECTIVE: This article focuses on how assistive activity technology can be used as symbolic expressions of identity among people with physical disability.

METHODS: Qualitative, semistructured, in-depth interviews with people with physical disability using assistive activity technology.

RESULTS: The use of assistive activity technology is most often voluntary and based on personal interest. The use of assistive activity technology affects how the informants experience themselves and their social surroundings, and how they act in social activities. Assistive activity technology provides people with disability the opportunity to show themselves from a positive perspective in recognisable and commonly valued activities in society. This phenomenon is changing how other people see and understand people with disability.

CONCLUSIONS: Assistive activity technology has the potential to contribute as symbolic expressions of identity for people with physical disability. The technology contributes through positively changing how individuals experience themselves and how other people perceive them. A new finding is that assistive activity technology differs from other assistive technology because the choice of using assistive activity technology is normally based on individual preferences and interests.

Keywords: Assistive technology, self-expressions, participation, physical activity, qualitative study

1. Introduction

1.1. Assistive technology as a tool to support participation

Assistive technology (AT) has been shown to support participation for people with disabilities [1-6] but can also prevent it because the technology can be perceived as negative and may negatively affect a person's self-image [2,6,7]. The cultural understanding of disabilities and AT affects both how a person and how the social environment choose strategies to manage a situation, as well as whether individuals are willing to accept the help that

technological innovations represent [6,8-12]. Studies have revealed that AT is used as a form of self-expression and as a representation of identity and that awareness about technology use influences social expectations regarding it [3,6,7,13]. AT abandonment can occur when the technology does not align with the impression an individual with a disability wishes to project about herself or himself [3,6,7,9,10,13]. Therefore, it is important to study how AT use affects the individual's self-image in order to avoid negative perceptions and to identify factors that contribute to successful technology use and a positive self-image among people with disabilities.

The International Classification of Functioning, Disability, and Health (ICF), defines AT as 'any product, instrument, equipment or technology adapted or specifically designed to improve the function of a disabled person' [14]. Assistive activity technology (AAT), the focus of this article, is a subgroup of general AT. AAT is considered assistive technology that is designed specifically to help individuals with impairments participate in physical activities. These include outdoor activities, exercise, sports, play, and physical education [15]. Some examples of AAT are adjusted bikes, alpine equipment, wheelchairs modified for playing tennis or dancing, and hockey sleds. In Norway, people apply for state-funded AT at the Assistive Technology Centre (ATC), a division of the Norwegian Labour and Welfare Administration. The applicant is required to have a permanent illness, injury, or disability that affects his or her daily life at a significant level [15].

Researchers in the field of disability studies are aware that the use of AT to improve people's functioning is considered part of a normalisation discussion [16,p.100]; however, they have also recognised the importance of exploring the positive potential of technology use to support identity formation for individuals with disabilities. AT has been shown to support participation [1-6]; however, how it affects the individual aspect of participation requires

further examination. This study explores the processes that lead to individual participation through the use of AAT, and more specifically, its use from an individual perspective to a broader understanding of contextual factors influencing the individual's understanding or experiences with this type of technology. The research question is as follows: "How does AAT contribute to the negotiation of symbolic expressions of identity among individuals with mobility impairments?" This study was conducted in Central Norway.

1.2. Earlier research on the use of technology for adapted physical activity and participation

To access knowledge about the use of AAT, it is natural to consider research that focuses on adapted physical activity, such as sports or recreational activities. This is because AAT is often a prerequisite for disabled persons to participate in such activities [17]. Earlier research on adapted physical activity and participation has demonstrated that it affects participation both at an individual and at a social level. Participating in an adapted sport has a positive impact on psychological factors, especially behaviour-related abilities, including self-esteem, self-efficacy and sense of belonging [18]. Playing an adapted sport also has the potential to influence the individual's quality of life and self-esteem by changing society's attitudes towards those with mobility limitations (*ibid.*). Moreover, a reciprocal relationship between positive emotions and a sense of belongingness has been identified in earlier research on recreational sports activities [19]. Participation in organised physical activity offers individuals opportunities to experience new interpersonal interactions and different social roles [20]. Adapted sports participation motivates individuals by providing psychological pleasure and offering inclusion in supportive networks [21]. It is also motivating through the awareness of a larger understanding of participation that empowers advocacy and education

for others in regard to disabilities and sports (ibid). Furthermore, positive associations have been identified between physical activity and employment, educational status, leisure-time schooling, volunteer work and participation in disability organisations [22]. Still, more knowledge is needed about *how* AAT becomes part of the process that leads to individual aspects of participation and symbolic expressions of identity among individuals with disability in their social environments.

1.3. Identity and body in meaning making

Identity indicates what type of person an individual is or wishes to be and is explained as context-sensitive and dynamic [3,6,13]. Having an impairment may involve stigma, a symbolic expression of a physical or mental attribute of a person that causes the person to be perceived by others as well as by herself or himself as different, less attractive and less capable [23]. AT provides symbolic signals that affect individuals who are disabled, and the social environment and interpretation and feedback of these signals influence the individual's identity [3,6,8,9,11]. Thus, identity creation occurs at an individual and a social level. Semour [8] claims that the social and cultural understanding of technology affects the identity of people with disabilities and makes it important to understand how social environment and culture contribute to the understanding of AT.

Based on the work of philosopher Maurice Merleau-Ponty, a perspective for considering how people interpret situations and create meaning has gained new status in recent years [24]. Merleau-Ponty focuses on how people create meaning in here-and-now actions, and he claims that the body is of central importance to how meaning formation occurs. In his phenomenologist philosophy, the body is a natural symbol of how individuals interpret the world. Significant bodily and mental dimensions infiltrate one another and interact in the

interpretation of situations; thus, the body is always a part of the interpreted world [24,25]. The winter snow can trigger feelings associated with doing winter activities with friends or represent memories of freezing in the snow. These feelings affect the meaning individuals ascribe to the things they experience. Furthermore, Merleau-Ponty described playing with different perspectives of the world to find a better way to interpret and understand a situation as a part of human nature [24]. Thus, identity and bodily dimensions are involved in experiencing new situations, such as technology use.

1.4. Understanding technology use

The Western cultural distinction/dichotomy between machines and organisms, referred to as nature, culture, and society, has been challenged during the last 25 years. Donna Haraway [26] argued that there is no natural body and no clear understanding of the body. The body is always bonded to cultural understanding, and truth about the body is constructed rather than revealed (ibid.). Technological devices have been shown to be experienced as extensions of the body, and it may be difficult to distinguish where the body ends and the technology begins [9,27,28]. A recognised framework is to understand AT use as an interaction between a person, the environment, and technology [3,29]. People's assumptions, expectations, and responses to using AT are highly individual and personal, and they are influenced by varying needs, opportunities, preferences, and past experiences with and exposure to such technology [30-32]. Studies have shown that a person with a disability is likely to accept AT if it helps maintain the person's self-image, conveys what the person wants to convey, or strengthens the efforts to maintain the user's social role [6,7,10,33]. For a person with disability who uses AT, the relationship between the person and the AT is even closer if the technology is visible or if the person's actions depend on the technology [11]. Madeleine

Akrich [34] claims that, in order to understand the relationship between human and technology, it is necessary to examine the technical and the social, which is technology design, the competence of those with disabilities, and their abilities to transform the technology to fit their specific needs. The social accessibility of AT has been shown to be an important factor for its use, and AT can be designed to communicate self-efficacy [6].

In studying AAT use, it is worthwhile to examine the symbolic interaction [35] between a person, technology, and society to assess how the social and the technical influence each other and affect the ways in which individuals interpret technology use and users. Moreover, because people's knowledge is always situated in bodily experiences intertwined in a broader technological and cultural context, cultural and value expectations are also related to physical activity and the participation of individuals with disability in it [36]. What one does, how one does it, and where one does it and with whom seem to have great significance for the opportunity of self-expression and how the individual is perceived by others. Thus, an exploration of how AATs, with both their opportunities and obstacles, contribute to the negotiation of symbolic expressions of identity among individuals with mobility impairments is worthwhile.

2. Method and design

2.1. Study design and sample

The study method and design are inspired by social constructivism, which builds on symbolic interactionism and phenomenology [37]. As the father of symbolic interactionism, Mead [38,p.39] explained that the human self evolves through the individual's ability to assume the attitude of the social group. The individual's ability to control the impression he or she gives others and the reactions that follow constitute the self [38, 35]; thus, the self is

based on social interaction. Social constructivism explains how individuals understand the world as based on various social factors. Especially notable in this perspective is how social phenomena become objective or stable truth [39,p.11]. Individuals seek to understand their world and to develop their own particular meanings that correspond to their experiences. Often these subjective meanings are negotiated socially and historically [37]. These perspectives offer a theoretical framework for understanding how people construct and give meaning to social phenomena like the understanding of identity, disability or technology.

This study employs a qualitative research approach [39] and aims to contribute additional information about how individuals with disability experience the use of AAT in social interactions with other individuals, both able and disabled.

We used a strategic sampling method [40] to recruit informants. The inclusion criteria were as follows: age 18–67 years, having a mobility impairment, and having received AAT within the last 18 months. The ATC confidentially recruited the informants by sending written invitations and information to all persons registered in their database who fulfilled the inclusion criteria. Individuals who expressed a desire to participate sent a confirmation SMS message or an e-mail to the first author. A total of 51 persons confirmed their wish to participate; of these, seven were unable to meet with the first author during the time she was conducting the interviews. As a result, 44 persons participated in the study: 11 women and 33 men. The level and type of mobility impairment varied among these informants (e.g. spinal cord injury, multiple sclerosis, cerebral palsy, stroke, and other muscular or skeletal disorders). Table 1 displays a brief overview of age, type of mobility equipment used, and type of activities the informants participate in using AAT. Substantial variations were found in the population regarding age, family situation, occupation, and variations in geographical conditions where they live as urban and rural areas.

Table 1. Main features of the sample

2.2. Data collection

The first author conducted semi-structured, one-on-one in-depth interviews that aimed to illuminate the informants' own experiences and meanings regarding using AAT in their natural social environment. The goal of in-depth interviews is to create a relatively free conversation that addresses specific topics pre-planned by the researcher [39,p.114]. By using open-ended questions, the informants had opportunities to talk about their understandings, actions, and experiences with using AAT in detail. The researcher conducted the interviews at the informants' homes, in cafes, or at the informants or researcher's workplace, by the informants' desire. The duration of each interview was approximately one hour, and all interviews were audiotaped. Each interview began with introductory questions to collect background information about the interviewee, such as age, interests, and earlier experiences with AT. The researcher then asked open-ended questions on different topics related to the use of AAT in the interview guide, including 'allocation process and user involvement', 'technology and function', 'identity and personal preferences', 'social interaction', and 'physical activity'. Examples of the open-ended questions include: *What is the significance of this AAT regarding how you feel? What would have been the consequences if you had not had this AAT?* Finally, the researcher asked closing questions [39, p.117], which are used to turn the focus towards more practical tasks, such as asking if any part of the study seems unclear and if the informant would be interested in more information before ending the interview.

2.3. Ethical aspects

The Norwegian Centre for Research Data (NSD) approved the study (reference no. 45484), which was also approved by the Norwegian Labour and Welfare administration, Unit for Control and Management. Informants were recruited anonymously. Before the interviews, the researcher confirmed that the informants understood the purpose of the study and the informed consent, and then advised the informants that their participation was voluntary and they could withdraw at any time. The researcher removed all personal identifiers from the empirical material. Data comprised audio files and notes, which were stored immediately after the interviews on a secure server at the researcher's workplace.

2.4. Analysis

The stepwise deductive-inductive approach (SDI) [39] was used. This systematic approach is based on an ongoing movement between an inductive interpretation and theory proximity in the analytical work. Before starting the analysis, the first author transferred electronic transcripts verbatim from the interviews to the software program NVivo, which is suitable for storing and organising data and was appropriate for supporting the analytical work in SDI. Initially, the first author performed detailed inductive coding by reading the first text (interview) thoroughly and coding small sections that conveyed meaning about how the informants experience using AAT in their social context, using the same words and expressions used in the text. The first author identified striking nouns, action verbs, anecdotes illustrating the informants' experiences with using AAT, expressions of irony, and comparisons, and then coded the text. The goal in SDI is to generate codes from the data and not from previously planned themes. In this rigorous, bottom-up analysis, it is not possible to establish the codes before (a priori) the analysis [39]. This process resulted in approximately 600 codes. In the next step, the first author collected the codes that had inner thematic

meanings into code groups that seemed relevant to the research question. In this step, the authors met for a joint analysis session to discuss data saturation and the quality of the codes and code groups. The analysis resulted in six code groups that had inner thematic meanings and represented the potential of the empirical material. Two of the groups (see Table 2) laid the foundation for the themes in the results section: ‘To feel better physically and mentally’ and ‘To show other people and oneself that you have mastery’.

Table 2. Examples of code groups and associated codes

In the final step, theories about how meaning is created [24,35,38] and perspectives on technology use [26,34] supported the analytical work to gain an understanding of what the codes were about, according to the SDI approach [39]. These theories provided a framework to understand how AAT became part of the informants’ experienced and negotiated social world, and how bodily dimensions are part of these experiences and negotiations. The analysis revealed that AAT equipment, as objects of activity and, more specifically, as identity changers in a socially constructed world, contributes to constructivist perspectives on technology use [3,9,26-28]. This will be illustrated in the following section.

3. Results

The results demonstrate that AAT contributes to identity negotiations affecting the individual and social identity of individuals with physical disability. As part of the social construction of identity, the technology interacts in role modelling and communication across ascribed identities. As acting symbolic objects in the lives of users, AATs differ from ATs by their strong association with socially valued activities. In this section, we refer to the informants using pseudonyms.

3.1. Feeling better physically and mentally contributes to positive self-image

This theme is related to how we understand the content of the codes in code group 1. The practical and physical work associated with the use of AAT helped the informants to avoid thoughts that some described as negative thinking about themselves and their situation and to think instead about more positive aspects of their lives. AAT equipment contributes to increased movement of the body, and this positively affects how the informants experience themselves and their social environment; this was of particular significance to those AAT users who struggled with negative thoughts about their situation as persons with disability. The following remark illustrates how AAT use provided one informant with a better physical and mental state:

If you feel a little depressed, it is just getting some exercise and taking a shower, and then it feels so much better. You see things in a slightly different way if the body has moved a little, the pulse increased, and you sweat a little. (Roald, age 49)

Physical activity affected how Roald experienced other aspects of his life as well because he noted that he saw things differently. This example illustrates how both physical and mental dimensions infiltrated and became part of how Roald experienced the world. Participating in physical activity using AAT affected the bodily state of the informants in other activities after technology use, and this influenced both their personal and working lives. Informant Isak (age 49) said, 'I get in better shape both at home and at work. I manage to endure more.' By changing their bodily state through activities using AAT, a temporal effect positively influenced how the participants experienced other activities.

Several informants even used physical activity as a strategy for eliminating negative thoughts. We observe this type of reflection when Lars talks about the significance of AAT, especially in his post-injury period:

After such an accident, one has a lot of up and down trips, at least in the beginning. Eventually, I saw the signs ahead. If I went outside every day to have a workout and went out in nature, they did not come. (Lars, age 34)

By using AAT to avoid negative thoughts, Lars reflected on and interpreted his own behaviour. He became more objective about himself and his situation as he planned his own behaviour with an aim towards avoiding negative thoughts. Another informant, Gjert (age 52), discussed his physical and mental well-being following a workout; the improvements he experienced resulted in his using workouts as a strategy to improve his health because they positively affected his actions in other activities throughout the day: ‘It is not just the physical you train, you train the psyche as well. After a training session, I feel a bit refreshed, and it follows me further throughout the day.’ As the quotation illustrates, some informants were aware of how bodily dimensions affected how they experienced themselves and their environment.

The informants interpreted their behaviour and acted strategically by utilising AAT to reach a better bodily state that, in turn, strengthened their capacity to respond to themselves and their social environment. They acted upon themselves to change how they experienced and acted in the world. These findings demonstrate that AAT affects how informants experience themselves and their social environment, and how they act in the world. In subsection 3.2, we show how AAT use also contributes to changing how other people interpret the users of this type of technology.

3.2. Mastering physical activity leads to the ascription of a more-positive social identity

This overarching theme and the two following subthemes relate to our understanding of the content of the codes in code group 2. The informants told anecdotes about how they experienced others perceiving them differently when they used AAT, adding that they had opportunities to participate in ordinary activities like biking, skiing, dancing, and other sports activities or unorganised physical activity, resulting in others responding to them in a more positive manner. This experience changed their social selves through the interpretation of how other people looked at them and expected from them. When the informants talked about receiving positive attention from others when they used AAT, the adaptive bikes stood out. Anecdotes repeated in the data included people stopping the bike-users to make positive comments about their adaptive bikes, and such comments came from adults and children alike. When one answered questions about whether the AAT device was important to how others perceived him, he discussed the positive responses he received from other people in the street:

People point, laugh, smile, and greet [me], and the young boys say, “Dammit, that is a tough bike you have”. People shout, and if I ride uphill, other cyclists often join me. We talk when we ride up the hills, so you get in touch with other people. It is quite smart, that bike! (Charles, age 67)

Receiving these positive responses from others, the informants experienced that they got opportunities to be interpreted from a positive perspective, similar to strong and healthy individuals who master a physical activity. For the most part, the informants reported that they appreciated the positive attention.

The informants seldom considered people who asked about AAT equipment as a problem, but sometimes discomfort was associated with people looking at it. When one

informant reported that the bike was a social means of transportation, he also said that using an adaptive bike represented a threshold he had to cross:

When I started using that bike, I felt like I was undressing myself. That I have one amputated foot is more visible when I ride that bike. After all, you have such doorsteps you have to overcome. Like this summer, I have more or less never done it before, but this summer, I cycled a lot wearing shorts. I have been a little careful about that because then there are two things: one thing is the bike, and the other is the prosthesis. There is a lot to notice. Still, it is quite natural when you ride a bike, so I do it. (Per, age 55)

Even if the informants' most often experienced positive attention from others when using AAT equipment, the quotation illustrates that the adaptive bike could also have a negative symbolic meaning by being a form of custom technology. This made Per concerned about becoming more visible as a person with disability when he used his bike and, therefore, at risk for other people ascribing a negative identity to him. By contrast, using AAT equipment gave him a natural opportunity to wear clothing, in this case, shorts, that revealed his disability while he was participating in a socially recognised and positive activity. Thus, the AAT device, despite its negative symbolic meaning, helped the informant dare to show himself and the individual characteristics of his body. This situation also illustrates how the social self interacts with the individual self. Before taking the risk of allowing his disability to be visible to others, Per assessed the social situation and planned for the responses to his action by reasoning that it is common to wear shorts for biking. AAT devices change how individuals reflect on their possibilities to control the impressions they give of themselves to others.

The practical use of AAT reveals that this type of technology can have both positive and negative symbolic meaning. The technology interacts simultaneously with the user and the environment and influences how people interpret the situation. The results reveal that the

outcomes of using this kind of technology are fully constituted in the interaction with the user and in the environment where it is used. In the following quote, the informant shows that the technology's characteristics were not one-sided, either positive or negative, but also characterised by an unsuitable symbolic meaning. In her case, the symbolic meaning related to the age group that typically uses her type of device:

I struggled a little with that bike, the tricycle, because that is what the kids use, right? When I got the bike, it was inside the room. Then, I got a visit from my granddaughter when she was five, and she said she had stopped using a tricycle (laughs). (Karin, age 56)

Here, we observe the contextual and multiple symbolic meanings that characterise the technology: The user simply perceived herself to be in the wrong age group for using that type of AAT. By signaling what social rules were unsuitable for a person her age, it became what she calls 'a struggle' to use the technology.

People use technologies to give impressions to others, as when an informant described the need for good design in order to give a positive impression, especially in ordinary daily activities:

It does mean more to people that things look good in their daily lives. You are going to a wedding, you are going to a funeral, and you are going to something. Many people want to have slightly different wheelchairs, a different design or colour-coded, which you can change in between. (Gustav, age 59)

Nevertheless, he went on to say that design was not as important for AAT equipment as for other AT because AAT is associated with function, that is, what people can manage to do in a socially valued activity. He explained:

When it comes to physical activity, I do not know if AAT design is critical. It is rather

that people wonder what I can do with the technology. When I use the wheelchair front wheel attachment, it is not any design “pearl”, but people are rather impressed with the technology and what it is possible to do. (Gustav, age 59)

This new finding, illustrating a difference between AAT and ordinary AT, demonstrates that technology as an aesthetic symbol depends on the *activity* for which it is used. This study shows that the *activity* an AAT is used for – and the activity’s value in society – might become the most important symbolic aspect of the technology’s value. By considering the symbolic meaning of physical activity, AAT might, therefore, differ from types of AT.

3.3. To be part of a collective identity

The informants described that physical activity using AAT was a unique dimension of their social lives and a bodily experience of collectiveness. What Janne (age 36) reported about meeting others for training with her adaptive bike illustrated the non-verbal collectiveness in physical activity: ‘It is a very lovely sport and social. It is not that we talk so much every time we meet, but we are a bunch anyway.’ We interpreted this non-verbal, activity-based interaction as different from many other activities people engaged in together. It involves sharing experiences and values, that is, non-verbal aspects of communication that differ from the direct verbal communication people normally use in everyday activities. Engaging in physical activity by using AAT seemed to provide an opportunity to connect to other people in a non-verbal, commonplace social experience.

Sometimes, people stopped to ask about the AAT equipment, especially about the adaptive bikes, and several informants explained this as a result of bikes being common items to everybody. This opinion was expressed when Ellinor (age 39) explained that she thought people asked about her bike because they could imagine using such a bike, ‘I notice that

people get a little optimistic when they see that bike. I think they imagine how to use it themselves.’ This curiosity may be a result of the bike as a mainstream technology product.

To understand AAT use and those who utilize it, the informants explained that other people imagined using an adaptive bike themselves because this technology is similar to mainstream products. It may appear that the technology contributes, in this way, to a mutual influence between people who are disabled and non-disabled. In our interpretation, a common understanding is the result of people with mobility impairments gaining access to activities that people without disability have traditionally had easier access to, and that people without disability define themselves as users of similar types of technology. We observed this when an informant reported how he thought a Segway affected young people:

I think the Segway has changed the view of sitting in a wheelchair. We who sit in a wheelchair, people think we are sick, and that is not right at all. Now, we have modern technology that shows that we are much more like other people. (Ole, age 44)

Here, Ole explains that other people interpret disabled people differently based on their own experience with the use of similar technology. This means that a mainstream technology product and a common experience of technology use have the potential to change how people perceive and interpret users of the technology.

3.4. Identities as role models

To be able to present oneself in a positive light by managing what other people do is critical for parents, who are expected to be role models for their children. To manage what parents are expected to do for their children and their friends, in the school environment, or in the local community, is of great importance to the informants. This situation is what an informant described regarding following her son to school in her adaptive bike:

I have a son who is eight years old. Sometimes I follow him to school, and then I ride to work on my bike afterwards. Everybody thinks that the bike is so tough and so cool, instead of just being for a person who is handicapped. (Ellinor, age 39)

When people interpreted using AAT as something positive, Ellinor had the opportunity to be a positive role model by accompanying her son to school just like other parents. As she reported, instead of connoting a negative symbolic meaning, what she describes as being '*handicapped*' in front of her son, was positive.

The informants also expressed that they wished other disabled persons could see them using the AAT device so that this could influence others with mobility impairments to imagine such opportunities for themselves. One example is when an informant talked about when she rides back from work:

Sometimes, when I ride back from this job (at a hospital), I hope that if there is someone in a wheelchair who thinks that his or her cycling career is over, they will see that it does not need to be like that. There are so many things to do to live well. I feel fine, but it is nice if it motivates others. (Ellinor, age 39)

The informants reported that they both influenced and received more motivation from other people with mobility impairments who use AAT. The informants explained that the motivation to test AAT increases when potential users consider themselves in the same bodily position as the observed users. They expressed that similarity in age between people with mobility impairments and being AAT users helps them to understand each other better. We observe this when the following informant says that people with mobility impairments work to continue their own experiences for new users of AAT:

People who have been users, or who are users, have begun to realise that we must work to share our own experiences with new users. If there had been people with user

experience when I had to find a new bike and get the bike adapted, I could have had more choices. (Bernt, age 28)

This quote shows that having the personal experience of being disabled affects how people understand other people with disabilities, and that personal experience can provide a more specific understanding of all aspects involved in the situation. A more specific understanding can ease the communication in and interpretation of a situation, leading to more freedom of choice.

As the results illustrate, AAT differs from AT by being associated with recognisable and valued activities in society. AAT becomes part of how people with disabilities negotiate and construct their personal identity – and how they are ascribed a social identity – through an ongoing process of social construction. In section 4, we discuss ways to understand this construction process as well as its implications for people with disabilities who use this type of technology.

4. Discussion

In the following subsections, we discuss the limitations of the study, how AAT contributes to changing the identities of individuals with mobility impairments, and the differences between AAT and AT. Finally, we discuss the implications of the present study's results in regard to further research, and we offer conclusions.

4.1. Limitations

According to a social constructivist worldview, researchers interpret what they are told based on personal, cultural, and historical experiences [37,p.25]. Different academic

disciplines are based on different world views, and certain forms of understanding are more broadly accepted than others [39,p.16]. Our own backgrounds are in social work and disability studies, which might have influenced our interpretations during the interviews and in understanding the data. Despite this, looking at the empirical data through different theoretical perspectives has provided alternative ways of understanding it. This study was conducted in Norway, and cultural differences that affect the interpretation of technology use and users in other countries might exist. The sample in this study comprised twice as many males as females, which could influence the generalisability of the results. Nonetheless, we did not identify any gender issues related to identity; notably, compared with women, men seemed to demonstrate a little more technical interest when adjusting their AAT. We consider the results generalisable and valuable for understanding how AAT contributes to negotiations of personal identity among people with mobility impairments.

4.2. Changing identity through AAT use

This study clearly demonstrates that using similar technologies in commonly valued activities enables individuals to move beyond ascribed social behaviours and begin to understand each other in new ways. Persons with disabilities have different identities, which change based on the situation; thus, they require a multitude of means to express themselves [3,7,9,13]. In this study, the potential of AAT to contribute positively to identity formation for persons with disabilities by changing how they experience themselves and others has been established. Further, AAT use affects how individuals perceive themselves and creates a line of action [38], which means controlling responses to their behaviour in social interaction. Technology inscriptions are features of the technology that indicate how it is meant to be used [34]. As the findings illustrate, AAT interacts with the body in the lives of people with

disabilities and is critical to how individuals experience using this type of technology. This results in AAT use becoming an expression of individuality and a social construct, depending on how individual and bodily dimensions interact in the social context where the AAT device is used. AAT moves people with disabilities into situations where they experience themselves and their environment in different ways. Merleau-Ponty [24] claimed that bodily and mental dimensions become integrated when people make sense of the impressions they receive. The participants in this study experienced that using AAT influenced their lives through the social and bodily results presented by the technology, both positive and negative. Positive physical and mental experiences promote a healthy formation of the individual self. Negative responses are yet another confirmation of an earlier negative experience. As a contribution to identity formation, positive experiences with the use of AAT positively influence how people with disabilities think about and perceive themselves, act, and experience new social phenomena.

People attempt to control the impression they give of themselves to others [38]. When those who have experienced negative symbolic meaning related to an assistive device suddenly experience positive attention from others, the social interaction changes. Positive responses from other people regarding the use of AAT, for example, positive comments and questions, result in increased well-being and recognition of a positive social self. The activities with which AAT devices are associated are well-known and valued in society. AAT is, therefore, interpreted by the symbolic meaning [35] of the activity the technology represents. Thus, people with mobility impairments can achieve recognition through the activities to which the technology provides them access. The technology demonstrates the potential to provide a more positive understanding of people with mobility impairments, a group that has traditionally been stigmatised [23]. Positive responses from others change how people with disabilities think about themselves and act in new situations. This finding supports

the theory of a multidimensional relationship between technology, humans, and the environment [3,11,29]. When implementing AAT in the lives of people with disabilities, the implementation process should consider that these different factors interact.

4.3. Technology as an expression of personal preferences

Another notable aspect of AAT versus AT is that the use of AAT is voluntary because it is chosen based on individual preferences. Technologies that are chosen by users differ from other technologies because they represent technology for doing something the person 'chooses' to be or to do [13,27]. AAT use is based on personal choices and, therefore, might reflect the informants' interests more than an adjusted chair table or a door opener, for example. Thus, the prerequisites for implementation differ from those people with disabilities need to have in order to accomplish necessary, everyday tasks. When the use of AAT is voluntary, it contributes to people with mobility impairments being able to acquire better conditions for expressing themselves. The technology becomes part of the complicated process of interaction between different symbolic objects in people's lives. Thus, this study supports other studies that have highlighted the significance of personal preferences for technology use [7,9,10] because individuals with disability have a great deal of knowledge about the personal and environmental conditions that affect AAT use.

The characteristics of being human include the ability to apply different perspectives to the world, to consider things from several different perspectives, and to play with different perspectives regarding the same situation [24,p.44]. While people can change their perspectives, it seems that they also easily become 'locked' into familiar patterns of interpretation, such as with negative symbols and the meaning of being a person with disability. AT affects how other people perceive people with mobility impairments and what

they expect from AT users and often makes those without disability unsure of how to interact [3,6,13]. By contrast, using AAT appears to allow people with mobility impairments to break with expected impressions by acting in a manner that a person without disability can recognise, understand, relate to, and appreciate. As AAT becomes more similar to mainstream technology products, it is likely to make it easier for non-disabled individuals to imagine the use of AAT and to identify with the experiences of individuals with disability. Merlau-Ponty [24] described that, in order to understand the position of others, people start with their own experiences. By enabling people to imagine or take the perspectives of others, AAT contributes to a situation where people interpret those with mobility impairments differently and gain opportunities to respond differently. AAT devices, by being mainstream technology products used for recognisable and valued activities in society, create a 'bridge' for non-verbal communication between people with and without disability, which results in the opportunity to create a new social interpretation of a situation [35]. Thus, the technology becomes a medium for communication. All types of technology are changing, as are user groups, and these changes are affecting the interpretation of technology and users of technology. In addition, more people are gaining an understanding of technology use, and this can contribute to breaking down barriers that might exist regarding how people interpret and understand individuals with mobility impairments. By leading to a new interpretation, technology that makes a common understanding across barriers possible in the interaction between people with and without disability. In the end, the results of technology use will always rely on an ongoing process of construction that includes interpreting the various symbolic elements of its use in the process of social interaction.

4.4. Further research

AAT as voluntarily used technology has been shown to enhance the abilities of people with physical disability to promote their personal and social identities in social interactions. The technology becomes part of the capacity of its users to interpret themselves and to act upon themselves. It also becomes an actual interactive element of their personal and social selves. Further research should investigate this process in greater detail and the potential in the free choice of AAT to enhance the process of personal identity formation.

5. Conclusions

As chosen individual expressions of identity among people with mobility impairments, the use of AAT differs from several kinds of AT. In social interaction, the use of AAT creates a foundation for common bodily experiences and non-verbal communication; this, in turn, creates an opportunity to understand technology use and users in a new manner. By being associated with recognisable and valued activities in society, the activity becomes the symbolic object for interpretation. Through this effect, the technology can contribute to positively changing the interpretation of people with mobility impairments and can also change the personal identity of people with mobility impairments. This process of social interaction can contribute to creating gestures or breaking down behavioural barriers between those with and without disability.

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Declaration of interests

The authors report no conflicts of interest.

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Table 1. Main features of the sample.

Gender	Female (n=11)	Male (n=33)			
Age	18–30 years (n=7)	31–45 years (n=14)	46–60 years (n=16)	61–67 years (n=5)	Unknown (n=2)
Mobility Equipment used	Electric Wheelchair (n=27)	Manual Wheelchair (n=19)	Crutches/Cane (n=9)	Foot prosthesis (n=3)	No mobility equipment (n=10)
Activities using AAT	Outdoor individual summer activity (n=41)	Outdoor individual winter activity (n=14)	Outdoor team activity/sport (n=12)	Indoor individual activity (n=4)	Indoor team activity (n=9)

Table.2. Examples of code groups and associated codes.

Code groups	Associated codes
<p>To feel better physically and mentally</p>	<ul style="list-style-type: none"> • Activity is positive for physical and mental health • AAT maintains my health • It is wonderful to increase the heart rate and do sports • Riding is very good for my mental health • Things get easier to manage • Without the aid, it would have had serious consequences
<p>To show other people and oneself that one is capable and can master physical activity and other aspects of life.</p>	<ul style="list-style-type: none"> • Activity provides a feeling of mastery and confidence • Creates a picture of myself as well-trained • Other cyclists stop to talk • It is fun that others are interested • I feel that I mastered something that some healthy people cannot • Important that others do not see me as very handicapped

