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Configurations of the User in the Trajectory of Wheelchairs in India: Learnings for the Socio-technical Design of Smart Assistive Devices

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Abstract. Many features of a wheelchair affect users' actions in a manual wheelchair, determining the overall mobility performance. Based on an ethnographic study of wheelchair users in India, we develop a trajectory analysis centered on the wheelchair as an artifact and the stages in its lifecycle from design to use. This paper focuses on the decisions made and practices in the production and acquisition phases and the consequences further down the line for the end user. In particular, we focus on how different configurations of the user across production and acquisition can make it difficult for users to find a wheelchair well adapted to their situated needs once they bring the artefact into their home and daily routines.

Introduction

Our research deals with the meaning of intelligence in the concept of an "intelligent" or "smart" wheelchair from a socio-technical perspective. Depending on the designers' perspectives, we can place intelligence in the assistive device or in the environment. It would be helpful for designers to find a balance between focusing on the wheelchair design or "designing the ecosystem" to foster the independence of people with mobility impairment (PMI). This aspect is primarily at stake in less-resourced settings, as in the Indian context.

We position our research at the intersection of assistive technology design, CSCW, and HCI4D (Ho et al, 2009). We see a rising interest in the questions of accessibility and assistive technologies in CSCW (Kameswaran et al., 2018) (Pinatti et al., 2020). Following a similar direction, we are interested in understanding the use and limits of assistive devices from a sociotechnical perspective. For CSCW, achieving successful design and innovation is considered a process where attention needs to be paid to technical possibilities within a specific social and work environment. Ethnography (Martin & Sommerville, 2004) is specifically targeted at providing rich understanding of social phenomena as it occurs in everyday settings (Randall et al., 2007).

We are interested in how technology and assistive devices can hamper or provide support for people to develop their independence in their daily lives (Scherrer, 2005) (Rumeaux et al., 2021). This phenomenon is tied to complex interdependencies between persons, assistive devices, and the environment (Bennett et al, 2018). What factors influence the opportunities and decisions of acquisition and training of an assistive device like a wheelchair? What are the challenges and the outcomes after obtaining a wheelchair? We focus our analytical contribution toward an artifact's trajectory through multi-sited ethnography (Marcus, 1995). Our trajectory analysis presents how an artifact goes through different stages, from production, acquisition, and use of the assistive device into a daily routine up to sometimes discarding it. We emphasize the critical issues that influence the decision to acquire a wheelchair and the challenges and outcomes after obtaining it. These issues stretch beyond the dialogue between designers and users through an artifact and involve stakeholders often not anticipated in assistive technology design. To understand the challenges faced by persons with mobility impairments (PMI), we examine the different configurations of the user (Iivari, 2006) at crucial decision points and describe the elements involved in how a person ends up with a particular wheelchair and how she succeeds to do something or not with it. Once the decision is made, it is often too late to re-consider the choices made in an earlier stage.

In this paper, we specifically focus on how different actors throughout the trajectory are enacting different configurations of the user and how this can lead to a mismatch of the wheelchair with the user's needs. Our notion of configuration of the user has its roots in the work of Goode (1994) dealing with the

communication skills of deaf blind children where he emphasizes the contrasting views of family, hospital or specialized schools towards the children's' abilities. The notion is also connected with Iivari (2006) on HCI practitioner's perspectives. We present example cases from our field study to illustrate different situations of acquisition and evaluation of the user as a welfare recipient in a bureaucratic process, a customer or a patient undergoing rehabilitation.

Related Work

We present the overall aim of building smarter wheelchairs and the different approaches researchers and designers are mobilizing towards this direction. Then we highlight the adoption of assistive technologies as a complex sociotechnical achievement that requires a considerable amount of work for finding a good fit between a person and a wheelchair. However, the studies on the complexity of the appropriation of wheelchairs tend to put in the background the production of the artefact and the question of how a person ends up with an assistive device for use in her daily life. We suggest that there is a need for a more longitudinal and multi-sited approach, a trajectory analysis, to account for part of the complexity and decisions that are at stake before the person with mobility impairment (PMI) even encounter her wheelchair and which could inform future approaches for the development of smarter wheelchair.

Towards "Smart Wheelchair"

Research on the design and technology components of "smart wheelchairs" covers a broad spectrum of topics and sub disciplines in the Human Computer Interaction and Human Robot Interaction fields.

One approach is focused on providing new features and improvements to the wheelchair itself. A substantial amount of research, for example, addresses ergonomic topics focused on reducing or minimizing the physical and cognitive (perceptual) requirements to navigate in a wheelchair. An example of this line of research might include adapting interfaces and controls to the specific physical and mental impairments or preferences of the users by replacing the traditional joystick-based movement interface with a voice controlled or gesture-based interface (Trivedi et al, 2013, Guedira et al, 2016, Megalingam et al, 2011)). Navigation is also a central concern with the aim to seamlessly transition between autonomous, semi-autonomous, manual and caregiver assisted navigation (Kobayashi et al, 2011), or from having smart collision avoidance technology to better navigate crowded spaces (Kuno et al, 2001).

Another stream of research focuses on developing smarter environments for wheelchair users. Here the focus shifts on integrating the augmented wheelchair with other elements of an ambient intelligent or robotic platform. This may

involve making the wheelchair the central point of control for smart home infrastructure (Cardoso Bissoli et al, 2016), or extending the capabilities of the wheelchair to integrate (and make accessible) common ICT technology like pointers and projectors (Asai et al, 2016). Finding the proper balance between equipping the person or adapting the environment to foster mobility and independence appears as the current stake. However, the study of adoption of existing wheelchairs also points to supplementary challenges as technology grows in complexity.

Adoption of Assistive Technologies as a Sociotechnical Achievement

Restoring or improving the mobility of PMI is a complex endeavour as accounted for by the rich stories shared by Scherrer (2005) about persons with spinal cord injuries and how assistive technologies support them in their daily life. The adoption of a wheelchair can be seen as a process of *adjustment* between the person and the wheelchair (Winnance, 2006). Winnance describes with nuances how such an assistive device is personalized with customizable or additional components in search for a good trade-off in terms of comfort but also paying attention to the person's current and aimed activities, as well as her living environment and relationship with formal and informal caregivers (Winnance, 2010). This adjustment goes also in the direction of the person, her body that evolves and adapts to the wheelchair with time (or as adapted to a previous wheelchair), as much as her choices towards possibilities of action that will be more or less difficult with one wheelchair setup than another.

This complex process of adjustment echoes CSCW perspectives on appropriation and how users are integrating technologies to their actions. Dourish defines appropriation as "the way in which technologies are adopted, adapted and incorporated into working practice" (Dourish, 2003 p. 467) which concurs to the end-users adapting or developing work-around to the artefacts for achieving their practical purposes. This line of work insists on how the design of technology is continuing with use (Henderson & King, 1991). This research also put a special emphasis on the social dimension of appropriation (Draxler et al., 2012) where the adaptation of technology is emphasized as a collective achievement.

The sociotechnical approach of appropriation is also in line with the concept of interdependencies in assistive technologies research and design (Bennett et al, 2018). Distancing from the widespread view that assistive technologies should bring more autonomy, this perspective focuses on the interdependency relationships that develop between the person, her assistive devices and the persons who share her life (for instance, relatives, colleagues, caregivers). Appropriation and interdependence appear as key notions to understand assistive technologies adoption as a sociotechnical achievement. However, the studies so far are mostly concerned with situations where the artifact is already there and made available to the PMI without much inquiry upward into how a person gets a specific wheelchair. We suggest that there is also a need to better understand

assistive technology production and acquisition as it has impact on the range of options available for appropriation.

Longitudinal and Trajectory Analysis of Technology

In order to develop an understanding of how a user ends up with a specific wheelchair and the consequences about how she succeeds to do something about it or not, we need to go beyond a focus on appropriation situations. We identify three different approaches in literature that expand the boundaries of appropriation: domestication, the trajectory for technology-supported elderly care work and the approach of Biography of Artefacts.

The perspective of domestication (Silverstone & Haddon, 1996) considers the steps that are occurring before, during, and after the technology is introduced. This longitudinal approach provides an analytical framework to account for different stages in the adoption of technology artifacts: appropriation, objectification, incorporation and conversion. The model supplements research on the appropriation of technology in practices (Balka & Wagner, 2006; Draxler et al., 2012) as it accounts for steps before the technology is available in the field site. Several studies on technology domestication have been conducted on work organization (Pierson, 2005), healthcare (Gaglio et al., 2016), or social media (Simpson et al., 2022). From this line of work, we keep the orientation towards furthering the analysis before and after the encounter between an artifact and its user.

Woll & Bratteteig (2019) develop a trajectory analysis of elderly care work with a focus on the role of 'welfare' and assistive technologies. Grounding their work on trajectory analysis of healthcare work (Corbin & Strauss, 1991, Strauss et al. 1985), they tie the different forms of work at stake for the elderly persons and their formal and informal caregivers along their growth in age and the worsening of their condition. In a similar vein, Pollock & Williams develop an approach of Biography of Artefacts (BoA) in order to go beyond local issues of technology adoption, that is bound to one person or organization. Despite their approach being focused on e-infrastructure and information systems we share their concerns "to engage more coherently with the ways in which longer term history and the broader context shape innovation processes and outcomes" (Pollock & Williams, 2010, p. 531). In this direction, we follow their suggestion to develop longitudinal and multi-sited studies (Marcus, 1995) to achieve a better understanding of the sociotechnical dimension of assistive technologies with the aim to inform the development and deployment of future innovation for smarter wheelchairs.

Fieldwork and Methods

Fieldwork provides insights into the user's everyday space, their day-to-day activities, their relationship with their assistive devices and their caregivers, the role of assistance, and most importantly, the trade-offs between being independent and interdependent, that is, relying on others. Given the distributed nature in space and time of assistive technology for mobility impairment in India, we have grounded our approach on multi-sited ethnography (Marcus, 1995). Among the different strategies for conducting ethnography suggested by Marcus, we choose the one of following the object, the wheelchair, as an artifact.

We have first conducted exploratory online interviews via Zoom with multiple wheelchair users and representatives in Bangalore and Delhi (n=15). Then we have organized our fieldwork in Karnataka's metropolitan city, Bangalore, and the rural town, Vijayapura. The town is located 524.9 km away from Bangalore.

Different locations for the ethnographic research were chosen: the user's house, rehabilitation center, hospitals, surgical shops, and NGOs. We also had the opportunity to visit the organization Motivation UK, a global disability charity and social enterprise providing wheelchairs and services to PMI in developing countries.

The locations were purposely chosen, as each had a different setting and faced specific complexities in relation with the wheelchair artefact. During the fieldwork, a translator accompanied us, as the majority of the users were comfortable in their native language, Kannad.

We summarize our fieldwork by location in Table I and Table II.

Table I. Fieldwork activity chart in Bangalore, Karnataka

Rehabilitation Centre	30 days of observational studies
Home visits	5 days of interviews and ethnography, 10 different houses
Motivation India	1 day visit
Production house	2 days visit (same site)
Surgical shops	1 day visit, 2 surgical shops

Table II. Fieldwork activity chart in Vijayapura, Karnataka

Rehabilitation Centre	2 days of observational studies
Home visits	7 days of interviews and ethnography, 14 different houses
Distribution camps	1 day visit
Hospital	1 day visit
Surgical shops	1 day visit, 2 surgical shops

For the analysis of the collected material, we have adopted a trajectory approach following the wheelchair as an artifact that goes through different stages from production, acquisition, and use to discarding the assistive device. This thematic analysis reflects on the ecosystem as a whole, involving the different environments, actors, and users with spinal cord injuries. Through our trajectory analysis, we emphasize the critical issues that influence the decisions to acquire a wheelchair, as well as the challenges and the outcomes after obtaining it.

Findings

In this exploratory paper, we focus our analysis on the production and acquisition stages in the trajectory of wheelchair as we focus on the question of how a PMI ends up with a specific assistive device. We also mention the use stage when we consider the decisions made along the trajectory on the situation of the user. Especially, how the user succeeds or not to do something with the assistive device they received.

Production

In our study, we encountered two organizations, ALIMCO (Artificial Limbs Manufacturing Corporation of India) and Motivation who are producing most of the wheelchairs we encountered in our fieldwork. Both organizations have different perspectives on the end user's involvement in the design process.

ALIMCO falls under the Department of Empowerment of Persons with Disabilities, Ministry of Social Justice and Empowerment, Government of India. It is a non-profit organization that has manufacturing units in Kanpur and Bangalore. We had the opportunity to learn about their process, including assembly, quality check and shipment of the devices. In conversation with the production manager of the site at Bangalore, he mentioned:

“We have everything in place from the guidelines, specification of the product to the final control check. We never felt that there was a requirement to involve users in any testing of the products. ALIMCO aims to reach the masses and allow them to have access to assistive devices. Our goal relies less on comfort and inclusivity.” (ALIMCO, Production Manager)

Motivation is a global disability charity and social enterprise that provides wheelchairs and services to disabled people and partner organizations in developing countries. The organization has multiple regional offices worldwide, and we had the opportunity to visit its regional office in India, where the regional manager explained how the organization works and how its designs cater to the Indian population. He mentioned:

“Usability testing is a deal-breaker. [...] We always try to create a prototype and pilot test it with the users before moving on to the production” (Motivation India, Regional Manager).

The organization follows the WHO guidelines and develops its wheelchair anticipating a trajectory of assessment, training, follow-up, maintenance, and repair.

Although both organizations focus on providing the assistive device, Motivation emphasizes research and has a user-centric process while ALIMCO's aim is to provide an assistive device to a larger audience, especially those who can't afford it. Motivation follows the WHO standard for design, while ALIMCO follows the BIS (Bureau of Indian Standards) and emphasizes quantity over quality. ALIMCO is directly involved in manufacturing and delivery through distribution camps. Motivation has a different approach, designing and distributing via various mediums and organizations, especially collaborations with other NGOs for distribution.

Acquisition

In India, PMIs obtain assistive devices through various mediums. These mediums could vary in location, level of injury, and financial aid. During our fieldwork, we had the opportunity to explore different acquisition mediums and organizations: provision through government welfare programs, independent purchases from surgical shops and acquisition guided with the support of NGOs and rehabilitation centers. We encountered the challenges of acquiring the wheelchair and how the lack of awareness of users' needs leads to partial configurations of the user. We observe that these limitations could lead to more complications at a later stage.

The configuration of the user as a welfare recipient

The government of India has a welfare program intended to "Assistance to Disabled Persons" (ADIP). ALIMCO wheelchairs are provided based on this scheme. The essential criteria are that one should have an income certificate that shows that your income is less than Rs. 15,000 per month (170 €). The program has three requirements: providing a Disability Certificate, an income certificate and the identity card. One scheme applies to people above the age of 60 years and the other to the younger. For ALIMCO the age threshold plays a role in limiting the choices of artifacts and the compromises that users have to make in terms of parameters like portability, range, and robustness.

The acquisition of the assistive device can take up to two to three months. Among the required documents, the Disability Certificate is the most difficult one to obtain. After the injury, the user must visit the district hospital for an evaluation. This evaluation focuses on the percentage of lower limb injuries. For instance, the user must have 40% of lower limb injury to qualify for the ADIP scheme. This approach of quantifying the impairment makes it difficult to

appreciate the complexity of a user's situated needs. In this configuration of the user, the disability certificate serves more to demonstrate that you are "disabled enough" to merit assistance from the government than to make an evaluation for finding a suitable wheelchair.

The configuration of the user as a customer

In general hospitals, wheelchair service provision is least considered or not considered. The doctor suggests to the user that the assistive device they need is a wheelchair, and they refer them to the nearby surgical shops.

Surgical shops are like any other shop but to buy assistive devices. Anyone can purchase the device at surgical shops, but the shops are mostly inaccessible to people with physical impairment. It is usually located near a hospital or a rehabilitation center for easy access. The shops are mostly inaccessible, and there is no provision of ramps for PMI to enter the shop and explore the different variations of available assistive devices. In what follows we report on the case of Swami, who recently had an accident and is dependent on the temporary wheelchair provided by the hospital. Swami is assisted by her caregiver Seema and needs a wheelchair that fits his requirements and is easy to propel. Unfortunately, Swami, who has a mobility impairment, cannot access the shop because of poor infrastructure.

Seema: We would like to buy a wheelchair for my brother-in-law, who recently got discharged from the hospital. He has a T4 spinal cord injury.

Salesman: Do you have a model in mind?

Seema: No, you can suggest to us what is the best solution.

Salesman: We have a few models available in the shop, which I can show you, or you can place an order; it will take a minimum of two weeks to deliver.

Seema: We are looking for you to help us to decide on the model.

Salesman: What's your budget?

Seema: Rs. 10,000 (120 €)

Salesman: We have three models in this budget.

It is clear from this vignette that the sales assistant and Seema are exchanging dialogue with one another. Through conversation, they asked each other for help and checked on one another's understanding of finding a suitable assistive device under the given budget. Although, there was no dialogue exchange with Swami, the concerned PMI, neither about the evaluation or the envisioned use of the assistive device. The salesman isn't aware of the importance of an evaluation process of the PMI needs, so it's more like a commercial transaction. The shop does not provide any follow-up or training.

The configuration of the user as a patient undergoing rehabilitation

The acquisition process for wheelchairs with NGOs or at a rehabilitation center differs from the above-mentioned process. During our fieldwork at Motivation India, we studied the assessment process to acquire a suitable wheelchair.

After securing an appointment, the user or the caregiver must carry the necessary documents like the Disability Certificate, Income Certificate, and ID proof on the appointment date. In a few cases, the organization opts for part funding, where the user would contribute part of it, and the rest of it, donors, come into the play. Usually, it takes from one day up to one month to identify a donor.

The acquisition process with Motivation is a three-step process involving evaluation and prescription, secondly funding and ordering and thirdly and fitting, user training, and delivery of a device.

- (1) Assessment and Prescription: To begin with the evaluation process, the organization follows the WHO guidelines for wheelchairs (Figure 1). It includes forms and a checklist that can be modified according to the context and customized per the service provision. The wheelchair assessment form captures the user's demographics and preliminary information regarding their environmental condition, occupation/lifestyle (what they do), location (urban or rural), and activities they engage in daily life. The second step is the physical examination, which focuses more on their sensory level, strength regarding their transferring capabilities, and body measurement.

The image shows two pages of a 'Wheelchair Assessment Form'. The left page is titled '1: Interview Assessment' and contains sections for 'Information about the wheelchair user' (Name, Age, Address, Goals), 'Physical condition' (Cerebral palsy, Frail, Amputation, Bladder problems), 'Lifestyle and environment' (Distance travelled, Hours per day, When out of wheelchair), and 'Existing wheelchair (if a person already has a wheelchair)'. The right page is titled '2: Physical Assessment' and includes 'Prevalence, risk or history of pressure sores', 'Method of pushing', and 'Measurements'. The 'Measurements' section has a table with columns for 'Body Measurement', 'Measurement (mm)', 'Change body measurement to ideal wheelchair size', and 'Wheelchair measurement'. Handwritten notes and a calculation are visible at the bottom of the right page.

Body Measurement	Measurement (mm)	Change body measurement to ideal wheelchair size	Wheelchair measurement
A Hip width	380	380mm	360mm
B Seat depth	440	400mm	370mm
C Calf length	520	380mm	330mm
D Bottom of rib cage	310mm		300mm
E Bottom of shoulder blades	460	420mm	470mm

Handwritten notes on the right page include: 'P. some risk: address after sitting for 15-20min (10min times)', a calculation '(380 x 440 x 450)', and '430'.

Figure 1. An example of the document used during evaluation by Motivation India that exemplifies the configuration of the user as a patient undergoing rehabilitation.

- (2) Funding and Ordering: The organization charges a minimum amount for the process. They have trained staff to perform the procedure. The organization takes around 10% -12 % of the total cost. For instance, the end-to-end service amount is Rs. 30,000 (360 €), including the price for the wheelchair, which is around Rs. 27,000, including taxes and transportation. Depending on the scenario, the user or the funder bears the cost.
- (3) Fitting, User training, and Delivery: The organization has prefabricated support devices. It depends on the case-to-case scenario; as previously mentioned, location plays an essential role. If the user is in the vicinity, Motivation take around 1-3 days and split the tasks to complete the whole process from assessment to delivery, but if the user lives far away, the organization tries to complete the process in a single day, and that takes about 6-8 hours. Fitting is complicated as it depends on the case. If there are postural issues, it can take from two hours to a day.

The evaluation process is similar to what we observed in the rehabilitation centre we visited with the APD. The difference is that APD has a three-month rehabilitation program. The program is based on the caregiver model wherein the caregiver has to stay with the user for a month to assist them in their day-to-day activities. During this time, the user can form a relationship with the wheelchair and their primary caregiver. There are different training sessions to build up their confidence.

Pushing complexity downward in the trajectory

Most of the PMIs we met who benefited from a wheelchair through the government welfare program are complaining that the assistive device they received did not fit their needs. The situation is similar with PMIs who received a wheelchair purchased from surgical shops or from hospital donation. In such cases, the users describe those wheelchairs as "Good for nothing". One of the users mentioned, "This wheelchair is fragile and low-quality; it isn't robust enough to move around in the outdoor and indoor environment. These wheelchairs are meant for transfer but not for navigation, the seating isn't comfortable for long hours, leading to more complications than solutions."

Given the reductionist view of PMIs offered through the configuration of the user as welfare recipient or customer, the complexity of mobility impairment appears thrown downwards in the trajectory. To mitigate the lack of adaptation, PMIs and their caregiver engage in do it yourself (DIY) adjustments without much supervision. For instance, in the rural part of Karnataka, Vijayapura, we observed people who tried different DIY methods out of the available options in their

natural surroundings. The idea behind this approach is to have more comfort at the lowest price possible. The case of Kanna epitomizes the issue.

Kanna manages his shop from morning to evening and takes a break in the afternoon to sleep. He mentioned:

"Sitting in the chair for long hours is stressful. Your body requires movement, and I know some sitting exercises that I perform during the day, but the seats could be more comfortable and designed for prolonged sitting hours. There is no arrangement for air passage, and it starts to sweat and become quite uncomfortable. I have tried different methods like placing an extra cushion or shifting myself to the bed after every three hours. Vijayapura is a hot city, and sweat is the normal reaction to this weather. I have been using this method of placing an auto rickshaw tier on my seat for the last six months, and that's been helpful. It creates a space between you and your seat and provides a passage for the air passage".

Along the same lines, the healthcare professional had a different point of view, as explained by Saraswati, an occupational therapist we met:

"The practice of placing an auto rickshaw tier is damaging in the long run. It affects your spine and can also be a major cause of bed sores. There are multiple solutions available in the market, but most people do not have the awareness and purchasing capacity, and that's where our role comes into the picture. We do home visits and try to guide them towards the best alternative solution."

The case of PMIs who benefited from the support of NGO and rehabilitation centers have a more favorable evolution. The configuration of the user as a patient undergoing rehabilitation appears as a better support for dealing with the complexity of mobility impairment at least in part.

However, at the rehabilitation center, users don't have access to explore the environment outside the rehabilitation center. The rehabilitation center is like a "controlled environment" where the setting is accessible, and the professional staff is there to help the person in need. In the outer or uncontrolled environment, after the rehabilitation training, the users have to cope with the problems independently without having the flexibility to return. Once a person gets discharged from the training, the outside environment surprises most of them. The need for adjustment is felt more than ever. Parul is 29 years old and he described his experiences after the rehab training as:

"The roads are full of small stones and uneven while in the rehabilitation center; I had never faced such problems. It feels like a different world, and I began searching for my comfort and requirements options."

This comment highlights that even the configuration of the user as a patient undergoing rehabilitation is not without limits, and PMIs have to rely on the support brought by informal caregivers and relatives to overcome them. The case of Raja is particularly illustrative at this level.

Raja is 38 years old and lives in a village named Vijayvada in Karnataka. He has a family of four, two kids and a wife. He is the only breadwinner for his family. He overlooks the farm while sitting on the patio area of his home. He gained independence after his time in rehabilitation.

In a conversation with him, he said:

"As far as my responsibilities are concerned, I have a daily routine of bringing my kids to school in the morning, and while coming back, I make sure that I get a can of purified water and some fruits and vegetables for my family. The only hurdle I face is the difficulty of getting on and off the scooter while not in my familiar setting. When I go out on a scooter, I always ask my friends or son to get down to buy something. I can't perform the same action. It's quite hard to explain, and I feel free and restricted simultaneously".

With time, a PMI who succeeds to appropriate their wheelchair gains the experience and skills of using their assistive device and aims at more complex activities, for instance going for errands in the city with an adapted scooter. They would benefit from having the opportunity to get back to the rehabilitation center to find proper support and training for their new aim. However, this is scarcely possible given the limited availability of such service and its focus on previously untrained PMI.

Discussion and Future Work

Our study of the production and acquisition of wheelchairs highlights the involvement of different stakeholders that stretch the issue of how a wheelchair can support the independence of PMI beyond a conversation between designers and users. The complex adjustment between a PMI and a wheelchair (Winnance, 2006) gets more or less reduced along the trajectory depending on the different configurations of the user that are enacted by the different actors involved. Depending on the location and the hospital referral, the PMI sees her situation evaluated with more or less nuances, which makes her ending with a more or less adapted wheelchair and with little support to develop their independence apart from the case of rehabilitation center training.

As we have seen, the less the complexity of the situation has been dealt with in the acquisition process, for instance by reducing a PMI to her age, income and percentage of impairment, the more this complexity will have to be dealt with at a later stage. The PMI and their caregivers will have more efforts to do to compensate for the lack of understanding of their needs through DIY adaptation

and daily work to cope with mobility impairment. Echoing the observation that it would be more beneficial to learn the use of an assistive device before the need arises (Woll & Bratteteig, 2019), we identify that the early provision and support appear key for getting benefits from a wheelchair.

The critical importance of the acquisition stage appears often neglected in wheelchair production and design. Going back to the endeavor of designing smart wheelchairs, we observe that the ambition of improving the independence of PMI in our context will certainly get lost in the trajectory. Between the focus on improving the wheelchair or the environment, there is crucial room for improvements in the process of acquisition and evaluation for helping the user and their caregivers to find a proper assistive device. Adding complexity to the wheelchair itself is a challenging proposition. A more complex or “smart” artefact requires a more detailed and nuanced evaluation of its future user situation. If not properly dealt with in acquisition, the complexities are dispatched over the shoulder of the PMI and their caregivers.

In future work we are interested in furthering our trajectory analysis on the use stage contrasting the cases of our fieldwork between rural and urban area, as well as indoor and outdoor environments. We are interested in pursuing our analysis of how the PMIs and their caregivers develop innovative ways to compensate for the lack in the trajectory. We also plan to consider how and why a wheelchair gets discarded as this situation set out a starting point for a new journey in the trajectory.

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