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Alignment Work for Urban Accessibility: A Study of How Wheelchair Users Travel in Urban Spaces

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Mobility is the key for people with disabilities to have full participation in life. To support their mobility, previous work primarily focused on accessibility as an attribute of the external environment to be evaluated, labeled, visualized, and improved. Relatively less work has looked at how people with disabilities go out and move around in practice and work to achieve mobility. This paper presents a qualitative study of 14 wheelchair users' travel practices in everyday life in China, highlighting urban accessibility as *alignment work* – the use of an awareness of the conditions along the journey to continuously align and re-align various resources to ensure accessibility and mobility across contexts and moments. By highlighting alignment work, we present another side of the story of urban accessibility, and broaden design considerations to support mobility for wheelchair users.

CCS Concepts: • **Human-centered computing** → **Empirical studies in accessibility**.

Additional Key Words and Phrases: Wheelchair users, people with mobility impairments, people with disabilities, accessibility, alignment work

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1 INTRODUCTION

Full social participation is recognized as a basic right of people with disabilities [46], and the ability to go out and move around is considered the key to achieving this goal. Today, as the number of people with disabilities continues to grow, and the global population is gradually aging, increasingly more attention has been paid to issues of mobility and accessibility for people with

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disabilities in different kinds of environments. For instance, while China as a developing country has fallen behind in terms of making environments accessible for people with disabilities, in recent years, continuous efforts have been made to improve the accessibility of public spaces, including passing relevant laws and providing guidelines [86].

Different theoretical models towards understanding disability/accessibility exist, leading to different approaches to address it. The early medical model sees disability as a result of individual physical impairment, with the solution of medical treatment [45]. The more recent social model stresses the impact of the external world on the disability [54], shifting our attention from medical treatment to environmental improvement [13], such as removing steps and uneven surfaces [17, 70], and most recently shaping policies, regulations, and socio-cultural norms [23, 49, 62]. The relational model of disability [35], however, focuses neither on individuals nor on the external environment, but draws attention to the interactions between them, highlighting the relative, dynamic and productive components of disability and accessibility [31], and calling for more interactive and collaborative solutions.

Where urban accessibility is concerned, previous work has primarily been done through the social model. From this perspective, accessibility is the attribute of particular environments such as streets [53], public transportation [81], city centers [13], and sidewalks [40]. While these works reveal strategies people with disabilities use to achieve accessibility, such as carrying tools with them, or enhancing their own capabilities [73], their main focus remains on identifying the external factors that make a space accessible or not [49]. The social model is similarly manifested in works that explore how Information and Communication Technologies (ICTs) can support urban accessibility. Much work has been done to provide accessibility information for Points of Interest (POIs) on a map to support people with disabilities' planning of their trips [43, 55, 58]. Along this line of thought, topics such as manual or automatic collections of accessibility information [29], accessibility assessments and quantifications [2, 27], road accessibility modeling [74], and automatic path planning and navigation [38, 48, 75] have all been actively explored. As such, previous work has largely viewed accessibility as a property of the urban space to be assessed, modeled, represented, visualized and improved, and we still have a limited understanding of how people with disabilities manage a trip from here to there, often across different sections of the city and different kinds of space.

Drawing inspiration from the relational model of disability, this paper explores urban accessibility, not as a series of external properties but as dynamically constructed by interactions with the urban environment. We conducted a qualitative study with 14 wheelchair users from two different cities in China, and inquired about their practices of going out and managing their trips in their everyday lives. What the study highlights is that people with disabilities, rather than passively accepting the external environment as it is, actively and creatively work to arrange resources in a way that allows them to overcome barriers when traveling across the city, achieving mobility and accessibility. In this paper, we term this work *alignment work* – based on their awareness of the conditions along their journey, people continuously align and re-align various resources, designed with accessibility in mind or not, to ensure accessibility and mobility across contexts. Echoing the view of accessibility as dynamically co-created through human interactions with the environment, and extending the interdependence framework which stresses relations and work for accessibility [9], we use the concept of alignment to emphasize the various relations our informants engage in (e.g., with tools, peers, work staff, strangers), the agency they enact, and the work they perform to weave them together in order to achieve mobility when going out and moving around.

The contributions this paper makes are threefold: 1. an empirical study of how wheelchair users travel in China, a relatively understudied context of accessibility; 2. an extension of the relational model to the domain of urban accessibility for wheelchair users; 3. an emphasis on the alignment

work wheelchair users engage in, and a broadening of our design considerations beyond those of accessibility maps to support wheelchair users towards achieving mobility in urban spaces. In the following sections, we will first review related works on disability and accessibility as well as urban accessibility for wheelchair users, and provide a background on accessibility in China where the study is conducted. We will then present our study, followed by our findings on the different kinds of alignment work the study uncovered. Based on the findings, we will end with a discussion of urban accessibility as alignment work as well as the implications for future design to support mobility for wheelchair users.

2 BACKGROUND AND RELATED WORK

2.1 Disability and Accessibility

“Disability”, from the traditional medical point of view, is defined as a functional defect of the human body, and the solution is to treat and make up for the defect [45]. The more recent social model of disability, however, suggests that, compared to physical impairments, inaccessible environments and social attitudes are actually bigger barriers to mobility and participation in society [54]. Increasingly more work has been done using the social model to assess and improve the environment as a way to address disability and accessibility issues. For instance, research has identified a range of factors that make an environment accessible or inaccessible to people with mobility impairments or wheelchair users, including narrow aisles, missing curb ramps, steps, and uneven surfaces [13, 49, 52]. More recently, more attention has been drawn to the social properties of the environment, mainly in terms of policies and regulations [25, 62].

While helpful in identifying issues and solutions in the environment, the social model of disability is also considered insufficient to some extent [64, 65]. It focuses exclusively on barriers, overemphasizing the distinction between “impairment” and “disability”, and overlooks many of the medical needs of people with disabilities [35, 64]. It seems as though the medical and the social models are a dichotomy in the understanding of disability, and both are only able to capture part of accessibility issues [31]. What is increasingly recognized is that disability neither lies in the body nor in the environment, but is produced through interactions between the two [30, 31, 35]. For instance, studies showed that people with vision impairment continuously negotiate their abilities in different social contexts, through social and material interactions with the world [72, 79]. The contention is that disability should be viewed not as static or fixed, but as dynamically constructed and manifested through encounters and interactions with the environment [35, 51]. As such, this new perspective defines disability and accessibility as more relative, dynamic, and productive concepts, which we refer to as the relational model of disability.

Following the relational model of disability, Bennett et al. propose “interdependence” to complement traditional “independence” as a framework to help identify new additional design opportunities for assistive technologies [9]. In particular, they present four tenets that focus on “interdependence” can help make visible: relations that refer to how people and things come together in a particular moment; multiple forms of relations and assistance happening simultaneously; the work people engage in to co-create accessibility; and the ability-based hierarchies implicitly used in different domains [9]. Earlier work revealed the cooperative aspects of accessibility in mixed-ability situations in both home [11] and work spaces [12, 33, 76], and in interactive activities with others, such as navigation [78, 82], medical conversation [56], shopping [71, 80] and exploring new settings [72]. The new interdependence framework helps further uncover a rich set of collaborative and dynamic practices in the making of a range of activities more accessible, including extreme sports [1], canoe paddling [4], DIY(do-it-yourself) [18], co-reading [68], collaborative writing [19],

and co-designing [5]. This line of work has resulted in many design insights to foster peer co-operation and socialisation, as well as technology interactions [7, 15, 16, 60, 67]. However, this work heavily leans towards people with vision impairment and their long-term close-knit social relationships [6, 10, 19, 60, 68, 69], and it leaves some other areas largely under-explored, such as urban accessibility for wheelchair users, which is what we focus on here in this paper.

2.2 Urban Accessibility for Wheelchair Users

There are rich studies on accessibility in built environments for wheelchair users, mainly from the urban design perspective. These studies reveal the strategies people employ to move around, e.g., seeking advice from caregivers, using heuristics based on personal experience, and avoiding crowds [9, 13, 27]. However, overall, this body of research tends to focus on particular sections of the urban environment, such as a city center [13] or public transport [73], rather than focusing on traveling as a holistic practice that might involve all these spaces in one journey. Starting with an inquiry into wheelchair users' travel practices on a daily basis and how they manage their trips, we reveal the strategies they use and the work they perform in order to achieve mobility across different sections of the urban space.

There is also extensive research exploring ICTs to support mobility for wheelchair users in urban spaces. It has mainly focused on helping wheelchair users plan and prepare for their trip by providing accessibility information on the map [14, 32, 37]. For example, MPASS [58] is an urban accessibility map system, which collects geo-referenced information on urban obstacles and facilities through sensing, crowdsourcing, etc., and provides personalized maps and paths according to users' preferences and needs. Beale et al. collected information through aerial photography, ground-truth surveys, and questionnaires, and then quantitatively analyzed the differences between the travel barriers of able-bodied pedestrians and wheelchair users [8]. Other studies found that people with mobility impairments already leverage existing location-based technologies to evaluate the accessibility of the environment, e.g., using Google Street View to gauge travel routes and destinations [27, 28].

The functionality of accessibility maps is conditional on the availability of reliable data, and obtaining such datasets is no small feat [20, 22, 23]. As such, the collecting of accessibility data, in itself, has become an active area of research. For example, in order to encourage more users to become data contributors, some systems use game elements to entice users to join [57, 59, 63]. There has also been work focusing on combining crowdsourcing with other technologies, such as Google Street View, computer vision, machine learning (ML), and the Internet of Things, [28, 29, 36, 47] to collect physical accessibility data. The Sidewalk project, in particular, leverages Google Street View, crowdsourcing, and gaming to map out the accessibility of the sidewalks in a city, including curb ramps, places without curb ramps, sidewalk obstacles, surface problems, the lack of a sidewalk, and so on [63].

More automatic and intelligent technologies have also been explored for accessibility data collection and urban navigation. This body of work includes helping to automatically monitor and assess accessibility using smart sensing and cloud computing technologies [2], predicting the condition and the quality of urban pedestrian accessibility based on a fuzzy logic prediction model [66], and recommending the optimal route or suggesting paths based on the modeling of urban accessibility to help avoid obstacles [3, 38, 58, 75]. While most modeling focuses purely on external physical properties, some seek and propose frameworks to assess accessibility based on an integral consideration of human capabilities and the environment [25, 34]. Overall, however, we still have a limited understanding of how wheelchair users work out and co-construct accessibility and mobility in the urban space.

2.3 Accessibility in China

This study was conducted in China, the largest developing country in the world, with 85 million people with disabilities as of February 2020, accounting for 6.21% of the total population [86]. Over the past three decades, there have been continuous efforts to make environments in China more accessible. The notion of “accessibility” first appeared at a symposium on “People with Disabilities and the Social Environment” in China in 1985 [89], and the first accessibility construction design standards came into effect in 1989 (“Design Standards of Urban Roads and Buildings for the Convenience of Persons with Disabilities (Trial)” [87]. In 1990, the “Law of the People’s Republic of China on the Protection of Disabled Persons” specified that “The nation and the society will gradually put into practice the design standards of accessible urban streets and constructions”. Since then, a campaign to build model accessible cities has been underway, with Beijing, Shanghai, Tianjin and others identified as the first 12 cities to promote the construction of accessibility, with the campaign then expanding to include 100 more cities [89]. In 2008, the Chinese government signed the United Nations Convention on the “Rights of Persons with Disabilities” [46]. Based on the previous 20 years of practice in the construction of accessible environments, the Regulations on the Construction of a Barrier-Free Environment” [84] came into effect. In 2017, China committed to expand the construction of accessible environments to rural areas. Since that time, China has gradually added laws to legally ensure citizens’ rights for accessible travel.

Besides accessible environment construction, there are “Disabled Persons’ Federations” that provide certain services for people with disabilities. At the local Disabled Persons’ Federation in Shanghai, for example, people with disabilities can apply for assistive tools, such as crutches and wheelchairs, free of charge. Local Disabled Persons’ Federations in other cities also provide similar services. Overall, people with disabilities’ going out and traveling around are actively encouraged and supported by the Disabled Persons’ Federations.

However, despite these efforts and a great improvement in urban accessibility over the past three decades, there are still various challenges and inaccessible environments. Even though there are laws, regulations, and standards, due to differences in topography and built environment, ambiguity still exists in terms of how to actually guide the construction practices, and there is still a lack of unified standards. Also, there tends not to be much long-term planning in the guidelines for the accessibility construction process, and for many older buildings, it is difficult to adapt to the changing requirements. As a result, in many urban spaces, such as shopping malls, mobility challenges still remain for wheelchair users, although providing barrier-free access is required by law. At the national level, the accessibility of different regions remains unequal, with the eastern and central regions of China being relatively better constructed than the northwestern and northeastern ones, mainly due to different levels of economic development. More so, it has been reported that in the more accessible regions, only specific places (Beijing Daxing International Airport [85], Shanghai Disney Resort [83]) are actually accessible, and these places aren’t well connected [90]. This is to say, the construction of accessible spaces has not been properly integrated together, so wheelchair users still face a lot of issues when travelling around. With more than 600 cities with various levels of economic development, accessibility is very unevenly constructed in China. In general, the proportion of people with mobility impairments going out on a daily basis is still relatively low [91], and their daily travel activities are characterized by short travel distances and a lack of independence [88].

3 THE STUDY

3.1 Participants

We employed a qualitative study to gain a better understanding of the travel practices of wheelchair users. For the study, we recruited a total of 14 wheelchair users as our informants. Our main screening criterion was that they should have gone out recently. Considering different cities have very different levels of accessibility, apart from recruiting informants from Shanghai (also known as Hu for short), which is one of the most developed and accessible cities in China, we also made attempts to recruit informants from Qufu, a small county-level historical city in Shandong province (also known as Lu for short). It is worth noting that, as mentioned, the proportion of people with disabilities to go out on a daily basis is still relatively low in China, and the fact that we used “have recently gone out” as a screening criterion also means that the informants we recruited are relatively more active in travel and enjoy a relatively good social-economical status, and are not representative of the general population with disabilities in China. For recruitment in Shanghai, we first contacted a wheelchair user who we once collaborated with and who has been quite active in organizing volunteer activities for people with disabilities in China. Through his help, we recruited 5 informants, and one of them introduced an additional informant. We also then recruited 1 more qualified informant through the “Shanghai Hongkou Yiqunren Volunteer Service Center”, a volunteer organization that sometimes carries out projects for the local Disabled Persons’ Federation and helped distribute our recruitment information to some wheelchair users. For recruitment in Qufu, we first contacted someone in our social network who qualifies for the study, and then got 5 more informants through the snowball sampling approach. We also contacted the local Disabled Persons’ Federation for help. They introduced us to some wheelchair users, and one agreed to participate in our study. As such, we ended up with 14 qualified informants in total, 7 from Shanghai, and 7 from Qufu. We will use Hu and Lu to designate Shanghai and Qufu respectively, and number them according to sequence. Table 1 shows more detailed information about our informants, including their impairment and tool use.

3.2 Procedure

We conducted face-to-face interviews with our informants at locations of their choice, with 3 at home, 4 at their workplaces, and 7 at outdoor places including shopping malls, cafe, parks, and the activity center of the local Disabled Persons’ Federation. It seems that the more active and sociable informants were more likely to go out to participate in our interviews. The interviews were all semi-structured, and besides basic background information, we mainly asked for details on how they went out and traveled, such as where they went, what they did before the trip, what tools they used, if anyone was involved, how they got there, any issues they encountered and how they addressed them, and so on, starting from their most recent going out or traveling experience. We also asked about their most impressive travel experiences and so on. The interviews did not follow a strict outline, but rather, when interesting and relevant information was reported, we would ask further questions. As our informants were encouraged to recall their travel experiences in detail, some gave narratives of their experiences, and most interviews lasted one to two hours, depending on how rich their experiences going out and traveling were.

In addition, with the consent of the informants and their willingness to actively cooperate, we were given the opportunity to travel with Hu8 and Hu9 as a participatory experience after the interviews (traveled with Hu8 for a journey back home, and with Hu9, to visit a friend). When we encountered key situations (e.g., getting out of a building, getting on or off the subway) during our travels together, the informants explained to us what they were doing and why. All of the conversations were audio recorded as permitted. We also participated in and observed their moving

Table 1. Demographics of study participants. Tools including assistive tools they used to use or they use currently. AL denotes Artificial limbs;C denotes Crutches;T denotes Tricycle;W denotes Walker;HV denotes Handicapped vehicle;MW denotes Manual wheelchair;PW denotes Power wheelchair;SW denotes Sports wheelchair;MWDEL denotes Manual wheelchair with a detachable electric locomotive

ID	Age/Gender	Impairment	Tools	Occupation
Lu1	47/M	Left leg amputation	AL, C, MW	self-employed
Lu2	32/M	Lower extremity disability	MW	self-employed
Lu3	51/M	Left leg below-knee amputation	AL, C, MW	worker
Lu4	35/M	Born with paralysis	MW, PW	self-employed
Lu5	48/F	Lower extremity disability	MW, PW, T, C	librarian
Lu6	42/M	Paraplegia	MWDEL, SW	salesman
Lu7	33/M	Born with paralysis	MWDEL	self-employed
Hu8	34/M	Lower extremity disability	PW	graphic designer
Hu9	61/F	Lower extremity disability	MWDEL, MW, PW	retired
Hu10	72/M	Lower extremity disability	MWDEL, PW, C, MW, HV	retired
Hu11	52/F	Spinal cord injury(SCI)	MWDEL, MW	self-employed
Hu12	64/F	Ankylosing spondylitis(AS)	MW,W	retired
Hu13	61/F	Lower extremity disability	MWDEL, MW, PW	retired
Hu14	66/F	Rheumatoid arthritis(RA)	MW	retired

before and after our interviews, e.g., watched Hu13 leave and move on the street, helped H11 enter the cafe where the interview was conducted through the “barrier-free passage way” and so on. All these observations were recorded in notes and taken together with interview scripts for our analysis. After the interviews, all 14 informants were paid 80RMB as compensation for their participation. Except for one interview where the informant spoke the Shanghainese dialect and was accompanied by a staff member from the “Shanghai Hongkou Yiqunren Volunteer Service Center” to help translate, the interviews were conducted in Mandarin or in a dialect very close to Mandarin. All the interviews were audio recorded, transcribed, and stored in documents as data only shared among the research team.

3.3 Analysis

We use the grounded theory approach [26] for data analysis. The first and second author conducted open coding independently, and met several times to discuss the codes and potential themes until consensus was reached. Through the initial open coding and discussions, several themes emerged, mainly regarding the diverse work wheelchair users engaged in in order to move around urban areas smoothly (e.g., negotiate social assistance, scout ahead to get knowledge about the POI, select assistive tools based on the conditions along the journey). After axial coding and rounds of discussion, different kinds of work as sub-themes were identified. As the iterations of analysis progressed and the data was constantly compared through selective coding, we began to identify “alignment work” as the overarching theme. We then sorted out the relevant codes according to these themes, and extracted representative quotes to illustrate them.

4 FINDINGS

Despite recent improvements, our study revealed that wheelchair users in China still face many barriers when they travel outside, and some of these barriers become more salient as these individuals go across multiple urban areas. They often need to do extra work to learn about the conditions of their journey beforehand, such as the travel distance, the availability of public transportation, social regulations (e.g., no handicapped vehicle in the hospital), and related temporal schedules (e.g., opening hours of a store), in order to align various resources accordingly, including assistive tools, time, and social assistance, to overcome the challenges and ensure accessibility. This kind of work, which involves learning about the conditions along the journey and arranging various resources accordingly, is what we term *alignment work* in this paper. Below, we elaborate on the types and nature of alignment work done by wheelchair users with the help of others for urban accessibility.

4.1 Tool Alignment

People with disabilities often rely on various assistive tools [21, 24], and yet how assistive these tools actually are depends how they align with the context. In our study, we found it was common for our informants to own multiple wheelchairs as well as other tools, such as crutches and handicapped vehicles for travel. These tools varied in terms of weight, size, power, and other properties, and our informants chose different tools to suit different situations. For instance, power wheelchairs can go far but are bulky, which makes them inconvenient if people want to take them on other forms of transportation (e.g., taxis). On the other hand, manual/sports wheelchairs are light and relatively portable, but are not powerful enough to go far. Choosing and aligning them with the conditions of the journey was an important way to ensure accessible and safe trips. For instance, Hu10 owns all kinds of assistive tools to be used for different purposes, such as a manual wheelchair for activities at home, a handicapped vehicle for driving when going far, and power wheelchairs for places where handicapped vehicles are not allowed. More recently, he adopted a manual wheelchair with a detachable electric locomotive to increase flexibility to suit different situations all in one tool. The quote below elaborates his practices to align his tools with different travel situations:

I drove my handicapped vehicle to a nearby park, which takes about 10 minutes. But if we want to visit relatives or go somewhere far away, it is not safe to drive such a long distance, as we are old now. So we will use the power wheelchair and take the subway. If we need to go to the hospital, as the handicapped vehicle is not allowed to go into the hospital, a wheelchair will be used. For the same reason, I also use a power wheelchair to go to the [traditional] grocery store. Sometimes, I will use a manual wheelchair with a detachable electric locomotive. I have four kinds of wheelchairs...A domestic one, which I can use to avoid standing up on crutches and avoid falling which may easily cause fractures. If I go out, the domestic wheelchair[or manual wheelchair] is inconvenient, dangerous, and slow [so I will use another kind of wheelchair].

Hu9 revealed a very similar alignment strategy as Hu10, stressing the tension between power and portability, and the importance of flexibility to deal with varied situations when out.

In general, how many kinds of assistive tools people owned highly depended on the travel needs they had on a daily basis. In our study, Lu2 and Hu8 only owned one wheelchair each because their daily activities were mainly constrained to their workplaces and home, and Hu14, affected by rheumatoid arthritis (RA) to operate assistive technologies, only used a manual wheelchair and relied on her husband to help her get around. The rest were all equipped with two or more assistive tools, as they often needed to go out to meet people, participate in communal activities, and go to

work, among other things. Among these tools, a manual wheelchair installed with a detachable electric locomotive balances portability and power well, and is an ideal solution that suits many situations. However, our informants reported that its battery usage also makes it subject to more regulations than other power wheelchairs. Depending on the amount of watt hours the batteries have, they may not be allowed aboard airplanes because of the risk of battery explosion. As such, factors such as travel distance, the use of public transportation, the tool's portability and power, as well as safety regulations, are all taken into account when making the alignment for mobility.

For group activities, they also collectively share and align their assistive tools with other people with disabilities' in a way to cost-effectively accommodate different situations. For instance, Hu11 often organizes travel in Shanghai for non-local wheelchair users and has them stay in a hotel in the city center, where space tends to be limited, e.g., the entrance to the toilet is narrow. However, tourists usually only carry one wheelchair with them when traveling, and some of their wheelchairs may be too large to pass through the toilet door. To solve this problem, Hu11 would match different people with different kinds of wheelchairs as a way to accommodate that situation: *"My wheelchair can go into the hotel bathroom, but a bigger wheelchair can't. I've thought about that, like matching people who use small wheelchairs with those who use big wheelchairs. In this way, when they want to go to the bathroom, they can exchange their wheelchairs so they can deal with this problem."*

4.2 Temporal Alignment

Temporal alignment means making arrangement in relation to time. Sometimes, it means finding a particular time to go to certain places for more accessibility, based on an understanding of the flow of people in the space. As public spaces are socially shared, accessibility to them is also related to the social presence of others in the space – when it is too crowded, it also becomes less accessible. Hu13 provided a case showing how whether a space was crowded or not made a difference for her when using facilities in a hospital: *"It is usually quite convenient to go to the hospital, but things will be different if it is crowded. We live in a society, and there are all kinds of people [who need to use the elevator], including those who are old and ill. At these times, it is not simply you whom people would take care of. Anyway, it all depends on the actual situation. If there are too many people [using the elevator], I will not squeeze in. If there are only a few people, I will quickly ride my wheelchair in. That's it."* Hu8 reported how some crowded subway stations similarly pose mobility and safety issues for him: *"For example, at the Yuyuan subway station (a subway station that always has a lot of passengers because it leads to a famous tourist attraction in Shanghai), I will ask the staff to protect me so that I don't run into someone."* For better accessibility, our informants would try to go places when it wasn't crowded [13], e.g., avoid going to the grocery store when it is packed in the morning, or avoid going to local tourist attractions during holidays.

It could also mean that they need to plan beforehand according to related service schedules, such as arranging social assistance according to transportation timetables. Hu10 and his wife both have limited mobility, and each year, they go visit relatives in Wuxi together. However, the train only stops at the station for a very short time. As such, they need to make sure that they can get off the train in that very limited time span. To accomplish this, Hu10 contacts the station staff and his relatives for assistance to make everything align well, so as to get off the train and get out of the station smoothly. He explains:

We would contact the Shanghai station in advance and ask them to contact the Wuxi station about the time we will arrive and the staff at the Wuxi station will come to help us. Otherwise the train arrives, but no one is there to meet us, and then the train is going to set off again before we can get off, and we can't reach our destination. So we need to

connect with them. The relatives there told us that the Wuxi station in the new district was recently built, but without accessible elevators, only escalators. So, our relatives will come to pick us up, but we have to ask the staff to help us get out of the train station first.

Our study further revealed sophisticated ways that people with disabilities made temporal alignments in order to access certain businesses or services. For instance, our informants would take both the crowd size and the open hours into account. Hu14, based on her awareness of the different flows of people at different times of the day in different hospital departments, planned things out and aligned her activities carefully:

Generally speaking, hospitals are not crowded in the afternoon, but in the morning, especially Monday mornings, hospitals are overcrowded. After the weekend, many people want to see the doctor [some hospitals are closed over weekends]. So if possible, I will try my best to avoid going to the hospital at this time. Friday afternoon is a good choice too, for example, to get medicine. I generally register around 3:30PM [because there is no registration service after 4:30PM]. At that time, few people would go to the hospital, so I often choose this time to get the medicine, although it could be too late to do examinations, because many examination departments, such as B-ultrasound, are closed after 3:30, so we need to arrange the time so that we can see a doctor and, meanwhile, avoid rush hour.

As shown here, to access services, they have to carefully plan a trip by making the alignment, based on their awareness of the temporal patterns of the crowd as well as different services' schedules.

4.3 Social-Technical Alignment

Over the years of development, many public spaces have been designed with accessibility in mind, or equipped with accessible facilities. However, whether there are technically accessible facilities does not determine the accessibility of a space; rather, it is whether the social use or management aligns well with the technical infrastructure, or the social-technical alignment, as we may call it, that matters here. In this section, we will focus on how the social-technical alignment or misalignment shapes the accessibility of a space, and how people realign resources to make the initially inaccessible space an accessible one.

4.3.1 Social-technical Alignment and Misalignment. Our informants reported that while social use aligns well with accessible facilities in some places, they need to be more dynamically negotiated in other places, which shaped the accessibility of the space. For instance, when Hu14 was in Taiwan, she noticed that *"there are special seats for people with disabilities in the subway, and others would rather stand than sit there."* For similar facilities in Qingdao, however, the alignment is more flexibly negotiated, as observed by Lu6: *"There is a special area for wheelchairs in Qingdao's subway. If you don't use it, there will surely be someone taking that place, but if you go there, they will go away."* As such, while people with disabilities in Qingdao's subway still have priority to the resources designated for them, a large flow of people and limited resource availability often lead to people without disabilities taking some of the resources, and more dynamic negotiations are needed for accessibility to be achieved.

In addition, the availability of social assistance from staff working in the space is also considered critical for accessibility. In fact, the mismatch between the strained staff resources and the demands of their work is commonly reported as causing accessibility issues. Hu11 told of an instance when she missed getting off the subway as a staff member there was occupied by other passengers asking questions: *"I had told the staff which station I should get off. The moment the door opened, the staff was being asked for directions by someone, and by the time he came back to me, it was too late, and the door of the subway was closed."* Lu6 also noted that often the staff were too busy to be able to

provide timely help: *“I was a little confused when I used the Qingdao high-speed railway. I didn’t know where to wait, and the staff member was too busy to talk to me. I took the elevator down myself, but there was no waiting area, so I came back. I saw that there was an accessible passage, but nobody told me to go there and wait.”* As such, when there is a misalignment between social arrangements and technical facilities, accessibility problems arise.

The public bus transportation system is another area where it is commonly reported that staff work does not align well with the existing accessible facilities, rendering it practically inaccessible. In our study, most of our informants had negative reactions towards taking buses, despite the fact that many want to use buses more. We found that this was because they relied on the driver to make the bus accessible to them, and some drivers were not so willing to help. For example, Hu11 reported how hard it could be to get help from the bus driver, even on an accessible bus: *“I was trying it out, but the driver was in a hurry...The ramp needs to be manually put down...But the driver said it was too late, so he left. So I waited for the next bus and the driver of the next bus told me he did not know how to use it. The hardware (the ramp for accessibility) is good, but can’t be put into good use.”* As such, the work to make the accessible facilities available on the bus to passengers with disabilities is perceived more as a favor given by the bus driver, and not as part of their job responsibilities. This left many of our informants afraid that if they rode the bus, they would be a burden on the driver and others, especially during traffic. This reluctance of the bus drivers has made many unwilling to take the bus at all.

On the other hand, good service has often been a way to compensate for a lack of sufficient accessible facilities. For example, Hu8 compared the Hangzhou and Shanghai subways this way: *“Subway cabins in Hangzhou are much smaller than those in Shanghai. But the service is not bad. For example, workers help to get you on the subway, and so on. The passenger flow in Shanghai may be relatively too big, so although there are more staff, it can not be ensured that every station has that same [service].”* As such, although the technical facilities of the subway in Hangzhou are not as good as those in Shanghai, the good service provided there makes up for the lacking facilities and makes them more accessible in practice.

4.3.2 Social-Technical Realignment. While there has been quite an improvement, some spaces are still not designed with accessibility in mind. Instead of giving up, however, our informants reported ways in which they realigned and re-purposed existing facilities to achieve accessibility, often through negotiations with the staff there. For example, Hu10 reported how he negotiated with the staff at a supermarket to find a way to check out:

In supermarkets, there are problems with checking out. We waited in the line for the cashier, but the passage there was too narrow for the wheelchair to pass through, and it’s easy to get stuck. Then what shall we do? We asked the supermarket staff whether we could just pay for the groceries at the exit, but he said no. So what shall we do? The final solution was, we leave the groceries on the counter, and we go around to get out, and come back to the counter to check out.

Hu10 also reported cases of finding and using freight elevators to access some supermarkets, which were not originally intended for accessibility, after negotiating with the manager:

In the supermarket, it’s too dangerous to take the escalator. Even if the wheelchair can go up [some escalators come with ramps], it may slide down. Some supermarkets, like C (a western supermarket chain), have freight elevators, and the staff allows us to use them. But in L (a Asian supermarket chain), there are no such elevators, so we can’t go there to shop. So we can only shop in C. At the beginning, we asked the staff about it, and their manager came to take a look, and agreed that we can use the freight elevator: “OK, let

them use the freight elevator to go up when they come.” So after that, we would just go take the freight elevator directly.

It was also common for wheelchair users to re-purpose car ramps for accessibility. For example, Lu2 used a car ramp to get into the shopping mall ¹: *“The ramps at intersections and shopping malls are for cars, so they must be there. Where a car can get in, so can wheelchairs.”* In our study, it was common to hear our informants say that *“Where a car can get in, so can wheelchairs”*, indicating that using car ramps to address wheelchair accessibility issues is a common practice. Lu6 similarly used the gate with car ramps to get to the POI, and would need to ask the security guard to open the gate for him to enter: *“You can ask the security guard to open the gate. There’s a slow ramp over there for cars, and you can get in through it. It’s usually locked, so you need to ask security to open the door for you.”*

People also made arrangements to negotiate new boundaries to create accessibility, such as the gendered use of regular restrooms. Hu14 reported how she would make use of regular toilets with extra help from her husband and the restroom staff: *“Today, the accessible restrooms, especially the newly built ones, are in a separate room. As such, I don’t need to worry too much if I need my husband to come into the restroom to accompany and help me. When there was no separate restroom, I had to use the toilet in the lady’s room, but my husband is male, so sometimes if there were only a few people in there, I would ask the cleaning staff, ‘Please watch at the entrance. My husband comes with me’. If my husband is in the restroom and then other females come in, they will have concerns, so it is inconvenient...”* Here, when there is no separate accessible bathroom, the social assistance of her husband and the cleaning staff is aligned to make the regular gendered restroom accessible.

However, sometimes, our informants’ re-purposing came with the cost of safety concerns. While wheelchair users are supposed to use sidewalks, many would take the non-motor vehicle lanes instead, simply because some sidewalks are tiled and too bumpy for their wheelchairs. Before or after our interviews, we also observed that both Hu9 and Hu13 chose non-motor vehicle lanes for their journey. In the case of Hu9, even though the subway station was directly connected to the sidewalk, she would descend onto the non-motor vehicle lane via a ramp first since the sidewalk is too bumpy, even though she realized it might pose safety issues. She explained: *“Wheelchairs are supposed to use the sidewalk, but the pavement tiles make it very uneven, very bumpy.”* The non-motor vehicle lanes are relatively even, physically more comfortable and thus more accessible for wheelchair users, and were preferred by our informants over sidewalks. As the non-motor vehicle lanes have other primary uses, sometimes there could be safety issues. As Hu9 said: *“I just walk down here. It is a little unsafe. The best I can do is to be more careful.”* Hu8 told of times that he used the regular road although he too was aware that this could be dangerous; however, he could not get on the sidewalk due to missing ramps. In these cases, they had to compromise safety in order to achieve more accessibility.

As shown in the above cases, most of the time, the staff at these space were quite considerate, flexible and cooperative, willing to make concessions to meet the needs of people with disabilities. Lu3 reported how the security guards at a parking lot helped to make things work for him: *“Parking is a problem. The hospital I went to was small and I couldn’t find a parking space or accessible parking. I went there and said my legs are impaired, and that I was a person with a disability...The considerate staff would set up a temporary stop with a couple of plastic road cones and let me park there.”* However, when there are safety concerns, our informants’ use of certain facilities for accessibility might not be allowed by the staff of the space. For example, as similarly reported in [73], when there was no elevator, some informants would use escalators after learning a specialized technique. Lu5

¹While new buildings are constructed with accessibility in their design, many old buildings, including shopping malls, still have no wheelchair access.

explained: *“In some subway stations in Tianjin, there are no elevators, so I’ll take the escalator. It’s hard to use, but you can use it if you have mastered certain skills: put the first two wheels on one step, the last two wheels on the next step, and as long as you have someone to support you and keep you from falling over, [it works].”* Although many of them learned this skill, it was generally considered dangerous and was not allowed in some places.

4.4 Alignment as Communal Work

Previous work shows that communities of people with disabilities play an important role in mediating their interactions with the world [6, 7, 42], and we observed similar roles played by communities in developing our informants’ awareness and shaping their alignment practices.

4.4.1 Sharing Information and Strategies. Making alignments is not easy, and it takes quite a bit of work to learn about and develop an awareness of various conditions in the first place. In the instance of Hu12, it is her daughter, also her caregiver, who’d go to a place and developed a clear idea of the spatial conditions to plan ahead and arranged things accordingly beforehand, so that they could achieve better accessibility when they actually went. In our study, we found that some wheelchair users initiated efforts to produce and share accessibility information with their communities. For example, Hu9 reported how they made booklets with accessibility information for the subway and shared it: *“We people with disabilities did a survey, made a map of subway line one, and distributed it as a small brochure, which tells where there are elevators, at which exit. At this point, only line one has been labeled, as it was all based on people with disabilities going out and experiencing it.”* Here, the community of people with disabilities plays an active role in sharing related accessibility information.

Similar to what was found in [13], we also found that for places they have not been to, it was also common for our informants to draw on heuristics for alignment work, based on general spatial patterns they learned over time. For instance, through experience, they know that new shopping malls around subway stations usually have accessible facilities, and while there are usually accessible restrooms at subway stations, there are no accessible restrooms at grocery stores. Lu1, based on his travel experiences, summarized his observation of the different accessibility levels in different cities this way: *“Qufu is a tourist city, so its accessibility is OK. The circumstances in different areas [of China] are quite different. There are more [accessible] toilets in big cities, so things are OK, but not in small counties or cities, where accessible restrooms are either not there or damaged. The better the economy develops, the better the accessibility is.”* As such, based on their past experiences, certain accessibility patterns could be identified, which they drew on as they did the alignment work.

It was also common for our informants to learn and share related alignment strategies with other wheelchair users. In our study, almost all our informants have their own social circle of wheelchair friends. We found out that all our informants from Qufu were more or less connected, and four of our informants from Shanghai were all part of a larger social circle called “wheelchair friends”, and Hu11 was even actively organizing trips for them to travel together. Whether online or offline, it was common for the communities to socialize with each other and share various tips for travel. For instance, Lu7 reported how he became aware of and learned to upgrade and use flexible assistive tools to accommodate various situations from other people with disabilities. He explained: *“I had not used wheelchairs and only used crutches until the year before last or even earlier when I started to go out and hang out with [the other wheelchair users], and learned that they all used wheelchairs and could move fast, so I bought one.”* He also emphasized that some social media technologies, such as video sharing applications, also allowed them to share their experiences and learn from each other: *“Now with ‘KUAISHOU’ and ‘DOUYIN’ (two very popular short video platforms), at the very least, more and more people with disabilities know about [different kinds of wheelchairs], including*

the more recent sports wheelchairs. We used to use very big, heavy wheelchairs, and didn't know about these new types of wheelchairs, mainly due to the lack of information." Through this way of sharing, our informants developed an awareness of what was not only doable, but possible. For example, Lu7 learned that it was possible to "use a wheelchair to go to the beach" simply because he watched a video of someone in Hainan who went on the beach with a wheelchair, almost to the sea. As such, besides offline socializing, several informants reported sharing or watching videos on platforms, giving them exposure to more possibilities for outings.

4.4.2 Collective Maintenance. It also takes continuous and collective maintenance to ensure accessibility. In our study, it was commonly reported that some of the accessible facilities became unusable after not being used for a long time. Hu13 reported how accessible buses became inaccessible due to a lack of use : *"Only a few people with disabilities take the bus. Because of the low frequency of use, the boards designed for wheelchairs become rusty and cannot be pulled out. This is a chain of reactions."* Similarly, Hu9 reported: *"Take the bus as an example. The black, electric bus we commonly see actually has a board at the middle door that can be pulled down for wheelchairs to use. Because there are not so many people with disabilities going out, many don't know this, and hardly any know how to take these buses...Some of the boards get stuck with all kinds of trash there. I have experienced this situation several times where we couldn't pull the board out."* Therefore, public accessibility facilities take at least frequent and collective use to keep working.

Clearly, our informants have realized this issue and made conscious efforts to use them more frequently. As Hu9 put it, another side of accessibility construction is for them to go out more: *"The government has taken us into consideration and has done a good job in improving accessible facilities. People with disabilities also need to come out more, because if they don't come out, how can others know what they need?"* Hu11 also shared her experience of how the activeness of people with disabilities could enhance people's awareness : *"I used to live in a house over there in a village called Zhoudang, Qingpu, and it became a base for our wheelchair friends' gatherings. When I just got there, people looked at me strangely. After I'd lived there for more than three years [, they got used to it]. As long as they saw people using wheelchairs, they would say, 'Are you going there [Hu11's house]?' They all know us, and are well aware of us."* Hu11 also discovered the impact of a rehabilitation center on the stores around it: *"Because there are many people with disabilities going there, all the stores on the street were made accessible."* As such, with more people with disabilities going out more, public awareness of wheelchair users is also enhanced, which in turn, also helps improve urban accessibility.

In instances in which alignment can't render an environment accessible, collective action is sometimes needed. For instance, Hu13 told of a time when a door to a grocery store was locked in order to keep bikes from going in, which then also kept out wheelchair users. Hu13 and others in wheelchairs gathered together so that it was finally removed: *"The iron gate is about this wide [by gesture] and low. Able-bodied people can walk in, but we can't. We tried to find the managers to solve this problem, but there was no solution. Someone pried the iron lock open with a hammer and entered the market. Then, this matter got more attention. Then it had to be settled through negotiation. Several people with disabilities went to go to the town hall to report this problem and negotiate. At that time, a lot of people with disabilities took part, and it was quite visible. Ultimately, the door is kept open all the time now."* As such, many times, it takes people with disabilities going out more, being more present, reporting accessibility issues, and having their voice heard, to ensure accessibility in public spaces.

5 DISCUSSION

In the preceding sections, we presented a study of how wheelchair users go out and travel around in China, and illustrated how, given the variety of environmental conditions, our informants actively and creatively worked out solutions, managed their trips, and achieved mobility. We also characterized the work towards achieving accessibility as “alignment work”, highlighting how our informants aligned and realigned various resources according to the conditions and constraints of the environment and collectively worked together to support and ensure accessibility over time. The fact that the study was conducted in China, a country that is still relatively behind in terms of the construction of accessible environments and is also generally more crowded with constrained resources in many places, makes some of the accessibility issues and the alignment work more visible, just as [7] shows that the context of the low-resourced setting will make social connections play a more important role for support and assistance. Moreover, some kinds of alignment work are not so particular to wheelchair users or people with disabilities, but rather, shared by people with all levels of abilities, e.g., avoiding crowds, arranging resources according to travel conditions, and sharing travel tips. Nevertheless, where people with disabilities are concerned, they may be subject to more constraints, especially when situated in a context where the construction of an accessible environment is still far behind, and some of the work they do is more pronounced. Below we discuss how our study, completed from the relational perspective in urban China, helps to highlight and extend our understanding of accessibility and then present implications for design.

5.1 Urban Accessibility as Alignment Work

The framing of interdependence turns our attention away from the external conditions as evidence of accessibility and focuses on the “relations between those things that make and define disability and accessibility” and “the practices that people with disabilities engage in to co-create accessibility with their peers” [9]. By highlighting the alignment work needed for accessibility, we make the similar argument that the external world’s conditions are only part of the solution. As shown in this study, people with disabilities’ mobile practices are determined by many components, including assistive tools, the availability of care-givers, the conditions of the accessible facilities, the schedules of various services, the regulations of difference spaces, acquaintances with similar impairments, as well as other people (often strangers) who are present and share the same space. All of these elements are relevant to mobility and should be considered together to achieve accessibility. In addition, our study extends the framing of interdependence by highlighting the work people do to align and realign their relations in a way to achieve accessibility in urban spaces. That is, it is not simply that people and things are interdependent, but that people gain awareness, and weave and align different people and things together so that accessibility is afforded. Here, by focusing on alignment work, what we try to emphasize is the agency people with disabilities enact in gaining awareness, considering different factors, and aligning different resources to achieve accessibility.

Compared to long-term collaborative accessibility at home or other places [11, 12, 69, 78], the alignment work undertaken by wheelchair users when traveling in the urban space is quite distinct. Unlike home or work spaces, where people can have more or less control of the environment, it is challenging for them to even gain awareness of various conditions along the journey, as these conditions are dynamically changing, e.g., the crowds of people, the availability of taxis, and so on. As such, they need to deal with more complex and unpredictable situations, especially when going to new places, and often need to negotiate and cooperate with unknown strangers. It is difficult, if not impossible, for people with disabilities to change the public environment directly, as it usually has to go through certain procedures and takes the actions of different stakeholders to

make changes. As such, while individuals can use tools, social assistance, and alignments as temporary solutions, for longer term changes, collective efforts are often needed. As shown in the case reported by Hu13, even for simple things, such as keeping a door unlocked to the grocery store, it takes the collective voices and efforts of people with disabilities to make the change. Moreover, most of time, rather than asking for help from their roommates, housemates, or co-workers, people with disabilities negotiate and collaborate with strangers, the staff, the managers, the policy makers, and others, to use a space in certain way. Many times, it means putting forth a different level of energy for the work to be done. As pointed out in [11], “public spaces can undermine the types of collaborative accessibility work performed at home.”

Essentially, accessibility is based on hard work, and alignment work in particular, which is distributed among all relevant stakeholders. In the case of urban spaces, compared to home and workplaces, the alignment work for accessibility is more broadly distributed, including urban planners, environmental administrators, service providers, other strangers sharing the space, and peers with disabilities. When some stakeholders do not do their work well, e.g., service providers or urban planners, it means others, e.g. people with disabilities, need to take on more work to ensure accessibility. As shown in the study, social assistance, or realignment work, can, in many cases, compensate for the infrastructural inaccessibility. For instance, social-technical misalignment usually causes problems and forces extra work on people with disabilities. In a way, the space is a social-technical system with people, regulations, technologies and facilities, in which people with disabilities need to construct a micro-social-technical system of their own, with assistive tools, their caregivers, and peers, in order to achieve accessibility.

By starting from the relational perspective of disability and the practice of travel, and not from a particular section of the urban space, we are able to reveal a more holistic picture of the travel of people with disabilities and the factors related to urban accessibility. When considering travel in the urban environment, we need to remember that often people do not go out to interact with the environment, but for other practical purposes. It means they often have to traverse different physical, social, and cultural spaces, and fulfill practical requirements (e.g., getting medicine from the hospital). As such, all the various factors, such as regulations in a particular space (e.g., no handicapped vehicles in the hospital), the open hours of particular services, the distance they need to travel, the availability of public transport, as well as the metrics of a particular environment, all become relevant for them to successfully take their journey. Only by focusing on the journey as a whole, and not focusing on a particular space or the interactions with a particular space, are we able to see why some factors are important for them to consider when trying to achieve accessibility, e.g., choosing what time to go.

5.2 Implications for Design

While our study could have broad implications to improve urban accessibility for people with disabilities in terms of space and staff management, in this section, we mainly discuss implications for ICT design. These implications reflect our turning away from urban accessibility as an attribute of the environment, to the alignment work that people perform.

5.2.1 From Showing Accessibility to Supporting Alignment Work. To support alignment work, enhancing awareness of the conditions along the journey is the first step. Much work to support the mobility of people with disabilities is in the form of accessibility maps [8, 32, 37, 44], which shows accessibility information in a map form. It makes intuitive sense that these maps can help people with disabilities develop awareness and an understanding of the space so as to help them accomplish alignment work. However, this approach faces one salient challenge in practice – how we can collect reliable data that covers a sufficient area in a cost-effective manner? Innovative

approaches have been explored to overcome such challenges [58, 61, 63], both manually [50] and automatically [39], as well as a mix of both [47], although to obtain enough high quality data remains a challenge. Not to mention, much of this information is dynamically changing all the time, and keeping it updated would be even more difficult.

When we focus on supporting alignment work and recognize that many factors are relevant, we find that more information can be provided on the map, such as the flow of people, regulations, schedules, and the frequency of use. Moreover, rather than simply showing physical attributes or accessible facilities, we can leverage heuristics to help people infer the conditions of certain spaces. As we learned from the study, many will rely on heuristics to assess the accessibility of a space (e.g., whether it is newly built and when, the geographic and terrestrial features of the environment, whether it is a touristic or historical area or not), and we can provide this kind of information for people with disabilities. With such information, those with previous experience going out and traveling could then gain a basic understanding of a place and infer how accessible it is to them; this kind of heuristic information, compared to information about physical attributes or accessible facilities, is relatively easy to obtain (e.g., could be collected from institutions), is valuable to develop an understanding of the environment, and can potentially be done with existing machine learning approaches [41]. The point is that, instead of having a computational system infer and quantify accessibility, human beings could learn more and gain a better understanding of a space's accessibility by simply seeing the relevant information themselves.

5.2.2 Supporting Collective Alignment Work. In our study, we found that much of the alignment work was carried out by the community of people with disabilities as a whole, not individuals. Here, the community plays multiple roles. First, it is through the community, or a community of travel practices [77], that people gain awareness, and learn ways to do the alignment work necessary for traveling. That is, instead of people learning from trial and error on their own, the community allows people with disabilities to quickly develop the awareness and skills to achieve accessibility. In the case of Lu7, by socializing with his peers, he learned about new types of wheelchairs, and also the possibility of walking on the beach with a wheelchair. Second, as discussed above, for urban accessibility, a lot of the alignment work requires collective, not individual, efforts. For instance, to change environmental features, such as a small thing, like keeping a door unlocked, the collective efforts and voices of the community are needed. In addition, their collective efforts of going out more are essential for the public awareness of disabled people and the maintenance of accessible facilities. Finally, there are group-oriented activities, like traveling, that people with disabilities engage in together, where their assistive tools are shared and socially aligned. For example, Hu11 and her friends often organized group travel activities as a way to encourage more people with disabilities to leave their homes. As such, it is important to approach issues of urban accessibility in terms of collective efforts.

The understanding that accessibility is an alignment collectively carried out suggests new alternative design approaches to support mobility for people with disabilities. For instance, we could make the support more community-oriented, helping people share and learn from each other, and sometimes, do the work together. For example, instead of merely showing accessibility information on a map, we can show who has been where, and allow individuals to interact with and learn from each other about the place and how to get there. As people have different travel experiences and abilities, we shall encourage people to provide further information such as assistive tools used and their past traveling experiences. We can also support people with disabilities' sharing of related experiences using rich media, just as Lu7 and others have already leveraged video sharing platforms to learn about corresponding experiences. We could enhance this design to make it more location-aware, to further support their mobility. A map like this could provide

a number of benefits for wheelchair users to go out. First, it could provide social awareness and more visibility of where people with disabilities go, and thus could encourage others to expand their regions of activity. Second, it could support people to become aware of who has been where and to socialize based on related experiences. Finally, it could also be a map for policy makers, showing where people with disabilities travel, allowing them to check for consistency with their accessibility construction efforts, and helping to inform them to make better decisions.

6 CONCLUSION

In this paper, we presented a study of how wheelchair users go out and travel in practice in China. We highlight the kinds of alignment work involved for them to achieve mobility across different sections of the urban space. We argue that for them to achieve mobility, the accessibility of the environment is only part of the solution, and that we should also consider the collective work they and others do to draw on various resources to align and realign accordingly, based on their understanding of various spaces. The kind of work required in public spaces is more complex than the work needed for accessibility at home or the workplace, and involves more factors, such as policies, regulations, the staff of a space, and even strangers. Based on the study, we suggest that accessibility is not merely something to be evaluated, measured or presented, but also something to be achieved, with the agency of the people involved, the conditions considered, and the resources available.

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