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Designing from a Disabled Body: The Case of Architect Marta Bordas Eddy

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Abstract: Studies on design, disability and phenomenology offer rich insights into how the designed environment is experienced by people with different abilities. In architectural design, this experience is only starting to become recognized as a valuable resource for designers. Considering disability as a particular kind of experience, we report on the focused ethnography of architect Marta Bordas Eddy's design practice. We analyze how her design practice and outcomes connect with her embodied experience of being a wheelchair user and the role of architecture therein. We interviewed Marta, her sister/co-worker and her life partner/co-habitant, gathered design documents, and analyzed the house she designed for and by herself. Our study highlights how Marta's experience of being disabled, combined with her background, informs how she assesses design and establishes distinct architectural qualities. Being a disabled person and a designer enables Marta to detect problems in an intuitive body-based manner and think of solutions at the same time. The analysis of Marta's house moreover raises awareness of architecture's role in (disabled) people's lives insofar it can support or impair human capabilities. It challenges prevailing views of what a house for a disabled person looks and is like, and how design can neutralize apparently restricted capabilities.

Keywords: architecture; disability experience; design practice; embodiment; technology

1. Introduction

Technical solutions and technological artifacts enhance, extend, compensate or restore human capabilities among a plurality of bodies. Some technological artifacts, although fully operational and present, may fall into the background of people's perception [1,2]. Each object contains its own capability and its own ways of appearing and disappearing. In the relationship between a person and their wheelchair, for instance, Myriam Winance [3] recognizes Don Ihde's idea of a background relationship with technological artifacts: when a person sits comfortably, the wheelchair disappears from their conscious attention. At the same time, Ihde's idea of embodiment relations seems to be at play: by becoming an extension of the body, the wheelchair modifies how that person perceives, behaves and connects with the world. The (un)awareness of the technological aid relates thus to the (un)awareness of the body.

Similarly, a building can be considered a technological artifact insofar it has the potential to facilitate major life activities and 'compensate for human frailties and enhance human capacities' [4] (p. 35). Just like a wheelchair can enable an impaired person to autonomously move around at wish, a building can enable someone to perform other functions that are necessary for life. A building or environment can likewise fall into the background of people's perceptions [4] (p. 33). Yet, if it disrupts their wants or needs, it returns to the foreground, to the conscious world—just like a wheelchair that fails or causes pain becomes present again. This is precisely the objective of study in

this article: how disabled designers become effectively conscious of their environments in a bodily manner, which differs from other designers' perceptual and experiential approaches.

The article reports on a case study that explores how a disabled architect designs, to offer insight into the following question: how does her design practice and outcomes connect with her embodied experience as a wheelchair user and the role of the environment therein? Ultimately, the aim is to contribute to a better understanding of how disability can be regarded as a potential resource in design processes. While the study focuses on design in architecture, it might be of interest to researchers in other fields working on the role of embodied experience in designing technological artefacts. After outlining the role of the (disabled) body in architectural design in general, and presenting the methods and material used, we report on the findings of our analysis. These are followed by a discussion of the insights gained relative to related work, and directions for future research.

2. The [Disabled] Body in Architectural Design

2.1. The Body

Throughout the history of architecture, much has been discussed about the reductive conceptions of the body that still cast their authority onto today's designs and constructions [5]. In exploring practicing architects' and teachers' conceptions of the human body, Rob Imrie [6] (p. 47) observed a prevailing tendency to design by following specific technical standards and dimensions. These are based mainly on the "normal body", the classical understanding of the fit and able body that remains invariable over time. Imrie (p. 49) further explains that modern and postmodern architectural design considers the body subordinate to the mind; there is a latent idea of the body, rather than a wish to explore and consider its experience.

In 1950, Le Corbusier published the iconic stylized silhouette of the six-foot standing "Modulor Man", segmented according to the golden section: a universal system of mathematical proportions, the "Vitruvian Man" of modernism. Le Corbusier [7] regarded the human body as a contaminant that countered the ideal of geometrical purity, with the capacity to destroy the visual quality and intrinsic meaning of architecture [6] (p. 47). Bernard Tschumi [8] (pp. 123–126) argues that 'if bodies violate the purity of architectural spaces, one might rightly wonder about the reverse: the violence inflicted by narrow corridors on large crowds, the symbolic or physical violence of buildings on users. (. . .) Violence exercised by and through space is spatial torture. (. . .) Le Corbusier's Carpenter Center, with its ramp that violates the building, is a genuine movement of bodies made into an architectural solid. Or the reverse: it is a solid that forcibly channels the movement of bodies'. Others, like Karen A. Franck and R. Bianca Lepori [4] (p. 8), see architecture as necessarily needing to come from the inside, from 'the body as being an inspiration for design, rather than design imposing outsides that people have to fit in. (. . .) We see architecture as something to experience, and also as an opportunity to reinvent, to help us avoid being stuck in old patterns within new forms'. Buildings are full of conventions, assumptions and rituals that architects do not learn to question. Beyond serving as a source of dimensions, the body and bodily experiences may also act as a source of knowledge.

2.2. My Body

In '*Thinking Architecture*', Peter Zumthor [9] (pp. 7, 8) shares a distinct childhood memory of his aunt's house. He describes how the kitchen of that particular house and its atmosphere made an imprint in his memory. His idea of a kitchen is very much linked to that specific childhood experience. These memories, he writes, are 'the reservoirs of the architectural atmospheres and images that I explore in my works as an architect'. Taking one's own body as a point of reference is not unusual in design practice [6]. Experiences shape how and what architects design. In architectural thinking, there is, indeed, a phenomenological orientation—an interest in reaching into the experience of space through bodies, turning away from reducing it to a lifeless entity suspended in time and

space. Architects' situated bodies can thus act as knowledge providers with the potential of projecting themselves onto the object of design.

'The mind is inherently embodied' [10] (p. 3) is a key statement of embodied cognition science, a philosophical strand that emphasizes how the experienced world is portrayed through interactions between body and mind. Francisco Varela, Evan Thompson and Eleanor Rosch [11] introduced the concept of enaction, which suggests that a person continuously learns and makes sense of the world through bodily (inter)action. Our minds are thus enacted through the body. Relating embodied cognition theory and enactivism to design, Camilla Groth [12] and Maarit Mäkelä [13] argue that, through physical experiences of the material world, designers create mental images that they rely on in the design process. Thinking and planning thus build upon accumulated, embodied knowledge.

While Groth and Mäkelä focus on embodied cognition and design in the context of craft practice, an experiential articulation of this embodied knowledge can be found also in architecture. However, the degree to which architects include other or different types of bodies varies. In exploring architects' conceptions of the human body, Imrie [6] (pp. 56–57) observes that the body architects and teachers refer to—if at all—is either normative or self-referential. Furthermore, 'no one mentioned diseased, impaired or ill bodies as core to bodily identity, experience, and performance' [ibid.]. This lack of attitude to address diversity implies perceiving the atypical body as in need of special design. Design for such "exceptions" is currently understood as a burden, a highly technical matter, something that hampers architects' creativity [14] (pp. 43, 45) [15] (p. 35).

2.3. My [Disabled] Body

In considering design that does address diversity, Graham Pullin [14] (pp. 41, 43) detects that 'aesthetic qualities are not usually considered in design for disability, and when they are, it is often as an afterthought, a final cosmetic treatment of an already resolved and acceptable design. But it's impossible to disentangle our sense from our overall experience of a design, the visible from our social sensibilities, the tactile from our emotional response'. What qualities are considered in design can vary widely, indeed. Whereas some architects, for instance, focus on functionality or performance, others may attach more importance to the abovementioned aesthetics, affordability or sustainability, to name but a few. How the designed environment is responsive to the human body equally varies considerably.

The reciprocity between bodies and environments is explored by Tobin Siebers [16] (pp. 84–85). Not only are environments designed by people with a specific body in mind, architectural spaces may also imply a specific social body that is constructed by social norms and codes: bodies implied by spaces. Siebers thus concludes that the designed environment determines who is disabled and who is not. By consequence, environmental barriers need to be taken into account in how disability is defined.

The definition of disability used to be dominated by a medical discourse, and only recently shifted towards stressing the role of environmental determinants in performing day-to-day activities and fulfilling social roles [17]. This "social model of disability" conceptually distinguishes between disability and impairment [18], placing the explanation of its changing character in the organization of society [19], including the spaces and technologies that shape this organization. While recognizing this model of disability, Siebers [16] (pp. 22–33) takes a step further in his "theory of complex embodiment". Without returning to the medical model, he extends the effect of socially constructed disabling environments with other disabling factors which do come from the body and are somehow independent from social structures. Siebers describes how disability, seen as variations between individuals and variations within one's life cycle, needs to be linked with social forces affecting them.

Disabling interactions can thus equally be addressed from the body as from the environment. The latter is relevant to architectural design insofar it recognizes that problems can be created (or resolved) also externally to the impaired person. Interaction with designed artifacts or the environment can, in fact, disable a person, as can the mentioned normative practices involved in their design. Siebers explains that placing disability into the socially constructed architectural spaces exposes the

constraints imposed on bodies: 'in a society of wheelchair users, stairs would be nonexistent, and the fact that they are everywhere in our society seems an indication only that most of our architects are able-bodied who think unseriously about access' [ibid.] (p. 57). Disability experience in design has thus the potential to 'question "fixed" ways of working and thinking about architecture and formulate a critique on existing culturally constructed idées-fixes' [20,21]. The case study reported on in the remainder of this article explores this potential by analyzing the design practice of a disabled architect.

3. Materials and Methods

Our case study uses focused ethnography to gain insight into how Marta Bordas Eddy, a disabled architect, refers to her own bodily experiences in establishing conceptual design standards and how these are consistently enacted in actual, materialized design. The case study is part of a larger exploration of 'how disabled architects design'. We consider both how their experiences as disabled architects influence their designs, and, in turn, how the designed environment influences their experiences. Although phenomenological and embodied cognition theories lend themselves well as a theoretical background to support this study comprehensively, the main interest remains the content of disabled architects' experiences and their further implications and meanings. With architect Marta Bordas Eddy, and the design of the house she made for and by herself, we selected an information-rich case that is unique, rather than typical or representative, not seeking to generalize through findings, but to corroborate or contradict prevailing frames of reference [22].

The data that were available include articles, written summaries and various publications that Marta had published throughout her architecture studies. Additionally, new data were collected through two semi-structured face-to-face interviews with Marta, one at her work place and one at her home. Along with a guided tour of the building at issue, the interviews immersed us into two complementary experiences of her daily life. During the audio- and video-recorded interviews we asked open-ended questions, which Marta, at times, replied to by either sketching on plans or giving live demonstrations. Guiding us through her house helped stir up memories of the reasons behind certain decisions, i.e., movement and use made issues more obvious as they appeared. Seeking multiple sources of evidence to improve the level of accuracy, two more interviews were conducted: one interview with her sister/co-worker Mariona in the "work" setting, and one interview with her partner/co-habitant Joel in the "home" setting. Due to differences in language skills, interviews were held in Spanish with Joel, English with Marta and a mixture of Spanish and English with Mariona. None of the participants requested anonymization of the data.

The first author of this study is a disabled architect herself, and, similarly to Marta, uses a manual wheelchair. This facilitated the understanding of Marta's experiences, feelings, motives and vocabulary. Anthropological inquiries in disability recognize advantages in disabled researchers conducting research on disabled people and in using this strength to fully explore the phenomenological experience of disability [23–25]. To keep potential bias in the data interpretation to a minimum and improve the findings' trustworthiness, data were analyzed collaboratively, in line with QuaGol [26]. After all interviews had been transcribed, content reports and concept lists were made, shared and discussed. This resulted in an overall concept list, based on which the interviews were coded using qualitative analysis software. Finally, all coded citations were analyzed in response to the research question, articulating the main message behind each code. Selected citations from interviews in Spanish were translated to English by the first author.

4. Findings

Marta Bordas Eddy is a Barcelona-based architect who, at the age of 16, sustained a spinal cord injury. Prior to this event, she was not particularly interested in architecture. Yet, getting around in a wheelchair and thereby experiencing the built environment in a specific way made a profound impression on her perception, identity and further prospects, thus determining her professional choice. For many years Marta taught and conducted research in various universities in the field of accessibility

and inclusive design. In 2014, she and her sister, Mariona, an interior architect, established their own office (Boed Arquitectura), occasionally collaborating with external professionals on specific projects. Boed currently assesses accessibility in existing environments or buildings and proposes solutions beyond the legal standards, making strategic choices and establishing priorities, depending on the nature of the assignment. Of great interest for our study are Marta's personal, educational and professional experiences, and their implications for her design practice. In addition, we attend to the design of her own house by virtue of its innovative and symbolic quality.

4.1. "Experiencing" the Social Model of Disability

From an early stage of being a wheelchair user, and nurtured by multiple and diverse experiences, Marta recognizes that her capabilities highly depend on how well the environment supports her desired actions in life—if at all. Throughout the interviews and her publications, she addresses various negative encounters with the environment, ranging from having no access due to stairs, curbs or too narrow spaces, to being unable to reach certain heights from a seated position. In her approach to, and understanding of, design and its possibilities, other situations feature, such as having to access buildings through secondary routes, her way being blocked by hindrances, like mobile furniture, design-induced physical effort, or transfer- or use-related safety issues. Even as a novel wheelchair user, she became aware of the staging difference between the easy environment inside the rehabilitation center and an outside world full of architectural barriers. In other words, she became aware that a problem, which was external to her bodily abilities, was determining her autonomy and wellbeing. In one of her publications, she writes:

> 'Disability is in the eye of the beholder or, in other words, disability is the perception of the outside world and not necessarily how a "somehow-impaired" person sees him or herself. (. . .) Within the word "disability", it would be indeed very helpful to understand that the prefix "dis-", added to the front of the word to express negation, is imposed by the external environment, while "ability" is inherent to each person: the skill is latent and only needs the appropriate conditions to emerge'. [27] (p. 12)

Through the architectural curriculum as well as multiple personal experiences in the university setting, she is able to understand the reasons why, in the outside world, architectural barriers are present in the first place: physical obstacles mainly originate from attitudinal and cultural ones. That her eagerness to incorporate accessible design into her projects is not met by academic staff, reveals not only a lack of knowledge on how to design inclusively, but also a lack of willingness to do so. Her different ways of experiencing and seeing the world are not acknowledged nor encouraged in the university, to the point where she has to fight for recognition of their importance. She further notices a general distancing and misjudgment towards (designing for) people who are not standard. In addition, Marta experiences a lack of awareness on how to offer her autonomous use of the university building—through distinction, dependency or over-attention. This points towards an endless loop she equally detects at a larger scale: for her, the inclusion of disabled people is hampered by architectural barriers, and, in turn, the presence of architectural barriers is the main cause for a lack of disabled people in daily life, thus resulting in misconceptions of their inherent abilities (see Figure 1). The mismatch between how she is perceived, and her actual capabilities, is expressed in the following interview excerpt:

> 'It's often that I go on the street, I cross somebody and they smile at me (. . .). People have told me "oh, you're more capable than I thought, you can do everything (. . .)". I guess people [tend to] think that you need help with everything and then they just look at me and say "ah, she doesn't". But I believe that many people don't need help, if [they] are in the right environment.'

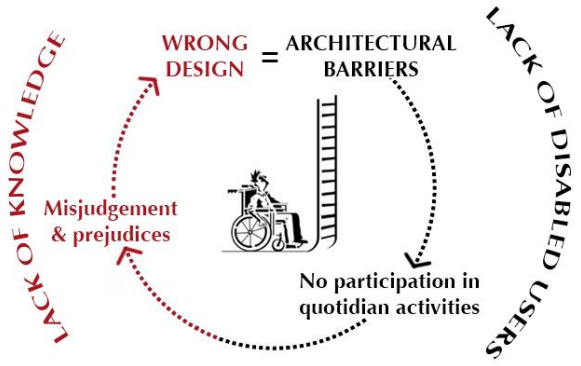


Figure 1. Marta Bordas Eddy's endless loop [28] (p. 25).

With architectural, attitudinal and cultural barriers being continuously present in her life, during her studies and beyond, Marta develops knowledge on proper ways to design integrated barrier-free environments. She likewise elaborates a theoretical resolution that aims for accessibility to be enthusiastically accepted and incorporated by the wider (design) community, integrating her idea(s) into her own designs whenever the opportunity arises. If accessible design, despite improving usability, is rejected, due to the "disability" stigma and poor aesthetic quality, she contends that architects shall move towards "unnoticed accessibility", i.e., designs that are equally functional and good-looking: an accessible design does not need to look "for the disabled"' [29]. She thus advocates for "accessible design", rather than "design for the disabled". Integrating inclusive design in such way shall furthermore enact a change of attitude in how disabled people are typically viewed.

4.2. Architectural Qualities and the Role of "Unnoticed Accessibility"

Marta's understanding of aesthetic quality in design is coupled with the abovementioned concept of "unnoticed accessibility", which emerges from two complementary sources: personal experiences of ugly/clinical looking designs "for the disabled", and her educational and professional background of being an architect. By "unnoticed accessibility" Marta means accessibility that is present but not obvious at first glance, i.e., aesthetic quality in her eyes is not for accessible design to be invisible, but "normal-looking", while avoiding excessive emphasis on establishing whom the design is intended for—"the disabled". Aesthetic quality in design is a concept she seldom mentions alone, but frequently links with functional design, understanding (or having experienced) the socio-cultural implications of separating both. Marta maintains that accessible design is usually more comfortable for everyone, but if the aesthetic quality is given a secondary importance, fewer people are likely to use it, as long as they identify "accessible" with "for the disabled".

> 'The word disabled or disability has bad connotations, so, if we keep using that word to refer to good design, I'm not sure if able people will ever use accessible design, if we say it's for the disabled. (. . .) We should try to communicate the difference of space instead. So, for instance, if you have a bigger bathroom, and a smaller one, instead of saying "this is for the disabled" and "this is for whoever", maybe we should say "this is big" and "this is small". (. . .) We should communicate the architectural space without necessarily referring to the users; that is, describe the facilities and whatever is inside and not so much the people. (. . .) Just say what's in there and everyone will be free to decide and you don't make a decision for them.'

Rather than mere aesthetic quality and functionality, Marta aims for higher goals of social justice through design, acknowledging how the environment not only impacts on a disabled person's life, but also portrays disabled people, often wrongfully depicting their inherent abilities and position in society. By advocating "accessible design", rather than "design for the disabled", she aims to palliate

the current division between "able" and "disabled". This should be achieved by giving aesthetic quality and functionality equal attention. In her own words [30] (p. 86), 'it's not possible to change people's impairments, but by adapting architecture and environments, we may change the physical, social and cultural barriers that constitute handicaps'.

In Marta's professional and personal life, she consistently gives aesthetic quality and functionality equal importance, and except when forced to choose (mostly because of market limitations), she does not favor one over the other. This idea is also latent in Boed Arquitectura's selling proposition; its motto is care for detail and aesthetics in an accessible and throughout integrated manner, go beyond "designing for the disabled" and enact the idea that disabled people are not the sole beneficiaries of accessible design, even though they are the most affected by it.

> 'We thought about it, this is a good mix; so, [my sister is an] interior [designer] and caring a lot, I mean, details, aesthetics and so on. And then I have this accessibility background. And one of my main complaints is that people do accessibility solutions ugly, so, this is a good (. . .) presentation. I mean, we're accessible and aesthetic.'

4.3. The Knowing [Disabled] Body

Marta's embodied experience determined what projects she chose to develop during her architecture studies, when she was less constrained by budget or expectations than she is in her professional career. Experiences in her life as a wheelchair user served as first entry points for deciding to design an accessible residence, in between a life-changing event that required hospitalization and the return to an autonomous life outside the shielded environment of a barrier-free facility. What and how she designed was thus prompted by her own struggles: 'we have the hospital where everything is perfect, doors are automatic, the corridors are huge and you're okay. And then [suddenly] you're home, you're crashing everywhere and everything is high'. Similarly, in her final thesis project, entitled 'Access for all', which was awarded the Schindler Award 2006 and recently published in *Four Wheelchair-User Architects* [29], she developed accessible strategies for the Palais de Tokyo in Paris on three different scales: urban planning, architecture and scenography.

Marta's embodied experience as a disabled architect equally plays a fundamental role in how she acquires, initiates and develops projects in her professional career. Even the slightest nuances in positioning certain elements are rooted in her personal experiences of living with a spinal cord injury. This becomes obvious, for instance, when she explains that ensuring transfers from both sides make sense for a toilet—as the regulations prescribe—but not for a shower seat, even when both involve similar bodily actions in similar settings. Shower seats, she clarifies, are better positioned at 90° angles relative to the tap, for better reach and manipulation, in addition to the safety and functional convenience of having a wall close to her in case of a slip. Furthermore, continuous interaction with environments, especially those that restrict her desired actions, constitute a selective pallet of information that influences her design decisions as well as the establishment of distinct architectural qualities. As an evolutionary spiral, the continuous knowledge gained from her professional life further informs how she perceives the world, namely as being both disabled and an architect, to a point where there is no division between both. This suggests no hierarchical dichotomy in her architectural practice between the mind and the body, but rather knowledge situated in (inter)action. It is through (vital) activity and consistent exposure to the (new) design repertoire in her environment—from which she selects details—that personal and professional experiences are continuously woven together into knowledge. In other words, her experience originates in architecture surrounding her, and, in the same way, her knowledge on architecture originates in that experience. Instead of assuming a double role—"being disabled" and "being an architect"—it can be argued that being a disabled architect has become her way of being, rather than a career or calling, transcending perceptual and identity boundaries.

Physical and emotional affect are consistently interlinked in a sequential manner. The physical affect of the environment negatively impacts on her emotional state. To diminish the latter,

she developed a conformist attitude, sometimes even adapting her preferences. Yet, these continuous bodily and emotional experiences are stored in her memory and selectively reactivated and applied over time, further stimulating reflection on her intuitive knowledge during the act of designing.

> 'I remember at the beginning I was angry at *everyone*, everyone who was walking (. . .). At the beginning I was like "okay, those stairs, *your* problem, *you* carry me." I'm probably not doing that anymore (. . .) I'm like "yeah, those stairs, *your* problem, I won't be your client". (. . .) I remember this situation of feeling bad myself. Nope, that doesn't happen to me anymore but I don't know why. I don't know if I just learned, if I just avoid to do it so I won't feel bad, (. . .) or if I just became used to it so it doesn't hurt anymore. (. . .) If you hit somebody a number of times enough, at the end, they no longer complain (. . .).'

Emotions play equally a fundamental role in the awareness that Marta ideally wants to achieve in the academic and professional community. In the interviews, Marta explains that, when asked to help a professor teaching accessibility matters, she introduced self-made videos showing how she uses space. Additionally, she guided wheelchair simulation outings that were discussed in real time. Marta asserts that the way accessibility used to be taught did not foster empathy. Moreover, she explains that, since accessibility is related to mobility, teaching it should require movement rather than static pictures. In teaching architecture students, she thereby favors knowledge transfer through communicating her bodily experiences with the environment by projecting herself onto the subject matter, rather than by communicating through abstract or static forms or elaborating on regulations. For Marta "knowing", "understanding" and "caring" are thus mutually linked. Besides "unnoticed accessibility", empathy and care are therefore important for her to promote a more substantial change of attitude in how architecture is conceived and experienced. The length of the experience determines, to a great extent, how much awareness can be infused; being exposed long enough to a problem entails reaching emotional affect. If people felt (physically and emotionally) close to the problem, they would understand its implications, making it harder to look the other way.

> 'My closest friends (. . .) they are most aware, they pay attention and they care. (. . .) Probably when you spend enough time and (. . .) you have the problem close enough to just care and think about it (. . .). It's normal, that [other] people don't pay attention, not because they are bad people, [but] because they don't think about it. (. . .) Simply because if it's not hard for you, maybe you just go and do it. (. . .) If they don't experience it themselves, maybe they are not able to think about it. That's why I think [teaching accessibility] is so important, and that's why I think I perceive the environment differently (. . .).'

In the professional realm Marta's embodied knowledge is acknowledged and valued particularly in the context of consulting. In such commissions, Marta's and Mariona's task is to determine the level of accessibility adequacy of buildings or urban settings based on their translation of regulations. Mariona explains that, whenever they visit a site together, she needs to take pictures of all the places Marta cannot access—pictures that are shared and discussed later on. Yet, during these visits, Mariona confesses struggling with not knowing exactly what to take pictures of. Whereas her sister is able to assess accessibility at a glance, she admits needing to 'look more', sometimes even needing to measure whether specific elements would be appropriate for wheelchair use or whether the regulations are complied with. Despite Mariona having a design background and a close relationship with her sister in a personal and professional capacity, a gap seems to exist between Marta, whose knowledge is partially rooted in her firsthand wheelchair user experience, and Mariona, who lacks such embodied experience and thus needs to ask for her advice at times. In a rare circumstance where others doubted whether it would be realistic to have a wheelchair user assessing inaccessible buildings, because she has, indeed, no access to them, Marta "defended" her expertise in this context, as follows:

> 'I'll find my ways, don't worry. And of course, I'm going to see many things that you *won't* see, because you're not the user. I mean, I know how it feels to be in the toilet left in the

> dark because there's a time-delay switch and it's not reachable from the toilet position, (. . .) this probably has never happened to you, but it *has* happened to me so many times so that I remember to check it. And like this, many other examples. So, I really *know* the problems, (. . .) those invisible problems that we don't think about but they exist'.

Worth mentioning in this respect is that Marta was asked to re-assess a sports facility that was previously assessed by other accessibility consultants, who based their instructions largely on the norms. Marta, by contrast, conducted a more nuanced evaluation, adding clarifications behind each requirement as well as prioritizing one intervention over another. In doing so, she tries to use 'some common sense':

> 'I'm analyzing this huge center, which has so many different spaces, and there are *some* of them, just a few—maybe the solarium (. . .)—[that] are not accessible, and to make them accessible (. . .) it's quite expensive, and it's quite complex, and I find myself in this situation, where I have to decide and ask "is it worth it?" I mean do I need to spend this *much* money to reach this point, when I can do the same activity here, maybe differently, but not necessarily in worse conditions?'

In this respect she is very keen on what she calls "in-between solutions" or "greys"—solutions that do not perfectly obey the regulations, but nevertheless mean a substantial improvement. These make sense particularly in existing buildings, where implementing the regulations too strictly becomes so expensive that clients instead do not change anything.

In conceiving such solutions, Marta develops design decisions, on different scales, in three stages:

- on paper, building on a repository of scenarios that she conceptualizes into a built form, while being inclined to ask the user(s), which enables her to consider the most likely choreography of the users (herself included) when using the space;
- *in situ*, using her own body as a source of reference or instrument, verifying or contradicting previous assumptions (also refining those concerning measurements or details);
- *a posteriori*, accommodating/adapting the design or behavior through use, whenever necessary after the design has been materialized.

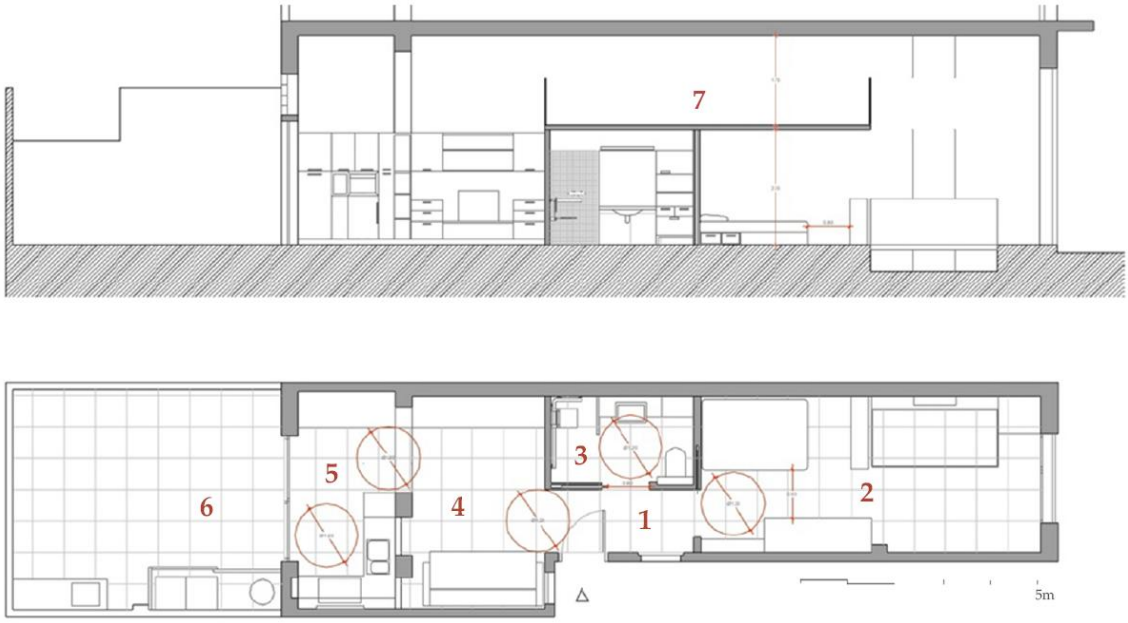
In particular, the first and second steps require time to deeply reflect on all conceivable future scenarios concerning the design's functional aspects—appreciations that are mostly informed by a selection of her own past and present embodied experiences (i.e., she reflects on her intuitive knowledge). In designing through, and according to, her own needs, she is extending her experiences and offloading their meanings into the built form, as if extending her own self into materialized objects.

Besides personally assessing a building and posterior balancing the existing conditions against accessibility codes, Boed Arquitectura's approach involves describing the reason for change and explaining the requirement, so that the architects who materialize their proposal understand not just "what" and "how", but "why". Marta's body thus provides knowledge, not only for herself, but also for others. To Marta's understanding, this knowledge source is crucial for achieving accessible quality design standards, rather than merely suppressing architectural barriers. Likewise, because she is aware to what extent external factors impact on her own life, her experiences spark awareness on how they can equally affect other people, with or without impairments. She favors human interaction (feedback from actual users) over technical/normative sources. Rather than applying standardized solutions, she aspires to accommodate individual needs yet seeks for a balanced formula that benefits all. Marta works towards suppressing architectural barriers in an integrated manner, and, in doing so, she is aware that she does not possess full knowledge on design(ing) for people with other types of impairments. Her embodied experience of using a wheelchair seems to raise her awareness of her limited knowledge about how other people experience space, thus making her mindful of including them when assessing design issues.

4.4. Marta's Home

Marta's home is located in the center of Gràcia, a district of Barcelona with narrow alleys and squares that historically was a town of its own. Her 46 m^2 home occupies the ground floor of a traditional four-story building. The narrowly-shaped property includes a small entrance hallway connecting the living room/kitchen area with the bedroom area, the bathroom placed in between, a mezzanine and an easily accessible exterior patio of 20 m^2 at level with the kitchen. Marta transformed an initially single-story space intended for commercial use into a two-story house by inserting an auxiliary mezzanine above the entrance and a bed and bathroom area, while maintaining the original direct entry from the outside and the regular entrance through the inside. With the added mezzanine ceiling at a lower height than usual—but still enough for her to comfortably get by in her wheelchair—the upper area was initially intended for occasional use, such as storage or a guest room, but got occupied when space became scarce. In order to reach the upper area, Marta opted to install a generous platform aligned with the ground floor pavement. Unlike a boxed elevator, it provides continuity to the room without losing valuable space and allows (see Figure 2b) Marta to maintain eye-contact with her surroundings while gradually reaching the upper level.

In relation to how Marta's bodily experiences informed the design of her house, we observed that she foresaw (and represented in plan—see Figure 2a) turning areas at all places where she expected needing to turn, keeping those free of obstacles or positioning the furniture in a specific way. Likewise, and seeking for optimal functionality by keeping the maneuvers with her wheelchair to a minimum, she positioned the elements she needs to use or transfer to according to how she enters the space (e.g., toilet, sink, bed, couch or kitchen—see Figure 3). Interestingly, the reduced dimensions of the house brought about unexpected benefits in terms of usability for Marta, as they allow for items to be at reach more easily, in and out of her wheelchair.



(**a**)

Figure 2. *Cont.*

(**b**)

Figure 2. Marta's house. (**a**) Cross section and floor plan; Legend: (1) entrance hallway; (2) bedroom; (3) bathroom; (4) living room; (5) kitchen; (6) patio; (7) mezzanine; (**b**) Two positions of the platform.

Figure 3. Marta using her kitchen.

In her own designs, like the one for her house, the main challenge for Marta is not about the ideas—'I can imagine how to do it'—but to find the appropriate materials and devices in the market. One of the examples she refers to in this respect concerns the design of her shower chair. Marta struggled with the salesperson in purchasing a longer bar than is usual to allow hanging both the shower chair and the towel. While the longer bar was available in the catalogue, Marta's intended use differed from its conventional use, resulting in a clash between Marta not wanting to settle for a product she did not see fit, and the salesperson not accepting to sell the product in this way. Marta ultimately purchased the products—long bar and seat—separately to assemble them later on according to her tastes and needs.

Asked about what Joel appreciated about their house, he underlines Marta's design concept. On the one hand, he asserts that the house has no negative effect on him, although it was initially designed with only Marta's requirements in mind: 'that the house was designed for her doesn't mean anything bad for me; I believe it's actually the contrary'. On the other hand, Joel also refers to the idea of unnoticed accessibility in his own words: 'one of the things that amazes me about this house is that, upon entering, you wouldn't know a person in a wheelchair lives here (. . .) at the level of the design it's a very nice house, very convenient, very practical and comfortable'.

5. Discussion

This case study offers a nuanced insight into how a disabled architect uses, experiences and perceives her environment. We identified how she attends to distinct architectural qualities and how her body serves as a knowledge provider in her own designs and building assessments. We also

analyzed the house she designed for and by herself to consider the role of the environment within the established capabilities that are assumed for disabled people.

5.1. A House that Challenges Assumptions

In defining disability, Maciej Perkowski and Anna Drabarz [31] (p. 143) point out that the shift from the medical model to the social model 'has not been fully mirrored in legislative definitions of disability in the EU and domestic legal systems of Member States'. Also, outside of Europe, this is the case: the Americans with Disabilities Act (ADA), for example, still describes disability as 'a physical or mental impairment, which substantially limits one or more major life activity' [32]. In defining it in this way, the ADA situates disability closest to the body and, in line with medical discourse, does not acknowledge external factors of the socio-material context that the disabled person lives in; it does not contextualize the disabled person. It is mainly through legislation that most designers approach accessibility matters, which they perceive as constricting their creativity, rather than enriching overall design quality [14] (p. 45). Marta, however, has a physical impairment and lives in an environment that does not limit her major life activities. Our study focused on the microcosm of a 46 m^2 private house, yet imagine if that design's enabling potential was considered on a much larger scale. The stereotype of a woman with a disability as a helpless, dependent burden—often getting in the way of full participation in society—would blot out [33] (p. 61).

As a disabled architect, Marta acquired and developed proper knowledge in appreciating design's potential to bring about the appropriate conditions for her to live the kind of life she enjoys, ensuring that her environment does not limit in any way 'one or more major life activity'. According to Sieber's [16] "theory of complex embodiment", which views disability as involving both social and physical forms, Marta cannot be considered as being less impaired in her house than she is anywhere else. But she is less—or even not—disabled. Marta's house thus shows 'that it is possible to step out of assumptions and conventions and figure out what is breathing there' [4] (p. 6). Certainly, having designed her own house, Marta offers insight into an extreme example of how much design can support and enhance human capabilities.

Besides pre-established assumptions of what can or cannot be considered a disability from a societal/anthropological angle, the case study also questions what is considered as a given in architectural design. Marta's house challenges 'perceptions and prejudices of an able-bodied majority' [34], especially those contemplating what capabilities a disabled person possesses, how they use space, what kind of space they need and enjoy, and what such a space looks like. These are concepts that, to this day, cannot be extracted through technical books, regulations or guidelines. '[How disabled people] use, experience and inhabit space is invariably more nuanced than the simplistic stereotypes of Modulor or Vitruvian Man' [35].

In the same manner, Marta's house challenges the assumption that a house for a wheelchair user has to accommodate large open spaces and thus allow for huge turning radiuses placed almost everywhere. As a disabled architect, Marta has the ability to foresee, during the design process, her own choreography down to a very detailed level, mainly based on previous embodied experiences with her environment. Fitting everything in a small house for a person in a wheelchair surely represents a challenge. Yet, through the double circumstance of being a disabled designer, Marta achieved not only full functional autonomy in a very limited space, but even turned the reduced dimensions into a benefit in terms of reachability.

By extending her theorization on "unnoticed accessibility" to the design and materialization of her own house, Marta challenges yet another widespread assumption: that design for disabled people necessarily comes with an unwanted unaesthetic side effect. Although design professionals are starting to implement care for aesthetics in the disability realm [14] (p. 49), the design industry comes from a widely established trend that accessible products had a dominant orthopedic/hospital-looking appearance and a strong "for the disabled" stigma attached to them. Design for wheelchair users most often revolves around enabling to "do things", i.e., reducing activity restrictions, rather than

addressing what things look like. Apart from obvious market limitations, the issue can also be traced back to a lack of cultural and practical knowledge needed to bring together accessible and mainstream design. Yet, "unnoticed accessibility" should not be confused with invisibility or camouflage, i.e., 'a lack of self-confidence that can communicate an implied shame' [14] (pp. 17, 18). As Pullin writes, the middle ground between two extremes—highlighting design for disability to make a statement versus camouflaging it to gain acceptance—requires a skilled and subtle approach that appeals to both groups (borrowing momentarily the "able" versus "disabled" split), so that they can approach each other.

Being independent and included in society is a choice of Marta's, and she theorizes and materializes ways to accomplish this. She points out—and proves, in her own way—that the built environment plays a substantial role in achieving autonomy and inclusion. Yet, in order to avoid further stigmatization of disabled people, Susan Wendell [33] reminds us that independence and inclusion are, again, socially constructed goals that not every disabled person can or wants to strive for, be it because some individuals simply will always need to rely on external help, no matter how their surroundings are built, or because some disabled communities are not interested in being integrated in the non-disabled society.

5.2. From Embodied Experience to Expertise

Expertise can be considered in multiple ways: as knowing more, using different processes, or using the same processes, but quicker and more selectively [36]. An alternative view posits that expertise is derived from the notion of differentiation or connoisseurship: experts are able to differentiate and perceive variables in their body and the surrounding world that would be meaningless to novices [37]. For instance, as Jos Boys [38] points out, 'for the able, the work involved in repeatedly accomplishing [routines] is mainly invisible. Their experiences of built space are generally frictionless, but for disabled people the process of everyday life—getting dressed, going out, shopping, etc.—may take varying amounts and types of effort, leading to a careful attentiveness which is itself an expertise'. In considering disabled user/experts as playing a complementary part in the design process side-by-side professional designers, Ann Heylighen et al. [39] advance disability as a potential resource to be integrated in their professional practice. How, then, should we consider Marta Bordas Eddy, a practicing architect, who has first-hand access to distinctive variables through her own body?

Our study suggests that Marta's approach to her body is similar to that of other design professionals. She possesses knowledge on all that is standard in architectural education, training and practice. In line with Imrie's aforementioned findings, Marta equally takes her own body as self-referential. Yet, what distinguishes her from other architects is precisely all the cumulative bodily and emotional experiences that her impairment has brought along over a substantial amount of time, making her aware of "invisible problems" that other people have no access to (or experience of). Very telling in this respect is Marta's collaboration with her sister. Although Mariona has developed both personal and professional interest and concern for accessibility matters, the fact that she is not a disabled designer herself still makes her dependent on instructions coming from one who is: Marta. Mariona needs to ask her sister 'where to look'. Similarly, recalling her experiences in the university setting, Marta describes how some professors—non-disabled designers—came to her asking for her opinion on how other students (Marta's peers) had integrated accessibility matters into their academic projects. Her experiences thus grant her an intuitive understanding of accessible design, not needing to consult accessibility codes very often, sometimes even going beyond what regulative competences say about how disabled people use, perceive and inhabit spaces. Her intuitive understanding, in combination with accumulated professional knowledge, equally grants her the ability to carefully consider reasonable design propositions, balancing requirements and preferences against feasible solutions or budgetary resources. The abovementioned examples illustrate the relevance of Marta's embodied knowledge and how non-disabled designers show confidence in her assessment. We did not have an opportunity to enquire into clients' perception of Marta's competence, yet the fact that she

was asked to re-assess the accessibility of a building that had been assessed based on norms before speaks volumes.

Our study further illustrates that, in making intuitive designs, decisions as well as developing viewpoints on accessible design, Marta is guided by emotions. This supports Damasio's view on how bodily experiences generate emotions that guide intuitive decision-making [40]. Although a substantial time gap exists between Marta's encountering of environmental barriers and her drawing on them during the design process, our analysis suggests that considering the body as contributing knowledge involves what Donald Schön [41] calls knowing-in-action, as it is only through (inter)action that she has the opportunity to acquire embodied knowledge. Embodied cognition theory supports this notion in considering the body as contributing to knowledge creation, through action in, and perception of, its surroundings, thus questioning the mind as the sole knowledge creator [42–45].

5.3. Adaptive Preferences

Adaptive preferences are relevant in Marta's personal life and design practice insofar the experiences that generate them reveal how the environment can thwart her capabilities and how some of her desires cannot be met by design (rather than her (dis)abilities), thereby sparking her interest in specific architectural qualities. Jon Elster [46] describes adaptive preference as an unconscious adjustment of wants to possibilities. It is often assumed to be an irrational coping mechanism and 'an unreliable guide to its possessor's best interest' [47]. The aim of adapting one's preferences is to reduce the emotional affect (i.e., tension or frustration) one feels in having wants that cannot be satisfied. Yet, others argue that not all adaptive preferences are necessarily irrational and consider Elster's constraints too narrowly focused [48–51]. Martha Nussbaum maintains that over the course of our lives, we all adapt our preferences, not because we are acting irrationally, but because we adjust to feasible options through experience. Luc Bovens advances an alternative way of distinguishing irrational from rational preference changes by considering an adaptive preference rational if it coheres with the agent's beliefs and desires. For Bovens, adaptive preferences can thus be regarded as autonomous, considered actions.

In Marta's decision-making—both in her personal and in her professional life—we can easily distinguish between deliberate adaptations that do not involve preference, and rational adaptive preferences (in the Bovens sense). Preferring not to carry out a desired action in response to environmental constraints is increasingly prevalent and more significant over the time she has been a wheelchair user—through accumulation of experiences—yet still dependent on the circumstances behind her desire. Marta has thus learned mechanisms (e.g., preferring to avoid certain inaccessible buildings) to keep frustration, due to the environment, low. Decisions regarding the design of her own house and choices in product acquisition seem to be primarily (but not exclusively) firmer and followed through. In her role as designer who designs for herself, a certain stability of preference-dominance can thus be considered.

In her role as an accessibility consultant, however, adaptive preferences are motivated by balancing acts between gains and losses. Although at first glance her adjustment might be considered in tension with her beliefs, desires and preferences (thus seemingly irrational), which of the available options is the better one is not determined immediately. The option to fully implement the mandatory regulations entails a huge (budgetary) effort and the risk of cancelling or postponing the project, thereby negating immediate benefits of implementation. Limited resources and/or accessibility regulations play thus a fundamental role in her favoring a less optimal but more immediate option, as, in her view, doing "less" is preferable to not doing anything at all, even when—or precisely because—she possesses first-hand knowledge on how these decisions affect one's life. Rather than fighting unrealistic battles, she prefers to adapt, as long as her decisions still generate "enough good" in the outcome, a preference formed by her skilled and balanced approach to designing as a disabled architect. A preference initially adapted by infeasibility of other options may even end up altering her entire preference set. When considered more broadly, adapting one's preferences from an unrealistic aspiration to feasible options can thus be considered entirely rational or even worthy of pursuit.

6. Conclusions

The contribution of this case study is two-fold. On one hand, it suggests that Marta's design raises awareness of architecture's role in (disabled) people's lives, insofar it can support and enhance or discourage and impair human capabilities. In her home setting, the environment does not represent any limitation to her functioning, i.e., in her home, she no longer is disabled, even when she does not cease to be impaired by a spinal cord injury. It is outside her home that she becomes disabled. Her capabilities thus change depending on the context. Hence the limitations she experiences do not come solely from the inside out (as a feature of the body that hampers intended actions), but also from the outside in (from design failing to meet bodily requirements). By demonstrating the environment's impact on amplifying or reducing the restrictive effects of impairments, Marta's personal and professional experiences show the social model of disability—and by extension, the theory of complex embodiment—at work. Rather than a very specific, extremely personal or even slightly eccentric design conceived around her particular skills and tastes, Marta's house appears here as a benchmark to challenge normative practices and assumptions of what design for disability should be like, as well as an invigorating statement of what (or who), in fact, disables a person. In paying equal attention to functionality and aesthetic quality, Marta's idea of pursuing "unnoticed accessibility" aspires a wider acceptability of accessible design in the mainstream design community.

On the other hand, our study shows how the embodied experience of using a wheelchair, simultaneous to being an architect, plays a role in Marta's assessment of design. It informs her in establishing distinct architectural qualities and in making design decisions that go beyond solely solving architectural barriers. Being a disabled person *and* a designer enables Marta to detect problems in design in an intuitive body-based manner and think of solutions at the same time. Her appreciation for specific architectural qualities was initially established through personal experiences as a user, even before initiating her career, and further developed and refined through educational, professional and continued personal ones. She thereby moves from "disabling, expensive, exclusive, non-integrated, ugly/clinical looking and stigmatizing" encounters with design to an "enabling, affordable, inclusive, integrated, aesthetic and equal" compendium of qualities in her own designs. Some of these previously established qualities also act as working tools and inform design decisions.

In her personal life, adapting her preference to what can realistically and effortlessly be achieved is linked to keeping her frustration low. In her professional life, however, preferences she rationally adapted prompted by limited feasible options, potentially can change her entire preference formation. Marta's resolution of issues that arise from adaptive preferences entails a form of expertise with significant budgetary implications for clients and design professionals: her accumulated intuitive knowledge enables her to build towards pragmatic and balanced solutions. Based on the (un)availability of certain options, she aims for reasonable—although not integral—improvements, thus avoiding withdrawal of the project or eternal procrastination.

The selected case and building have allowed us to gain insight into architecture's role in supporting and enhancing human capabilities. The analysis of Marta's house challenges prevailing views of what a house for a disabled person looks and is like, and how apparently restricted capabilities can be neutralized by design. Any other design would have been restricted by client expectations, regulations, budget, social conventions or other (disabled) people's needs. Further research would profit from covering a wider spectrum of building typologies, ranging from private over public to urban. Whereas Marta's private house was designed by and for her, studying other project types would allow attending to how disabled architects' designs affect other users.

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