# Weathering the storm: Generating intersectional urban design understandings for winter cities

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*Abstract*
Taking an intersectional approach, this research explicates the unique manner in which spatial injustice is experienced in a winter city when an individual possesses the multiple disadvantaged identities of disability, gender, age, and class. Employing case study methodology and go-along interview methods, this research answers the question: how can the lived experience of an older, formerly homeless woman with mobility and mental health disabilities inform intersectional design recommendations for winter cities? The findings identify three priority areas for intersectional design in winter cities to facilitate inclusion, wellness, and resilience among those disadvantaged by disability, gender, age, and class. These areas are: components of the built environment requiring intersectional understanding of accessibility (sidewalks, public transit-access routes, building entrances, and public transit pick-up zones); the urban context of senior and affordable housing; and public transportation. This paper contributes to the literature by demonstrating that intersectional understandings of urban winter environments are potent knowledge towards transforming cities from ones that disable and marginalize, to ones that enable and empower.

Keywords: intersectionality, urban design, winter cities, accessibility, disability

*Résumé*
En adoptant une approche intersectionnelle, cette recherche explique la manière unique dont l'oppression socio-spatiale est vécue dans une ville d'hiver lorsqu'un individu possède les multiples identités défavorisées du handicap, du sexe, de l'âge et de la classe. En utilisant une méthodologie d'étude de cas et des méthodes d'entrevues, cette recherche répond à la question: comment l'expérience vécue d'une femme âgée, anciennement sans-abri, à mobilité réduite et souffrant de troubles mentaux, peut-elle éclairer les recommandations de conception inclusive pour les villes d'hiver? Les résultats suggèrent trois domaines prioritaires pour une conception inclusive dans les villes d'hiver: les zones cibles de l'environnement bâti nécessitant une attention accrue sur l'accessibilité (trottoirs, voies d'accès aux transports en commun, entrées des bâtiments et zones de ramassage des transports en commun); l'emplacement urbain des logements pour personnes âgées et abordables; et les transports publics. Cet article contribue à la

littérature en démontrant que la compréhension intersectionnelle des environnements hivernaux urbains est une connaissance puissante pour transformer les villes de celles qui désactivent et marginalisent, à celles qui permettent et autonomisent.

Mots-clés : design urbain, villes d'hiver, accessibilité, handicap

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## Introduction

The design and construction of the Canadian urban environment is a blueprint of oppression that disproportionately marginalizes persons with mobility limitations in convergence with other experiences of disadvantage, including mental illness, age, poverty, and gender. This paper addresses the potential learnings from approaches that privilege the embodied knowledge of persons with mobility limitations within an intersectional framework: melding lived experience, spatial knowledge, and multiple dimensions of identity to generate nuanced design understandings in a Canadian winter city. Connecting the micro-level knowledge of individuals with the structural-level knowledge of urban space is increasingly called for within disability and health scholarship (Lid 2014; Northridge, Sclar, and Biswas 2003), which proposes that the embodied experience of disability is manifested and reproduced through the built environment (Gleeson 2001; Lindsay and Yantzi 2014). Accordingly, this research seeks to answer the question: how can intersectional theory and the lived experience of one older, formerly homeless woman with mobility and mental health disabilities contribute to design understandings in a Canadian winter city?

Urban scholarship increasingly advocates for diversity and social justice perspectives within the field but offers limited strategies towards achieving this goal (Agyeman and Erickson 2012; Hamraie 2013; Sandercock 2003; Wood and Landry 2008). Walker, Frediani, and Trani (2013) assert that urban research seeking to understand the relationship between intersectional identities and urban contexts is critical for advancing spatial justice, defined by Soja (2013) as seeking the equitable distribution of resources, occupation, and opportunity in space as well as understanding the impact of the built environment on processes of identity and experience. Spatial justice is based on a socio-spatial dialectic that attests "social processes and spatial contexts interact and mutually create each other to shape human experience and meaning" (Grittner and Burns 2021, 3).

Further, Agyeman and Erickson (2012) acknowledge that gender, age, class, and disability as identities of disadvantage have been overlooked within design research. Accordingly, we propose that intersectional understandings of how urban winter environments are experienced by persons possessing the disadvantaged identities of disability, gender, age, and class is potent knowledge towards transforming cities from ones that disable and marginalize, to ones that enable and empower.

## Disability and the built environment

The disabling design and construction of the Canadian urban environment is a structural barrier: privilege and power materialized in built form. Schindler (2015) identifies architecture's exclusionary power to regulate and segregate society as powerful as the law but more implicit and invisible. Urban environments reflect the values and beliefs of designers, architects, and planners regarding who inhabits a city: "built environments serve as litmus tests of broader social exclusions" (Hamraie 2013, n.p.). The exclusion of persons requiring mobility devices in Canadian cities is particularly pernicious, preventing individuals from engaging in their everyday activities (Di Stefano, Stuckey, and Lovell 2012), and connecting with their communities (Word Health Organization 2011). In 2012, almost 14% of Canadians reported having a disability that impacts their ability to maneuver through urban environments, including mobility, cognitive, and sensory impairments (Bizier, Contreras, and Walpole 2012). Further, approximately 289,000 Canadians with disabilities report using a wheeled mobility device, such as a manual wheelchair, power wheelchair, or mobility scooter, to access their communities (Ripat, Borisoff, Grant, and Chan 2018).

Despite the prevalence of disability within Canadian society, design practice within Canada typically approaches accessibility design codes as "another meaningless checklist to tick off in the process of design creation" (Rieger and Strickfaden 2016, 4). Unlike European contexts, the Canadian design environment largely approaches

disability through the lens of safety and risk management, while considerations of identity, wellness, and inclusion remain overlooked (Strickfaden 2018). Indeed, Jónasdóttir and Polgar's (2018) recent scoping review identified the interconnected areas of planning, architecture, construction, and transportation as the most common barrier to community access.

## Intersecting oppressions

Collins (2015) defines intersectionality as an analytical stance where "race, class, gender, sexuality, ethnicity, nation, ability, and age operate not as unitary, mutually exclusive entities, but as reciprocally constructing phenomena that in turn shape complex social inequalities" (2). Applying intersectional theory, this research explicates the unique ways an individual possessing the disadvantaged and interlocking identities of mental illness, gender, age, class, and physical disability, experiences spatial injustice in a Canadian winter city. Therefore, intersectionality is the location where multiple identities and systems of inequality converge (Marsiglia and Kulis 2009). Intersectional theory asserts that overlapping axes of oppression form a unique experience of the world and that multiple aspects of identity "are always at play in shaping and influencing social positions and power relations" (Hankivsky and Christoffersen 2008, 276). Intersectionality developed via a long legacy of black-feminist scholar-activism and social justice movements concerned with the interlocking experiences of gender/race/class (Collins 2015). Labelling this already ongoing work "Intersectionality" is attributed to black feminist and critical race scholar Crenshaw's (1990) Stanford Law Review paper "Mapping the Margins: Intersectionality, Identity Politics, and Violence Against Women of Color." While intersectionality emerged from explorations of race/class/gender, Collins (2015) advocates expanding intersectionality to include other systems of power, including socially constructed categories of age, ability, ethnicity, and sexuality. In doing so, intersectionality seeks to discern how interlocking identities create unique lived experiences, entwined with relationships of power (Hankivsky and Christoffersen 2008). Intersectional theory is undergirded by the argument that: "knowledge that is too often missing and is often desperately needed is at the intersection between things and people, between feats of engineering and social structures, between experiences and bodies" (Tuana 2008, 189).

Creating an intersectional understanding of urban environments is necessary to create inclusive cities that support the complexity of human experience and habitation; disability-related urban scholarship traditionally frames disability as a singular experience, assuming that a person with disabilities "pre-eminently belongs, for all practical purposes, to one collectivity only" (Sen 2006, 20). This uniform perspective results in "the invisibility of multiple subordinated identities" (Walker et al. 2013, 122) and overlooks how multiplicities of oppressions can create "cumulative disadvantage" (Purdie-Vaughns and Eibach 2008, 379). In their everyday life worlds, persons with mobility limitations require environments that support the totality of their identities and experiences. As Russel (2007) writes, "a real-life person is not a woman on Monday, a member of the working class on Tuesday, and a person of African descent on Wednesday; intersectionality requires one to read these categories simultaneously" (47). Recognizing that persons with mobility limitations possess other intersecting and melded aspects of identity, as well how these experiences are supported and challenged by our urban environments is a key step towards inclusion. Intersectional understandings of the urban environment can bring together and address "common sources of exclusion, exploitation and oppression" and facilitate "interlinked agendas for recognition and redistribution" (Levy 2009, viii), ultimately advancing spatial justice within Canadian winter cities. We argue that intersectionality will generate critical and productive understandings of design strategies for winter cities that challenge our current state of spatial injustice.

Intersectionality also argues for a different modes of knowledge creation, emphasizing the need to flatten power differentials in knowledge by emphasizing diverse voices and collaboration (Choo and Ferree 2010). Intersectionality centres the voices and lived experience of those who are marginalized as the basis of empirical research, carried out for the express purposes of making experiences of marginalization visible as well as affecting change (Alexander-Floyd 2012). Understanding how these experiences of oppression might be mobilized and translated towards transformation is a critical component of intersectionality (Moosa-Mitha 2015). Design rooted in intersectionality will challenge the expert-based decision making that currently dominates our urban environments.

*Disability, gender, class, and age.* Throughout their life course, Canadian women consistently experience disability at higher rates than men and live with more severe disabilities (Morris, Fawcett, Brisebois, and Hughes 2018). Similarly, compared to their male counterparts, Canadian women are more likely to experience poverty as they grow older, live alone, and depend more heavily upon support services (Plouffe 2003). The DisAbled Women's Network Canada (DAWN 2014) shares that Canadian women with disabilities experience an unemployment rate of 74% throughout

their life. Women possessing a disability for six years or more are four-times more likely to have low incomes than women without disabilities. With lower employment and income throughout their life course, older Canadian women with disabilities are significantly more likely to be living in poverty. In 2015, the after-tax median personal income of Canadian women aged 65+ with disabilities ranged from $22,980 (milder disabilities) to $19,520 (more severe disabilities) compared to their male counterparts who report personal incomes of $31,550 (milder disabilities) and $27,560 (more severe disabilities) (Morris et al. 2018). Living alone with limited incomes, older women with mobility-related disabilities are unable to fund private solutions to mitigate inaccessible urban environments, such as adapted private vehicles, private support workers, delivery services, and customized home environments.

Understanding how the subordinate identities of gender, income, age, and disability commonly intersect within Canadian society allows us to identify a group made structurally vulnerable by the Canadian urban environment: older women with disabilities and lower incomes. Members of this group depend heavily upon affordable housing (McCracken and Watson 2004; Milaney, Ramage, and Screpnechuk 2019), public transportation (Mercado, Páez, and Newbold 2010; Ripat and Colatruglio 2016; Ripat et al. 2018), and social support services (Plouffe 2003) to meet their basic needs. Residents of Calgary's affordable housing stock are overwhelmingly female (84.4%) and a majority live with a form of disability, including pain (57.4%), mental health (42.2%), and mobility issues (35.2%) (Milaney et al. 2019). This group is at high risk for further mental health challenges due to acute social isolation and physical harm due to the disabling design of Canadian cities, a situation exacerbated by Canadian winter weather that makes challenging environments increasingly hostile (Lindsay and Yantzi 2014; Ripat, Brown, and Ethans 2015). As these statistics reveal, persons with mobility limitations are commonly dealing with a constellation of vulnerabilities, including lower-incomes, gender, and mental health, all of which intersect with aging as an individual advances through life. Spatial needs must be considered across this confluence as opposed to along a singular axis of identity.

## Winter and disability

A burgeoning body of research is beginning to examine the added impact of winter upon persons with mobility limitations (eg: Lindsay and Yantzi 2014; Morales, Gamache, and Edwards 2014; Ripat et al. 2015) and is exploring how winter weather compounds environmental disability. This body of research can broadly be divided into two main areas of focus:

1. Impact of winter conditions upon persons with mobility issues, and
2. Specific issues with the built environment in winter.

### Impact of winter conditions

The impact of winter on persons with mobility limitations is widespread. The inability to leave one's home throughout winter prohibits social connections, prevents access to critical services including health and social services, and blocks participation in meaningful activities, including employment (Gamache, Routhier, Morales, Vandersmissen, and Boucher 2019). This forced incapacitation results in profound harm to an individual's social, emotional, physical, and financial wellness (Clark 2014; Gallagher et al. 2011; Gamache et al. 2019; Ripat et al. 2015).  Research with persons relying upon wheeled mobility devices found that 42% of respondents decreased their outings in winter from 3-7 occasions per week outside of winter to less than three outings per week (Ripat et al. 2015), describing themselves as: "shut-in, hermit…homebody" (Ripat and Colatruglio 2016, 101). The resulting social isolation fosters loneliness and depression; individuals also experience fear and anxiety concerning their physical safety (Morales et al. 2014; Ripat et al. 2015). Compounding these experiences of poor mental health, physical inactivity, which comes with being confined in-home throughout winter, is associated with a 50% increase in rates of chronic illness among persons with disabilities (Public Health Agency of Canada 2019).

Colder weather impacts the physical functioning of persons with disabilities, who report increased pain, muscle tightening, and difficulty breathing (Lindsay et al. 2015). Sitting in a mobility device makes individuals susceptible to cold faster (Lindsay et al. 2015); becoming stuck in snow and lengthy waits outdoors for transit increases the risk of frostbite and hypothermia (Lindsay and Yantzi 2014; Ripat and Colatruglio 2016). Uneven frozen surfaces commonly tip mobility device users onto sidewalks and roadways leaving them stranded or injured (Ripat and Colatruglio

2016). Also, many mobility device users are forced to use the road instead of sidewalks to traverse the city, increasing their risk of being hit by vehicles (Lindsay and Yantzi 2014).

### Built environment in winter

Pedestrian infrastructure and public transportation are two significant barriers for persons with mobility limitations for equitable movement and inclusion in winter cities (Ripat et al. 2018). These barriers prevent physical movement and increase social stigma; the lack of cohesion between persons with disabilities' needs and the urban environment reinforces their position as community outsiders (Edwards and Imrie 2003).

*Pedestrian infrastructure.* A barrier-free pedestrian realm is a key element of mobility and inclusion for persons with disabilities, as this network connects their homes to all other areas of the urban environment (Gamache et al. 2018). Without a private vehicle adapted for accessibility, persons with mobility limitations rely upon the pedestrian network to leave their homes. Snow and ice removal from the pedestrian realm is a primary obstacle for persons with mobility limitations living in winter cities (Mortenson, Oliffe, Miller and Backman 2012; Ripat et al. 2015). Sidewalks, curb cuts, crosswalks, bus stops, pedestrian crosswalk buttons, and building entrances are identified as especially problematic for snow removal (Lindsay and Yantzi 2014; Lindsay et al. 2015; Morales et al. 2018; Ripat et al. 2015; Ripat and Colatruglio 2016).

Snow removal from pedestrian infrastructure is frequently neglected due to municipal policies, which prioritize snow removal from roadways before pedestrian areas (Morales et al. 2014). Snow barriers also stem from improper snow removal; snow from sidewalks is often cleared and pushed into curb cuts or around pedestrian crosswalk buttons, making curb cuts impassable and crosswalk buttons unreachable for anyone using a mobility device (Morales et al. 2014). Scholarship commonly advances technical solutions for snow removal, including the redesign of curb cuts and sidewalk built-in hydronic or electric snow-melting systems (Morales et al. 2014).

*Public transportation.* Persons with disabilities largely rely upon public transportation due to the economics and inaccessibility of private vehicles. Jónasdóttir and Polgar (2018) identified transportation as the number one factor impacting on community mobility and access for persons with mobility limitations, which manifests in the intersectional position of living as a woman with a disability on a low-income. The majority persons with disabilities—even more so if they are women (Plouffe 2003)—do not possess the economic means for private accessible transportation (Ripat and Colatruglio 2016; Ripat et al. 2018). Public transportation for persons with mobility issues is dictated by both the built environment and snow removal, as the built environment determines transportation routes, spatial proximity, and access, while snow removal impacts the ability to access transportation.

Scholarship identifies specialized-accessible public transportation services as critical for persons with mobility limitations in the winter (Labbé, Mortenson, Rushton, Demers, and Miller 2018; Lindsay et al. 2015; Morales et al. 2018; Ripat et al. 2015; Ripat and Colatruglio, 2016; Torkia et al. 2015). Specialized-accessible public transportation services are both in greater need and disrupted by winter weather and unreliable for non-medical related activities (Labbe et al. 2018; Lindsay et al. 2015). For example, accessible transportation is frequently cancelled as soon as snowstorms are forecast (Morales et al. 2018). These findings emphasize the need for inclusive public transportation within a winter weather context, moving away from the "dividing practice" (Labbe et al. 2018, 13) of segregating persons with mobility limitations from the general transit population.

Winter conditions make buses and shuttles challenging for persons requiring accessible public transportation. Accessible transportation vehicles employ lifts, ramps, and platforms that often freeze in winter weather (Lindsay and Yantzi 2014) and must be used on flat surfaces, which tend to be non-existent in winter ice-and-snow conditions (Morales et al. 2008). Entering and exiting public transportation during the winter season is another accessibility issue (Morales et al. 2014).

This accumulating evidence within the disability field elucidates the impact of inaccessible winter cities. Our research builds upon this prior scholarship to consider how these experiences within a winter city are magnified by the intersectional experiences of physical disability, mental health, class, gender, and age.

## Methodology

### Research design

This research draws upon qualitative, case study methodology; go-along interviewing and spatial analysis are the primary research methods (Grittner 2019). Case study research explores contextual processes, aiming to develop knowledge and understanding through a "force of example," distilling knowledge through a single sample imbued with specific qualities (Flyvberg 2006, 228). As it typically focuses on individual events, relates to a specific time and place, and prioritizes context (Willig 2004), case study methodology is appropriate for understanding lived experience in relationship to specific environmental contexts. Stake (2005) identifies an "instrumental" case study as one that provides insight into an issue, creating "understanding as a tool to be used in the on-going process of practical transformation of society" (Fossey, Harvey, McDermott, and Davidson 2002, 720). This case study draws from a secondary data analysis (Irwin 2013) of the *Beyond Housing* study, a two-year study (2017–2019) examining how older adults aged 50+ created a sense of place after homelessness in Calgary, Canada (Burns, St-Denis, Walsh, and Hewson, 2020). The study received approval from the University of Calgary Conjoint Faculties Research Ethics Board. All participants—seven older adults with histories of homelessness—provided informed consent and agreed to portray their experiences through individual and group interviews, go-along interviews, images, film, and spatial analysis.

*Go-along interviews.* The go-along interviews from the *Beyond Housing* study form the basis of this case study's data. Go-alongs, a mobile interview method predominantly used within anthropology, is one in which researchers accompany participants in their habitual activities and environments to uncover "spatial practices in situ while accessing [participant] experiences and interpretations at the same time" (Kusenbach 2003, 463). Spatial practices are one of the five areas of potential Kusenbach (2003) identifies with go-along interviews, asserting they allow researchers to examine how participants relate to their environmental context. During the go-along interviews researchers accompanied participants throughout their homes and communities and asked questions about community activities, aspects of community journeys, social interaction, transportation options, and challenges and assistance they experience during their activities. The intention of these interviews was to elicit participants' thoughts and feelings concerning their everyday environmental contexts.

While four of the study's seven participants participated in community-based go-along interviews, this "single holistic case study" (Baxter and Jack 2008, 549) focuses on the experiences of a single participant, Laura, who also contributed as an author of this paper. This case study approach allowed for a deep analysis and connection between Laura's community mobility experience in a winter city and her surrounding urban fabric, aligning with intersectional theory that advocates for deep engagement with lived expertise (Alexander-Floyd 2012). Adhering to case study methodology that calls for multiple data sources (Baxter and Jack 2008; Patton 1990; Yin 2003), integrated with the data from the go-along interviews include both spatial data (maps) and visual data (photo documentation), facilitating a holistic understanding of community mobility experiences in a winter city. Interdisciplinary methods of analysis combined these multiple sources of data. The go-along interviews were recorded, transcribed, and inductively coded using NVivo software. Maps and photo-documentation were analyzed to understand Laura's spatial and material context, understanding that the material and spatial elements of the physical word are data that can be parsed similar to written text (Cameron and Markus 2003; Dovey 2008; Grittner and Sitter 2020). Converged, these multiple data sources facilitated a thick appreciation of Laura's lived experience within a Canadian winter city, verified and cross-checked against Laura's own interpretations. All findings and the final manuscript were reviewed and edited by Laura as a co-author.

### Setting

Approximately 1.2 million residents live in Calgary, Canada, (City of Calgary 2018) located in the Canadian west, with an average winter temperature of −6.4°C (Environment Canada 2010). Winter weather varies with periods of temperature dropping to -44°C and extreme daily snowfalls reaching between 25–48 cm. Each winter sees a substantial accumulation of snow between the months of November and April. Access to shelter for low-income persons is a pressing need in Calgary, which has the second highest rate of income inequality in Canada (Statistics Canada 2016). Recent research indicates that almost half of shelter users in Calgary are over the age of 50 (Rowland and Hamilton

2016), a situation confounded by Calgary possessing one of the most limited affordable housing inventories in the country (Canadian Mortgage and Housing Corporation 2016). Winter weather, demographics, and socio-political context make Calgary a suitable locale for generating intersectional knowledge of urban winter environments.

### Participant
As part of the *Beyond Housing* study, Laura, aged 67, participated in four home-based interviews and two go-along community interviews with Laura navigating using her manual wheelchair. Laura was dependent upon her mobility device to engage in her everyday routines both within her home and outdoors in the community. With limited financial means, Laura spent 80% of her gross income on her room in seniors supportive housing. She had been using both a walker and electric scooter for 25 years.

## Findings

Laura's go-along interviews and convergent spatial analysis suggest three priority areas for inclusive design in winter cities to facilitate inclusion, wellness, and resilience among those disadvantaged by disability, gender, age, and class. These areas are: components of the built environment requiring an intersectional understanding of accessibility (sidewalks, public transit-access routes, building entrances, and public transit pick-up zones); the urban context of senior and affordable housing; and public transportation. The findings are supported using illustrative quotes from Laura's interviews and spatial analysis of Laura's urban environment. Laura's situatedness gives rise to knowledge specifically generated by the challenges she encounters in the material world.

### Built environment target areas
Laura's experiences navigating her community in her electric scooter pinpoint areas of the built environment that exclude older women with disabilities and lower incomes from community and diminish their wellness during winter, including public transportation access points, sidewalks and crosswalks, and building entrances. How these target areas are currently constructed do not reflect an intersectional understanding that older, lower-income women with disabilities navigate the world independently and largely without support, while often possessing histories of trauma and heightened vulnerability. As Laura's expertise illustrates, intersectional knowledge broadens our understanding of how the design choices embedded in these target areas impact human experience, particularly concerning dependency and vulnerability.

*Public transportation access routes*. Bus stops, ramps, and walkways leading to train stations, as well as pick-up/drop-off areas for Calgary's specialized accessible bus service were all highlighted by Laura as winter city barriers that increase her risk. As a lower-income older woman with multiple disabilities, Laura is solely reliant upon public transportation to access all services and amenities, she has no personal vehicle, lacks the financial resources to pay for taxis or ride-sharing services, and has no other members in her household to assist in helping her access community. Laura experiences widespread barriers in reaching transit. She describes the high-traffic pick-up area in front of her senior's residence as treacherous in the winter:

> My biggest problem is getting myself even out in this weather … so when the bus comes I have to go out there, they have to try to get me out there and in this ice there's been a few times when they've had problems and slipped … and then the other points is if I was doing this by myself you know I'd be going backwards. I feel like an invalid.

This experience of slippery dependence could be mitigated through an appropriately designed pick-up area that is covered, heated, and reflects knowledge that persons with disabilities must navigate this space independently and spend long periods of time waiting throughout the winter.

Laura experienced similar issues exiting public transportation in other areas of the city, sharing how in the winter of 2018 she seriously injured her knee while exiting an accessible transit bus: "the bus driver while pushing me, shoved me right over 'cuz he got caught on some snow, and smashed my knee and that's why it's been hurting ever since." Even the public transit train station three city blocks from Laura's home, shown in Figure 1, poses issues ac-

**Figure 1**
Prolonged route to LRT station in winter due to lack of snow removal and circuitous design
Photos and map by Alison Grittner and Laura Fiorilla

cessing and navigating during winter. The access routes to and from the station are not prioritized for snow removal, requiring Laura to either navigate through snow and over ice or to take longer routes, exposing her to longer times in freezing temperatures: "During the whole winter … we have to go out there, up down around and back to get to [a specific community name] in the snow." Laura mentioned this barrier in multiple interviews: "They don't clean the walkway between here and the LRT station [in the wintertime]….So, we have to go three blocks up, three blocks over and back down to get to the station."

*Sidewalks and crosswalks.* Laura cited the sidewalk and crosswalk portions of the pedestrian realm in both her immediate neighbourhood as well as around the city as significant barriers for winter mobility that prevent her from accessing community services and public transportation. Discussing the sidewalks around her building, she noted that it "comes down to the snow removal…This sidewalk right by their city…building, which they're supposed to keep that walkway clean isn't." Sidewalks and crosswalks meant to connect public transportation and community services are dangerous in winter conditions:

> I got stuck on 50th and crossing it going from my Alcoholics Anonymous (AA) meeting going to 48th, where the meeting is, to my home at 55th. Well I got run over. Because they were rushing to get in front of traffic; and I got run over with my scooter and everything. Another example is I was in my manual wheelchair crossing 61st and I got stuck three lights and the police had to come to get me to the side.

Laura's experiences highlight the inadequacy of Calgary's snow and ice removal from winter sidewalks (an environmental and policy context that needs to be considered during the design process) resulting in physical injury and psychological fear. Laura's experiences of being immobilized and helpless in the winter pedestrian realm, having to

rely upon strangers for rescue, is even more dire when examined through an intersectional lens that includes gender. Women experience heightened fear of assault and victimization in the public realm (Day 2010), and women report higher rates of harassment in spaces they navigate to access transit (Transport 2014). In winter, for Laura to attend her weekly AA meetings—a crucial element supporting her wellness—comes with heightened experiences of vulnerability due to her gender and disability.

*Building entrances.* Laura lives in an independent living facility for seniors and many residents have mobility limitations. Despite this concentration of need for accessibility, the building entrance is commonly covered in snow and ice in the winter; Laura describes that: "Even in front of this building, which they never clean, is ice so high that more than say five or six drivers have slipped." Laura illustrates that navigating from the accessible transit pick-up and drop-off area to the building entrance is particularly difficult in winter: "When [the accessible bus] does come in the front, the snow is so hard … they slip and [a] few of them have fallen trying to put us in there." Building entrances in this winter landscape are not built with the basic elements required to foster independence among individuals who are aging or living with a physical disability, instead their current design creates "unequal relationships of dependence and independence" (Barron 2010, 434). As a result, Laura, and individuals with similar social locations, experience increased vulnerability by having to depend upon others for safe winter egress.

## Urban location

Laura's housing location is predicated by her housing need and intersectional social location. As an older woman with disabilities and a limited income, Laura requires housing that is safe, affordable, accessible for an electric scooter and power chair, and accepting of the mental health issues she experiences. The seniors housing provider that owns her current building has over 1500 units throughout Calgary, but this is the only building that allows her scooter and power chair in her suite. Laura has very little choice in where she resides in Calgary because most housing providers want her to buy a parking spot outside to store her scooter and power chair.

The neighbourhood where Laura lives has a higher concentration of residents over the age of 65 (13% compared to 10% in the City of Calgary overall), the majority of whom are female (64%), and a quarter of whom are low-income (25%) (City of Calgary 2019). Laura notes that: "We have five major senior's buildings in a four-block area. That's too much actually, I feel. You know, something's wrong, you know, that's just, they're dumping everybody in one area." Despite the high number of older, low-income women living in the area, Laura notes that the neighbourhood does not have the amenities she—and others like her—require, including a grocery store, an affordable pharmacy, and a hospital:

> There's no food, there's no cafeterias except expensive ones around here. They're not food wise, diabetic wise or healthy wise. Hospitals they took out the only one, imploded it. The two hospitals I go to are hard to reach. Peter Lougheed, which is a mile from Rundle Station down a steep ramp, or Rockyview hospital, where the BRT station is a ½ mile down a steep road … The new Bridgeland-Riverside community centre, six blocks from us, makes it impossible for most seniors to get to. It's next to new developed condos.

In all seasons, Laura wishes to participate in meaningful activities throughout the city landscape, which include her weekly AA meetings, her three-day per week volunteer work, a senior's coffee group, and accessing the community food centre. None of these activities, services, or spaces are in her community and she is forced to take the separate accessible transit service during winter to reach all of them. Laura emphasized the importance of having these services in her community: "They dump us in areas which are not accessible to things that we really want." On a limited income, Laura is dependent upon the City's low-income transit pass, which is in continual jeopardy of being cut as a cost saving measure. Laura shares her fear of this pass discontinuing: "it will cause me to isolate and put me into a deep depression or suicide which I don't know if I could get out of it." Her biggest hope is to visit the mountains, where she went when she was young and identifies as a key aspect of mental wellness, but she has no transportation options to take her outside city limits.

Figure 2 illustrates Laura's experience; none of the amenities or locations she requires are located in her neighbourhood, although ones located close to an LRT line—the senior's support centre and her volunteer position—require the least travel time. Her travel times on general public transportation range from 22 to 71 minutes
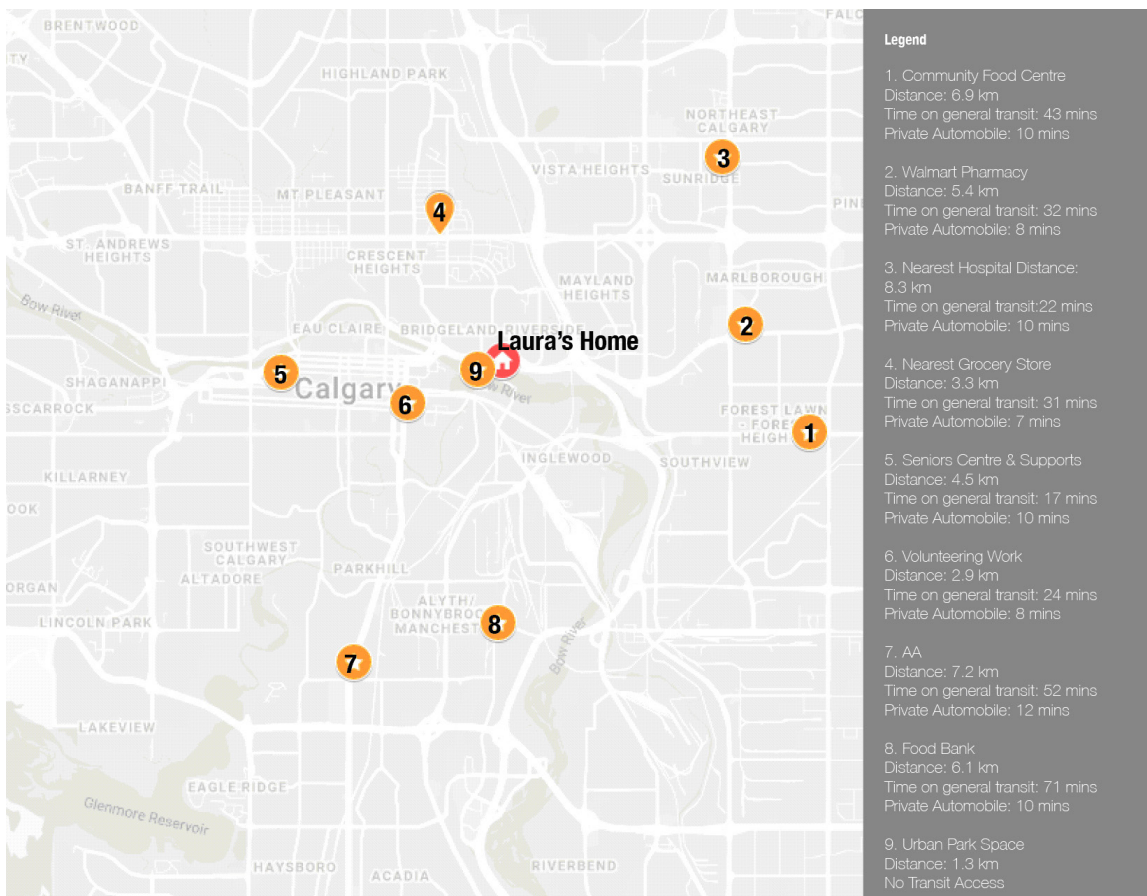
**Figure 1**
Distance and travel times Laura experiences when accessing community and supports in winter
Map created by Alison Grittner, adapted from Google Maps.

one way, with an average trip length of 37 minutes. Private automobile travel to these same locations would average between 8 and 9 minutes; Laura's position as a low-income, older women with a disability results in her spending at minimum 400% more time travelling across Calgary's urban landscape than someone with the means to access a private transportation. Further, in winter Laura's access to the general public transportation network is compromised by ice and snow, emphasizing her home's urban location as critical. An intersectional understanding of Laura's experiences of transportation and housing location challenge current design assumptions and power, which reflect the norms of white, middle-class, abled, masculinity, that prioritize suburban living and private car-ownership (Polk 2009). An intersectional lens towards the site location and design of affordable and seniors housing would take into consideration and question assumptions of transportation, travel time, neighbourhood context, and current municipal snow removal policy context.

## Public transportation

During winter, sidewalks, crosswalks, building entrances, and public transportation access routes are rendered inaccessible and dangerous by snow and ice. With no economic means to pay for private transportation, Laura's only option for accessing the world outside of her room is accessible transit, a separate accessible public transportation that provides door-to-door service for citizens who qualify. Laura views having to rely upon this service as her only option as problematic: "All of [my activities] are by [accessible transit] which is really rough on me because of my physical, back, and everything else."

The issues of winter, disability, age, income, and accessible transit render even a prescription medication pick-up from a pharmacy at minimum onerous and at worst impossible, further financially marginalizing Laura:

> Now, under the City and accessible transit you have to go and wait one hour at the drugstore, pick up your medication, come one hour to come back home. And, just to pick up drugs. So, a perfect example is … I used to have meds at Walmart 'cuz they're cheaper by one third. But, they only have one drop off location which is a mile from the Walmart. I can't push myself that far and down and up a ramp. I can't do that anymore, so I'm forced to go to a local expensive drugstore that delivers.

Having to use the accessible transit service also prevents Laura from participating in her favourite activities: "I like going to the seniors centre…which used to be across the street…I used to love going there but I'd have to take accessible transit which would be one hour there and one hour back." While the increased time involved in taking the accessible transit service interferes with Laura's ability to engage in her community, the non-specialized bus network can provoke trauma-responses and physical injury:

> I usually book the accessible transit service but … I forgot. AA to me is not just somewhere I go. Remember, I lost my kids because of it so, for me, it is a necessity. Well, I had my scooter so the Saturday I took it well, like weekend, all of the downtown is shut down because the LRT is shut down. So, at this, right here, there's a bus. It goes all way to the end and all the way back and then you can, change the down bus to there. Well, they're hanging over top of me and to the point where I get a little bit claustrophobic. And them hanging over me, it was terror so, I couldn't [take] that after getting back so I decided on taking on the local bus here which goes over near to where I go to a social service agency. It's only a couple blocks, well, they don't secure you. Well, I sit right behind the bus, and there's plastic there. Well, what happened is, he came … to a complete stop. My scooter went smashing into the front, smashing me back, wrecking my neck again, 'cuz I got C3s through T1, uh, T8 and L5, all crushed from the original accident… it re-wrecked my knee.

This accident significantly impacted Laura both physically and mentally, as she explains: "Since that accident…I can say that I've been suicidal more than once…until [then] I had never used the word…that [gives] you an idea of how depressing it can be." Laura's mental health challenges are exacerbated by her experiences on public transportation, enforced close proximity to strangers provoked psychological distress, while the lack of security straps aggravated her existing spinal injury.

Having a general public transportation system that is accessible and useable by all abilities (mental and physical) becomes crucially important in winter weather, as separate accessible transportation systems are operationally restricted during winter weather, when those relying upon them for community access most require the service. As a result, individuals in Laura's position are faced with the least-worst choice: social isolation or facing physical and psychological peril while attempting to navigate their community.

## Discussion

Laura's lived experience residing in a Canadian winter city as a low-income older woman with mobility challenges and mental illness reveals the structural violence that she—and others with similar intersecting identities—experience via the built environment. Her struggle of "power differences at work in a specific setting" (Kaijser and Kronsell 2014, 422) generates a specific type of knowledge, originating from "the practical experience of coming up against a world" (Ahmed 2017, 18). Laura's intersectional position illustrates a pathway towards valuable knowledge for designers and policy makers striving to forge inclusive winter cities, illustrating the importance of prioritizing intersectional understandings within spatial research and design practice.

### Inclusive design for winter cities

This research supports prior scholarship surrounding the challenges mobility device users experience in winter cities, clarifying the nature and impact of winter barriers in both the public transportation and the pedestrian realms. Further, Laura's experience emphasizes the need to prioritize winter accessibility when designing and refurbishing public transit infrastructure, sidewalks, crosswalks, and transit access points. This research also uniquely illustrates

the importance of locating seniors' and affordable housing in communities with wheelable connections to amenities and supports, LRT access, and opportunities to restore in nature. Further, municipal policy contexts regarding snow removal in relationship to seniors and affordable housing must be recognized and addressed during the siting and initial design process, to facilitate connectivity, reduce social isolation, and decrease vulnerability. When public infrastructure is developed or retrofitted, winter access to public space for individuals of all abilities should be incorporated as a human right under the United Nations Convention on the Rights for Persons with Disabilities (CRPD) (United Nations 2006).

Table 1 indicates the expanded understanding and questions that an intersectional analysis of the urban context in Calgary, Canada could provide to architects, urban planners, transportation designers, and policy makers in designing or retrofitting public transportation, affordable housing, and neighborhood layouts. By embracing an intersectional understanding of the diverse lifeworlds of urban inhabitants, design practitioners and policy makers can shift

**Table 1:**
Design questions for Calgary, Canada generated by an intersectional lens towards disability, class, age, and gender

| Design Questions for Calgary, Canada Generated by an Intersectional Lens Towards Disability, Class, Age, and Gender | |
|---|---|
| Affordable & Seniors Housing | What are the assumptions about the identity and needs of residents? |
| | Is the housing located on a pedestrian thoroughfare in a pedestrian-oriented community? |
| | How long would it take someone wheeling to reach: the nearest hospital, shopping centre, support services, park, pharmacy, grocery store, or library? |
| | Is the housing located in a neighbourhood with a high density of greenspace? |
| | Is the housing located directly on easily accessible transportation? |
| | Is the housing located within a half-hour journey on public transportation to a hospital, medical centre, and popular social support services? |
| | Does the housing possess a warm, comfortable, and dignified outdoor waiting area and loading zone that an individual can navigate *independently* across all seasons? |
| | Are the units and building universally designed? |
| | What aspects of identity and experience are neglected or deemed insignificant? |
| | For all of the above questions: *How do you know?* |
| Pedestrian/Wheeling Realm | Can a person using a mobility device *independently* navigate the pedestrian realm in winter? |
| | Would a woman wheeling alone experience heightened vulnerability from becoming stuck or requiring assistance from strangers in the winter? |
| | Are pedestrian/wheeling thoroughfares identified and prioritized for snow removal in municipal policies? |
| | Are primary routes between affordable housing, neighbourhood amenities, and public transportation access points identified and prioritized for snow removal? |
| | Are curb cuts, sidewalks, crosswalks, pedestrian crosswalk buttons between seniors/affordable housing and the nearest public transportation access points equipped with snow-melting or snow-removal systems? |
| | What assumptions are being made about snow removal? |
| | What assumptions are being made about identity and navigation through the public realm? |
| | For all of the above questions: *How do you know?* |
| Public Transportation | Are public transportation access points and routes (bus stops and LRT stations) equipped with built-in snow-melting systems or priority snow-removal systems? |
| | Are large and discount retailers and reachable via public transportation? |
| | Are persons with mobility devices able to independently access and use the general public transportation system in winter weather? |
| | How long would it take someone using the general public transportation system to reach: the nearest hospital, shopping centre, support services, park, pharmacy, grocery store, library? Is this transportation time reasonable and achievable by someone working full-time? |
| | What greenspaces are accessible via public transportation? |
| | What norms concerning transportation use are being assumed? |
| | For all of the above questions: *How do you know?* |

their normative assumptions and beliefs that end up embedded within the built environment.

## Intersectionality and design

We position this research as an illustrative case study intended to spur architecture, planning, transportation, and urban design research and practice towards intersectional analysis. Laura's lived expertise as an older woman with mental and physical disabilities, living on a limited income, highlights the need to understand and design affordable housing, pedestrian infrastructure, and public transportation as a holistic system. Intersectionality counters the dominant approach to affordable housing, public transportation, and community accessibility, which separates these elements in policy and design, dividing knowledge into categories that include transit-oriented development, transit design, walkability, affordable housing, and age-friendly cities. When these elements are treated as discrete entities the resulting forms and systems fail to meet the needs of Canadian winter cities' most vulnerable inhabitants. An intersectional perspective of Laura's experience highlights the need to understand and design affordable housing, pedestrian infrastructure, and public transportation as integrated support systems for those disadvantaged by gender, class, age, and ability.

Spatial professions and disciplines traditionally emphasize expert knowledge over creating relationships with community, cultivating a professional illiteracy towards diversity and difference (Rahder and Milgrom 2004). As Holston (1998) notes, urban design has largely failed to "include as constituent elements of planning the conflict, ambiguity, and indeterminacy characteristic of actual social life" (46). An intersectional lens can transform the design of winter cities beyond their present "white, masculine subjectivity" (Weisman 2000, 5) and towards a diversity of experience in which the "[imagined] bodies and spatial inhabitants" (Hamraie 2013, n.p.) within design visions include single women, those living in poverty, older persons, and individuals with disabilities. A shift in design practice towards designing with community members who possess marginalized identities and merging participatory design with community development could both generate inclusive design solutions and foster community movement towards change (Feldman, Palleroni, Perkes, and Bell 2013; Moomaw 2016; Grittner 2019).

One of intersectionality's goals is to make visible the underlying assumptions and beliefs that replicate socio-structural power (Kaijser and Kronsell 2014). Laura's story exposes some of the assumed norms and truths held by spatial practitioners made material in the urban environment of Calgary, including: persons with disabilities will have access to adapted personal vehicles; care-based family support is omnipresent; vulnerable individuals such as women, seniors, and persons with disabilities do not require or desire independence in the public realm; design and construction professions possess competencies in accessible design; delivery services are affordable across incomes; trauma is a private, not public, consideration; all bodies can participate in snow removal; and that public spaces are physically and psychologically safe.

Ultimately, in applying an intersectional lens to the design of winter cities, this research demonstrates the importance of embedding the voices of those most marginalized within Canadian design research practice by "highlighting the multiple intersectional forms of exclusion that inaccessible design produces" (Hamraie 2013, n.p.). Intersectional perspectives can direct designers, policy makers, and support agencies away from their own assumptions and connect them with multi-dimensional expertise outside their own purviews. In recognizing interactions between categories of oppression, as well as highlighting the many ways Canadian cities remain designed and built for those situated within dominant categories of class, ability, gender, and age, this intersectional analysis forges a pathway towards inclusive design for winter cities to improve wellness and promote inclusion, by broadening socio-spatial perspective around identity and the consequences of design assumptions.

## Climate justice

Finally, intersectional understanding of urban environments provides a connective link between spatial justice and climate justice, perhaps the most pressing issue facing humanity in the 21st century (Dunlap and Brulle 2015). Addressing spatial justice with an intersectional framework becomes ever more urgent for winter cities within the context of climate change. Extreme weather conditions are unpredictable and increasing; older women with disabilities and lower incomes are anticipated to be unduly impacted by the deleterious results of climate change and associated extreme weather (Lindsay and Yantzi 2014; Lindsay et al. 2015). Individuals' everyday relationships to climate justice, like spatial justice, are contingent upon their social locations within socio-power structures (Kaijser

and Kronsell 2014; Terry 2009). Many of the normative assumptions revealed about Calgary's urban design, are also intertwined with climate justice: absence of community considerations, private transportation, negation of human connection to the natural world, structural amnesia of difference, and affluent expectations of consumption and service (Kaijser and Kronsell 2014; Pipher 2013). Division between the built world and the natural environment is grounded in Eurocentric "hierarchical dualism" (Strega 2015, p.123), which divides and sorts the world in oppositional binaries, in this case privileging human-construction over the naturally occurring world, even though the built environment and the natural world are inextricably connected as part of an ecological system (for example, an estimated 55% of greenhouse gas emissions are generated by the built environment (Anderson, Wulfhorst, and Lang 2015). Thus, while this paper focuses specifically on the urban environment, conceptually it must be situated within a larger interrelated system of the physical world. We hope that advocating for an intersectional lens to spatial understandings will foster possible alliances and solidarity with climate justice, questioning prevailing norms and seeking common grounds, interests, and objectives (Kaijser and Kronsell 2014). Developing a complex understanding of the constellation of power relations embedded in both spatial and climate justice is a necessary precursor to systemic change and liberation across environments.

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