

Resilient climate urbanism and the politics of experimentation for adaptation

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Abstract

Cities are increasingly pursuing actions to become more resilient in the face of climate change and to seize related economic growth opportunities. Recent contributions have argued that “climate urbanism” is emerging as a hegemonic trend that is structuring climate adaptation with a focus on the selective securing of vital infrastructure for growth, promoting an apolitical vision of resilience and exacerbating inequalities. Developing situated understandings of these dynamics and their contestation seems key. We analyse this trend of climate urbanism in a specific setting of climate adaptation experiment: living labs. We investigate and intervene on two key processes of the politics of climate experimentation – making for compelling urban projects and focusing on infrastructure reconfiguration – whereby living labs could challenge or, conversely, amplify negative trends of climate urbanism. Our research in Montreal shows the value of understanding the subjectivities of the practitioners involved and the fields of political struggles where adaptation lands. Although the negative trends of climate urbanism appear very resilient and living labs have important limitations, we believe they can be used to muddle through pathways for more debates, equity and justice in climate adaptation.

Key words : climate urbanism, climate adaptation, governance experiments, urban living lab, infrastructure, climate equity

Introduction

A worrisome trend in urban climate policies was recently discussed in two important articles and a debate in *Urban Geography* (Castán Broto & Robin, 2021; Robin & Castán Broto, 2021; Long & Rice 2019, 2021) In this debate, Long and Rice (2019, 2021) argue that a dominant trend of what they term “climate urbanism” affects how urban climate action is structured. This trend is characterized by a focus on carbon control and the selective safeguarding of infrastructure deemed essential for economic growth. For Long and Rice, this carries a neoliberal pro-development bias with a resilience fix obscuring tensions and the exacerbation of inequalities in the face of climate change. While agreeing about the general trend, Castán Broto and Robin (2021) challenge this homogenous view. They contrast the homogenous view of climate urbanism with their witnessing of heterogeneous and messy governance, situated infrastructural dynamics of change and scantily documented mundane practices in ordinary cities. Inspired by this dialogue, this article delves deeper into the politics of urban climate action in a specific context: an experiment for adaptation in Montréal, a city of the Global North. Taking the form of a living lab, the experiment focused on urban redevelopment and infrastructure climate-proofing. While these domains have been analysed using discursive and structural lens, we think it falls short in seizing the agency, tactics and constraints experienced by actors manoeuvring in their messy contexts. To understand these dynamics, we need situated analyses of how these structures unfold locally, how they are interpreted and contested. In this article, we contribute to the critical appraisal of the struggles for transformative adaptation in everyday spaces of urban politics, considering the concrete governance tools, processes, and materialities through which authority is performed and contested, and urban infrastructure is transformed (Anguelovski & al., 2016; Shi & al., 2016; Zografos & al., 2020; Nightingale, 2017).

We particularly reflect on this climate urbanism dialogue in relation to climate governance experimentation. Indeed, in tandem with debates on climate urbanism, many authors have documented a sharp rise in cities adopting an experimental approach (including urban living labs) to address climate change, especially in the realm of climate mitigation and sustainability transitions. Less has been written on experiments for urban climate adaptation. In this article, we present a cultural analysis of these processes in Montreal and how they led to certain interventions in a living lab setting. We think such action research positionality brings another perspective to the understanding of climate adaptation in the making.

We first discuss recent debates about climate urbanism and introduce the literature on the politics of climate experimentation, with a particular focus on two processes typically involved in the making of experiments: 1) building interest, attractiveness, and imaginaries (Bulkeley et al., 2014), and 2) forging situated alignments to reconfigure infrastructure (Hodson et al., 2018; Monstadt & Coutard, 2019); two processes with ambiguous effects for the contestation of climate urbanism as defined by Long and Rice (2019). We then translate these processes into analytical questions and methodological steps used to understand the challenges of climate adaptation in Montreal and to reflect on our experience and interventions in a climate living lab.

Climate urbanism: an apolitical and selective framing of urban resilience

For Long and Rice, climate urbanism is a new variant of neoliberalism that hegemonically orients certain kinds of actions and policies in cities. These include some characteristics already emphasized in sustainable urban development, such as ecological modernization and economic growth (While et al., 2010), whereby climate urbanism selectively protects strategically important resources and assets instead of pursuing more holistic sustainable development. Climate urbanism focuses on safeguarding resources and resilient infrastructure against climate threats and on retrofitting their use and development for carbon control conducive to economic growth: “Investment in climate-resilient infrastructure is ‘the growth story of the future’”(GCEC 2016: 2; cited by Long & Rice, 2019, p. 999). The key takeaway from Long and Rice is that this focus secures infrastructure vital for growth at the cost of perpetuating and even exacerbating social injustice. The “resilience fix” means prioritizing infrastructural improvements that reduce the vulnerability of cities’ strategic services to climate hazards in the interests of urban competitiveness and investor attractiveness. But the focus on these “assets” does not necessarily orient climate adaptation where there are the greatest social needs and vulnerabilities (Anguelovski et al., 2016).

Indeed, many commentators have criticized the naive discourse of resilience policies and the types of measures they can endorse; trade-offs are often underestimated and even unacknowledged (Coaffee et al., 2018). The question of resilience for whom and for what thus often remains unanswered (Meerow & Newell, 2016), reproducing structures of privilege and the legacies of exclusions, social hierarchies, colonialism and racism that come with them (Long & Rice, 2021; Ranganathan & Bratman, 2019). Anguelovski et al. (2016) discuss how adaptation injustices can be due to acts of commission (e.g. displacing urban poor to protect infrastructure) as well as acts of omission (the indirect prioritization of social elites). Resilience can imply a tacit acceptance of the shocks imposed to communities and places by neoliberalism and our modes of development, which they need to adapt to (Bracke, 2016; MacKinnon & Derickson, 2013).

This trend of adaptation and resilience also comes with a form of consensus whereby climate emergencies call for certain responses with some described as “win-win” without further examination or debate. The emphasis that global networks of institutional and philanthropic organizations place on apolitical resilience strengthens this approach’s association with expertise, top-down decision-making and increased private-sector involvement (Leitner et al., 2018). Choices are seen as primarily technical or at best subject to compromise, with policies and politics being taken out of the equation. In this context, climate policies merely become part of a post-political environment with no questions asked (Ernstson & Swyngedouw, 2019). In the seemingly technical and apolitical work of adapting to climate hazards in cities, the climate proofing of infrastructure has played an important role.

Nightingale (2017) highlights the importance of considering how climate adaptation “lands” in places and organizations that have their own micropolitics: climate change politics empower certain forms of authority and knowledge over others, shaping “which actors are authorized to govern, and who is considered in need (or worthy of) assistance”. In other words, climate change adaptation is being defined and acted upon within preexisting fields of political struggle that differ from one place to another. These preexisting fields of political struggles imply certain biases, power asymmetries or unequal distribution of resources that can be embedded in institutions, in the material legacies of uneven urban development (Goh, 2021; Smith, 2008) or in certain cultures of planning and framing risks in adaptation (Zaidi & Pelling, 2015). The invisibilization of such situated legacies contribute to reinforcing dynamics of post-political climate action where all stakeholders seem to have the same power; best practices can easily circulate, and climate interventions can only have neutral or positive impacts on inequalities.

Yet, the literature seems to often conflate the post-political context with the actual political understanding and intentions from actors themselves. de Moor et al. (2021) argue that activists “consciously navigate the structural constraints posed by the post-political context in a strategic attempt to maximize their impact”. Castán Broto (2015) also speaks of policy entrepreneurs “muddling through” such an environment, while emphasizing the invisible adaptation work undergone in most cities of the world, often outside the gaze of strategic projects and academic observers alike.

In this article, we explore the subjectivity and agency of the actors involved in such urban climate adaptation interventions, particularly in the setting of a living lab experiment.

Living labs and other urban climate experiments

Climate change interventions in cities have largely been pursued in a spirit of experimentation. Indeed, the last few years have seen an explosion of contributions on the theme of living labs and experiments related to climate and sustainability transitions (Bulkeley, 2023; Huitema et al., 2018). As cities are pressured to become climate governance leaders, taking an experimental approach has become a mode of action in its own right. Experimentation has also been presented as a niche, as means of transforming broader norms and socio-technological regimes, starting with site-specific demonstration projects (Evans et al., 2016; Turnheim et al., 2018). Climate experiments would manifest a desire to establish alternative relations between scientists, policymakers and city dwellers as a basis for more adaptive processes of urban action and policy-making (Evans, 2011).

Urban living labs are “sites devised to design, test and learn from social and technical innovation in real time” (Marvin et al., 2018, abstract) that emphasize the involvement of users in co-production exercises and support open innovation with knowledge transfer across institutions (Marvin et al., 2018; Voytenko et al., 2016). While an innovation lens is generally used to study these interventions, authors like Marvin et al. (2018) and Bulkeley and Castán

Broto (2013) also consider them as part of a wider politics of climate governance experimentation insofar as they experiment with new relationships and regulatory modes. This is also the lens we use to consider these interventions. We approach living labs and other climate governance experiments as spaces where urban politics in the making can be closely investigated, and in which researchers can intervene (Voytenko et al., 2016).

Both urban living labs and other climate and sustainability experiments appear particularly well suited to challenges like climate change that are characterized by considerable uncertainty and ambiguity, since this experimentation is seen as “a way to unpack complexity and to gather evidence on the new relations and new roles that a transition requires” (Loorbach et al., 2017, p. 614), adopting a philosophy of learning by doing (Loorbach et al., 2017). As a social learning process, this philosophy encourages practical, as well as relational and institutional, learning outcomes (McFadgen & Huitema, 2017).

Urban living labs and other climate experiments are also situated in real-life contexts (Evans, 2011; Karvonen & Heur, 2014). These experiments are expected to generate and mobilize knowledge that is contextually embedded and contributes to (re)framing climate change interventions due to their situatedness in specific sites and infrastructure interfaces. Urban living labs, in particular, rely on user involvement and value users’ experiences and local knowledge (Voytenko et al., 2016). That is why these experiments and their users can help us identify and examine the pre-existing fields of political struggle that ultimately structure climate urbanism.

Yet, evidence suggests that climate adaptation experiments “tend to be still subordinate to business-as-usual interests and policy and planning approaches” (Hölscher et al., 2019, p. 854). For Bulkeley and Castán Broto (2013), the focus on learning has downplayed certain key elements in the politics of experimentation, avoiding discussion about political economy and conflictual dynamics and neglecting to address how these factors perpetuate or challenge power balances. Experiments may act as fronts that simply mask the perpetuation of traditionally unequal and unsustainable practices in the same way that green architectural assets can be used to support development and the unequal production of urban space (Karvonen & Heur, 2014; While et al., 2010). The underplay of conflict and politics is also visible in the literature on urban living labs which puts emphasis on different stakeholders working together to trigger innovations, without questioning much the power asymmetries between participants. Yet, as Karvonen and Heur (2014) have put it, this does not mean that some initiatives are not genuine efforts that can have transformational implications. For the policy entrepreneurs involved, this climate governance process is often one of activism within the State (Aylett, 2015; Finewood et al., 2019; Karvonen, 2018).

The politics of experimentation

Bulkeley and Castán Broto (2013, p. 367) propose considering experiments as critical sites of urban climate politics, for “sparking controversy, offering the basis for contested new regimes of practice”, and undo typical ecological modernization responses (Bulkeley, 2023). What role can researchers take to contribute, beyond mere observing and reporting? In this section we ponder about the specific characteristics of climate governance experiments enabling or constraining our ability to situate climate urbanism, expose its contradictions and pitfalls and empower alternative forms of climate adaptation.

From the literature we can highlight two processes through which experiments mobilize resources for climate action and offer analytical and intervention sites to question and contest climate urbanism (Long & Rice, 2021). The first process relates to the fact that urban living labs first need to be made compellingly attractive projects that can deliver and inspire. The resources and participants that these experiments attract seem to rely heavily on the projects’ visibility and perceived potential (Bulkeley et al., 2014). Urban experiments mobilize resources and interests in portraying inspiring visions of possible futures through concrete actions in the present, no matter how small. Experiments create imaginary new urban environments that can travel and become projects and debates elsewhere. However, Bulkeley et al. (2014) argue that much work needs to be done upfront to make such experiments appealing. When a diversity of actors commit to participating in urban living lab experiments, the importance of the experiment outwardly attractive appeal may make it more difficult to raise critical concerns and alternative views. To ensure the credibility, salience and legitimacy of a given experiment in the eyes of decision-makers, such experiments must be presented in a positive light (McFadgen & Huitema, 2017). de Moor et al. (2021) also argue that funding requirements and the objectives of diffusion and uptake by others seem to make it difficult to combine experimenting with agonism.

The second experimentation process giving traction to climate adaptation is the work of infrastructure reconfiguration (Robin & Castán Broto, 2021; Bulkeley et al., 2014; Coutard & Rutherford, 2015). This work can have enormous impacts on populations and urban landscapes while being very often opaque, with the political and economic interests entangled in infrastructural change difficult to read (Coutard & Rutherford, 2015; Finewood et al., 2019). Urban infrastructure and their experimental transformation in the name of climate change imply realignments in the social and material relations tied to the physical infrastructure in space, and its particular contingencies and relations with practices and institutional arrangements. Boundary work is accomplished across infrastructure domains “where individuals – engineers, operators, policymakers, planners, NGO workers and users – act to bring fragmented urban infrastructures together” (Monstadt & Coutard, 2019, p. 2197). This work of incremental infrastructure change by the experimentation of new relations is an important part of climate action in cities and differs in its concrete challenges and opportunities from one place to another (Goh, 2021). The trend for focusing on securing vital infrastructure for growth and survival, which characterizes climate urbanism as described by Long and Rice, can take different forms and meanings locally because of the material and cultural complexity of the embedding of infrastructure in both urban politics and the urban fabric.

Yet, in general, it seems that the language, codes and governmental instruments employed can make the political work inside infrastructure reconfigurations obscure to outsiders. This issue is discussed in science and technology studies (Hommels, 2005), but scarcely addressed in the climate experimentation literature. Framing experiments from a purely technical perspective can exclude and disempower certain voices and perspectives, including those of the most disadvantaged residents (Meerow, 2020). Power struggles over changes in infrastructure, such as green infrastructure and stormwater management in cities, reflect asymmetries between different components of the State, with technical debates between experts making conversation about equity and justice more difficult (Finewood et al., 2019). Defining climate adaptation predominantly as the development and transformation of infrastructure (even if beneficial) can also divert attention from other critical adaptation needs and tactics, threatening the long-term objective of reducing social vulnerabilities (Henrique & Tschakert, 2021; Nightingale et al., 2020).

These two experimental processes are synthesized in the Table 1, which shows our analytical framework to answer the following research questions: How do key processes of experimentation unfold in the Montreal governance context to mobilize resources for climate adaptation while reinforcing an apolitical and selective approach? How can the living lab setting help expose contradictions and pitfalls, and empower alternative forms of climate adaptation?

Table 1. Promises and potential pitfalls of experiments in resilient climate urbanism

Experimental processes	How they give traction to climate adaptation	How they can reinforce trends of climate urbanism
Making an experiment attractive and compelling	<ul style="list-style-type: none"> - Attract resources and interest - Produce & diffuse imaginaries for the future city 	<ul style="list-style-type: none"> - Work of securing funding & ambitions for diffusion is difficult to combine with agonism & contention - Emphasis on win-win solutions while obscuring inequities unaddressed - Climate experiments often coupled with urban development with a pro-development bias
Framing adaptation as infrastructure reconfiguration	<ul style="list-style-type: none"> - In-situ process = ability to tackle complexity, find locally relevant configurations and organize learning - Work of connecting across different infrastructure domains can increase resilience and bring cobenefits - Promise of changing infrastructural paradigm beyond the experiment 	<ul style="list-style-type: none"> - Opacity of politics in sociotechnical processes, low inclusion when technical focus - Focus on hard infrastructure can withdraw attention from other key needs and practices - Boundary work across sectors and expertise often do not recognize power disparities - Can naturalize the importance of certain risks and hazards over others

Action research on climate adaptation: situated cultural analysis and living lab workshops

Based on the literature review presented above, and more particularly on the proposals of Robin and Castán Broto (2021), we structured our living lab around the three following objectives: 1) identifying the actually existing forms of climate urbanism visible in our site and experiment, and the meanings they have for participants involved, in relation to the processes of making an experiment appealing and reconfiguring infrastructure, and 2) discussing the power asymmetries, political struggles and blinders in these choices of climate adaptation measures and 3) empowering alternative practices of adaptation.

Table 2 summarizes our living lab approach and methods. We conducted a cultural analysis of the governance of adaptation with techniques of institutional ethnography (Nightingale, 2017; Smith, 2005), coupled with sense-making with participants in the living lab (van Buuren et al., 2014). How climate adaptation is framed and experienced – an essential part of the dynamics we studied and participated in – is closely intertwined with how the politics underlying climate intervention are either obscured or tackled. The initial documentary phase involved documentary (102 documents: policies, bylaws, technical and study reports, meeting minutes) and social network analysis, many hours of observing public, civic and professional planning meetings (1-2 meetings each week for a year), and individual interviews (26). Those steps formed the basis of the subsequent phase of living lab workshops, a more active phase where we intervened, co-produced and diffused analyses and alternative perspectives on adaptation.

The living lab we discuss here is part of a set of initiatives and policy processes that aim to transform how the City of Montreal approaches climate change governance. For many years, Montreal has been engaged in climate change action – with a climate change mitigation plan in 2013, and a climate adaptation plan in 2015. Climate became a more important political issue in 2017 when Valérie Plante, the leader of the Projet Montréal party, was elected mayor. An Office for Ecological Transition and Resilience (BTER) was then created to spur innovative practices and launch special projects across the municipal administration. The idea of a living lab on climate adaptation was developed in 2017 by this new Montreal Office with Ouranos, a research-practice boundary organization on climate adaptation, to find ways to better integrate climate adaptation in urban planning practices (Ville de Montréal, 2019; interviews). A particular industrial brownfield redevelopment project was chosen as the experimental sandbox. Lachine-Est is a nineteenth-century, 125-acre industrial development site adjoining the Lachine Canal, formerly a strategic goods corridor and now a heritage site and recreational waterway (see Figure 2). The area has been affected by deindustrialization and an adjacent highway interchange. The site is coveted for housing and commercial development, with 72% of the area privately owned among four developers (Concert'Action Lachine, 2021). The transformation of this site needs public investment and the City also needs to establish the extent and ways it will regulate private development (ecological regulations, social housing requirements, access to shops, heritage protection, etc.).

After the first analytical phase we described above, our living lab involved a more active phase of workshops, in parallel to continued involvement in meetings and the production of research summaries. For the workshops, we designed a set of design thinking participatory exercises to have participants discuss the integration of climate change adaptation in their context, and allow us to identify and act upon power asymmetries in the governance of adaptation. The first workshop was focused on the governance and planning process of large urban projects. Each group worked on a common figure representing the urban planning process where they had to name and locate adaptation objectives, measures, actors involved, current pitfalls and aspirations. Each table discussed one climate hazard in particular that Montreal and the site Lachine-Est face: extreme heat, intense precipitation events causing floods, droughts, destructive storms, freezing/thawing cycles (Van Neste et al., 2021).

In the second workshop, we discussed climate adaptation in two imaginary scenarios (summer and winter) of a poorly adapted version of the Lachine-Est ecodistrict area 15 years from now. We challenged each participant on their individual and collective capacity to act and the constraints they experienced in pursuing socially just climate adaptation in this process. The third series of workshops were led by local community actors from Lachine-Est with our support. This series was designed to foster dialogue among the different actors about their vision of an eco-district adapted to climate change and the objectives and instruments to include in the masterplan and bylaws. A fourth workshop was finally organized to discuss green infrastructure priorities and choices that would contribute to climate adaptation in Lachine-Est (Van Neste et al., 2021).

In parallel and in the months following our workshops, we coproduced and diffused analyses and knowledge mobilization tools to show blinders in the framing of adaptation and empower alternative practices, which we present below. We now turn to our analysis of the living lab experiment, starting with the process of building attractiveness, and following with the focus on infrastructure reconfiguration.

Table 2. Our living lab approach and methods

<i>Phase</i>	Objectives pursued in the participatory living lab	Methods
1) Analysis & sense-making with participants	<ul style="list-style-type: none"> - Identify imaginaries and framings of adaptation are diffused; How are they linked to urban development? - Characterise the governance tools and instruments on which the attractive project & infrastructural reconfiguration rest, and analyse the political struggles and power asymmetries involved. - Analyse the actors, practices and territories are visibilised or marginalized. 	<ul style="list-style-type: none"> 1) Cultural analysis of governance structure, history of planning and development, current practices and resources of different actors that they relate to climate adaptation (participatory observation of meetings, interviews, and document analysis) 2) Co-construction with participants of the living lab : in participatory observation of meetings & first parts of each workshop involved a collective diagnostic of how participants frame and situate climate adaptation in relation to these questions (participatory observation of meetings, 4 participatory workshops)
2) Interventions	<ul style="list-style-type: none"> - Communicate the identified political struggles, tensions, power asymmetries and blinders - Encourage their discussion between participants in workshops - Empower alternative forms of climate adaptation 	<ul style="list-style-type: none"> • Participatory observation of planning and participatory meetings (within urban planning, water depart., local borough and community groups) • 4 participatory workshops to intervene & coproduce analyses and solutions with participants (from civic actors and professionals of different City& borough departments (e.g., mobility, water, parks, biodiversity, urban planning and the BTER), on the following themes: <ul style="list-style-type: none"> 1) integrating adaptation to climate hazards in the intermunicipal planning process (27 participants) 2) maladaptation scenarios, levers & constraints for adaptation on the Lachine-Est territory (12 participants) 3) community-based dialogues on local priorities (with more local associations:30) 4) green infrastructure for climate adaptation (34 participants) <ul style="list-style-type: none"> • Co-production and diffusion of analyses and alternative practices of adaptation (4 reports/briefs, 1 webinar, 8 illustrated summaries, 1 toolkit of adaptation bylaws, and many interactive presentations)

The politics of experimentation for adaptation in Montreal

The living lab: making for a compelling ecodistrict & a convincing municipal leadership

The brownfield area chosen for the urban living lab had previously been well publicized, by candidates in the municipal electoral campaign and grassroots organizations mobilized to *Imagine Lachine-Est*. The living lab was described by the borough mayor as “a major coup” because many different actors had joined forces “to define the nature of the new planning regulations that will deal with climate change” and make Lachine-Est “an experimental site to initiate and materialize the implementation of a twenty-first-century eco-district model”. Urban megaprojects in Montreal are considered opportunities to test and learn, notwithstanding the major public debates they often trigger. Our interviews revealed that such projects are expected to attract investment and mobilize expertise because they provide opportunities to innovate and develop new standards.

The association of the living lab with a redevelopment project does suggest a bias in favor of climate urbanism geared toward economic growth. The planned development would increase the borough’s population by as much as 25 percent, while also generating considerable revenue. Since the site was contaminated and had long been perceived as unattractive for developers; were the living lab and resilient projects primarily promoted to enhance Lachine-Est’s attractiveness for development? But the interest in an urban living lab, both within the City of Montreal and for Ouranos, was to test ways of integrating adaptation into planning and local government practices, in testing ways to regulate urban development. Policy entrepreneurs in the city had mobilized for the Labo Climat Montréal to help make the Lachine-Est area a test bed, to “show concrete examples that can work if X and Y are changed,” with planning and public instruments directly based on consultations with scientists and practitioners. As one BTER practitioner said in the starting phase of the lab: “As soon as we observe, we modify. We test, we challenge.” While this idea of testing and adjusting reflected some commitment, it also suggested scant recognition of enduring structures, such as deeply embedded norms and the political economy of urban development. Although resilience and climate adaptation was planned as a key topic of experimentation, it was not obvious if the City would actually translate this into mandatory requirements for developers. For several months, planners and community leaders spoke about convincing developers, learning and negotiating with them, bringing them on board.

The challenges to integrating more boldly climate adaptation were related to Montreal complex institutional history, with the partial decentralization of urban planning in boroughs that stem from the contested and partial amalgamation of the island into one megacity in 2002 (Collin & Roberson, 2005). Even today, Montreal-wide policies, especially in urban planning, involve negotiations as to who can decide what, with boroughs wishing to preserve local autonomy. A large project like Lachine-Est falls under the authority of the central city (which also finances necessary investments and studies), but actual everyday bylaws are still under the authority of the borough. This tense sharing of urban planning responsibilities with different planning cultures contributed to the slow emergence of bylaws demanding contributions to adaptation from developers (Van Neste et al., 2021).

In our workshops, we mixed borough and central city professionals. In the second one in particular, in which we discussed the barriers to climate adaptation, participants discussed the costs of adaptation and the fiscal dependence on revenues from redevelopment as the most critical ones. Participants themselves identified some ways forward. The central city urban planning department presented their efforts of developing new measures to evaluate the return on investments from the City in large projects, to go beyond sole tax revenue and include ecological investments and social benefits of local services and infrastructure. As a research team, we assessed how climate adaptation had been largely absent from municipal land-use regulations in Quebec; a summary toolkit on urban planning bylaws and private development regulations was developed (Fournier & Rochefort, 2020), and presented to planners and civil society actors. Clear constraints in the master plan were introduced on the percentage of parks and green spaces, with 60% of the non-built portion of individual private lots to be vegetated (Ville de Montréal, 2021, p. 40, 111).

Yet, a characteristic of the instrument used limited the positive impact of such measures. The Particular Urban Program (PPU) identified the area to receive special resources and planning for redevelopment; when adopted it became embedded in the Montreal-wide master plan. This planning instrument means that much effort, expertise and public investment are directed to the specifically bounded redevelopment area. In recent years, one of these areas was developed as a LEED-certified development project and had enormous impacts in terms of evictions in the adjacent low-income neighborhood (Guay et al., 2019). Although this situation raised concerns, a similar approach with a PPU bounded to the development area was to be used in the Lachine-Est project, exemplifying a potential reproduction of socio-spatial inequalities with attractive projects of climate adaptation concentrated in a privileged area (Figure 2). We raised and discussed this issue with participants, and the inequity in funding adaptation and greening measures were particularly discussed in the third and fourth workshops, as we discuss below.

In sum, the living lab did seem to contribute to the making of the ecodistrict attractive and the municipal leadership convincing, all the while climate adaptation tools threatened to increase disparities with neighboring areas. We perceived the troubling risks of the experiment contributing to a detrimental climate urbanism. Yet, we also witnessed intentions to use the living lab to develop stronger local state regulations for adaptation and raise questions about the pro-urban development bias associated with municipal fiscal policies.

Framing adaptation as resilient infrastructure reconfiguration

Infrastructure investment is always a burning issue in planning processes, for basic infrastructure can be an essential prerequisite for redevelopment. It is a stepping-stone on the political path of assembling enough interest and investment to redevelop a given area (Majoor, 2018; Van Neste et al., 2021). In this case, the former industrial site needed new water drainage infrastructure to support dense urban development. The City's urban planners presented this constraint optimistically as providing more time and leverage to develop a strong master plan with conditions and bylaws for private developers. This prerequisite and the substantial funding required were strategic components in the early planning that gave structural power to the Montreal Water Department (the department with the largest budget in the City, Ville de Montréal, 2021).

The importance of the water department was also due to Montreal's well-documented vulnerability to rainstorms that trigger polluted stormwater overflows into the St. Lawrence River and threatens homes and transportation infrastructure – a growing concern due to greater rainstorm frequency. Stricter measures were introduced to prevent further pressure on the existing stormwater system and the pollution of water bodies, with in situ green infrastructure and basins for rainwater infiltration or retention. Green infrastructure uses permeable surfaces and substrates (soil, plants, pavements, etc.) to store and infiltrate rainfall and stormwater, and improve evapotranspiration, unlike grey infrastructure that is composed of elements like pipes, tunnels and gutters. This change of paradigm to adapt the infrastructure involved considerable boundary work across different departments and forms of expertise.

The municipal water department had much more expertise on climate change adaptation than its counterpart departments in mobility, urban planning, and even parks and biodiversity. Since 2010, the water department had commissioned several studies on the impact of climate change on its infrastructure. It was also being obligated by both provincial and federal regulations to improve its stormwater management and was about to modify the municipal bylaw concerning private city lots.

In the first living lab workshop, we discussed what adaptation to each expected climate hazard should mean in the urban planning process. The discrepancy between the depth of the conversation from one climate hazard to another was remarkable. Water department participants discussing the increase in precipitations reformulated the information and explained the city's vulnerabilities. Discussions continued with urban planners, technicians, architects and heritage protection professionals about the courses of action already in process, the relationship with urban planning, and associated constraints. Engineers had a precise metabolic view of urban water flows and what materially adapting to increased rainwater meant: more water flowing to the city's topographic low points that would require designing sites and routes to accommodate this. Planners could grasp the implications: water, of course, does not follow property lines whereas the regulatory system (i.e. the responsibility for managing rainwater on each lot) does. The participants jointly identified a series of not-so-easy steps to make this

problem of infrastructure reconfiguration transform governance as well. In fact, although this would mean radically rethinking both stormwater regulation and urban design in terms of topography and water flow, the participants felt there was a path forward. Some “hot” issues, such as not building at all in the city’s lower points and the impact of redevelopment on neighborhoods were also voiced by some participants.

Discussions did not go as far in the other groups (on heatwaves, droughts or storms) where participants spoke broadly of more transversal collaboration, better planning, more front-end resources, and more participation by residents. There were no precise ways to grasp the overall issue, and sense-making in this regard was still at an early stage. This is partly the result of the work of framing climate adaptation in the City as mainly about infrastructure reconfiguration to cope with increases in precipitations. Other practices and expertise could have challenged this selective focus, but not every professional felt equipped to contribute. In terms of social infrastructure to help adapt to extreme heat for example, neither social inclusion nor public health professionals attended or were identified as key stakeholders. Parks and greening department representatives were present, but in a minority. Borough professionals were there, but felt less comfortable participating. Stormwater management emerged as the key technical issue to be addressed.

Resilience to extreme precipitation events was also the main topic at the community workshops on the Lachine-Est eco-district, with the water department requesting an extra 20 minutes to present its proposal. In practical terms, integrating sustainable stormwater practices meant two redevelopment “innovations”: considerably more greening with infrastructure to capture and infiltrate rainwater in situ, and the pilot development of “water squares” – public squares or parks containing above-ground ponds to capture rainwater during extreme intense precipitation events (see Figure 1 below for one of the examples shown to local groups by the City). Above-ground ponds are presented as win-win interventions for all because they are a lower-cost solution to the water retention function of below-ground catchment ponds, and bring co-benefits to the communities in terms of parks and public spaces. Both the local associations and private developer participants in the workshop were extremely interested in these proposals.

These resilient infrastructure proposals showed how greatly the water department was involved in mainstreaming climate change adaptation and collaborating with urban planners. Water squares represent an innovative way of safeguarding urban areas against increasingly extreme rainfall, while also bringing the co-benefits of increased greening. These infrastructures are also apparently attractive to private developers, but also hark back to this particular site’s hydrological and industrial history, close to the Lachine Canal. There appeared to be no contentious issue with these proposals – no winners versus losers.

Figure 1. Picture of a water square shown as inspiration for Lachine-Est. Presentation from Montreal water department in Atelier Lachine-Est participatory workshop on ecological innovations, May 6, 2020. Photo credit: Credit Peter Bennett, project by TCL.



Understanding the tactics and politics of greening through stormwater innovation

In the living lab, climate adaptation came to be essentially synonymous with sustainable stormwater management. A resilient Lachine-Est neighborhood was defined as resilience to extreme rain events with a 100-year frequency. This emphasis could be interpreted as the selective focus on strategic infrastructure to ensure economic growth, as described by Long and Rice (2019), for it shows a focus on built infrastructure and compliance to the requirements for real estate development. Yet, the urban planners involved in our living lab saw this as an opportunity. Given this, we took this focus as a case to understand and politicize the conversation about the purpose and expected beneficiaries of resilient infrastructure.

Indeed, while this resiliency to intense rainfall appeared attractive and consensual, there were clear tactics and political choices behind it. Urban planners did not want to limit adaptive measures to heavy rainfall per se. They needed hard numbers to justify imposing more stringent greening regulations on private developers and to convince elected officials to buy land on the

site for parks and catchment ponds. Water-resilient infrastructure meant substantial investment and some development charges. Hence, urban planners wanted data on the urban development constraints inherent in flood control measures. From the outside, this could be seen as consistent with the logic of selective climate urbanism whereby the dominant discourse is to use technical means to safeguard infrastructure deemed vital for economic growth. However, for the planners this was a tactic to leverage investment in greening and public spaces. Yet in their efforts to gain this leverage, they had to understand and use the language of stormwater management. Progressively, political choices became technical ones due to the very terms, codes and instruments the planners used as a levy for more transformative interventions.

Although our workshops addressed some of these issues, they were under-politicized because existing administrative and engineering codes complicated open conversation. The following questions, for example, were not thoroughly discussed in the community meetings (although planners did ponder about them): How much should be invested in a foolproof 100-year-frequency rainwater square versus other investments to maximize other greening uses and benefits like parks and other public spaces in neighborhoods? Could the tactic of greening through resilient stormwater infrastructure actually reduce the choice and scope of most “relevant” greening from the affected residents’ standpoint?

Empowering other imaginaries and practices of adaptation

Climate adaptation has been made attractive and tangible in Lachine-Est by planning for the greening of the built environment and the design of innovative ponds. Storm water management is undoubtedly a priority for the local government, which faces lawsuits from owners of flood-damaged properties. Although heatwaves are another major climate hazard with serious health consequences, these consequences are not accounted for by a municipal department involved in urban planning. Lachine-Est is a former mineralized industrial site, it is, like its surroundings, greatly affected by the heat island effect. This large site is slated for phased development over decades with considerable uncertainty as to the timing and localization of public transit infrastructure and adjacent services, which could mean long walking distances for residents in very hot weather. Although this is a worrisome condition given the increase in heatwaves in Montreal¹, extreme heat was hardly mentioned. Even the much-discussed green infrastructure for sustainable stormwater management was not much discussed in relation to reducing the heat island effect, except in the living lab workshop in which we specifically asked participants to consider this issue. This reluctance is related to the hidden politics of greening through stormwater management: North American cities tend to focus on water management when they plan green infrastructure with technical experts or engineers, which makes it more difficult to discuss optimal implementation in terms of other benefits like cooling, equitable access to parks for leisure, etc. (Meerow, 2020)

¹ The number of days above 30°C per year is expected to triple from 2040 to 2070 compared with the 1980-2010 period, going from 19 days to 30 fifth by 2050 (medium scenarios, Ouranos 2020).

The framing of adaptation as infrastructure reconfiguration around resilience to stormwater definitely brought progress in this field, but other perspectives and needs were overlooked. We questioned this framing, pointing at how current inequalities related to vulnerability to climate change. We also worked to democratize the adaptation choices, presenting connections between issues that preoccupied local groups (density, greening, mobility, social inequalities, and access to services) and climate adaptation, with the important role of community services, public infrastructure and local shops in heatwave resilience. These issues were still not concretely associated with institutional climate change adaptation, nor did they tip the balance in terms of investment or localization choices for services, public spaces and local shops in the area. It seemed that social vulnerabilities to climate hazards were not yet taken seriously (see Van Neste et al., forthcoming).

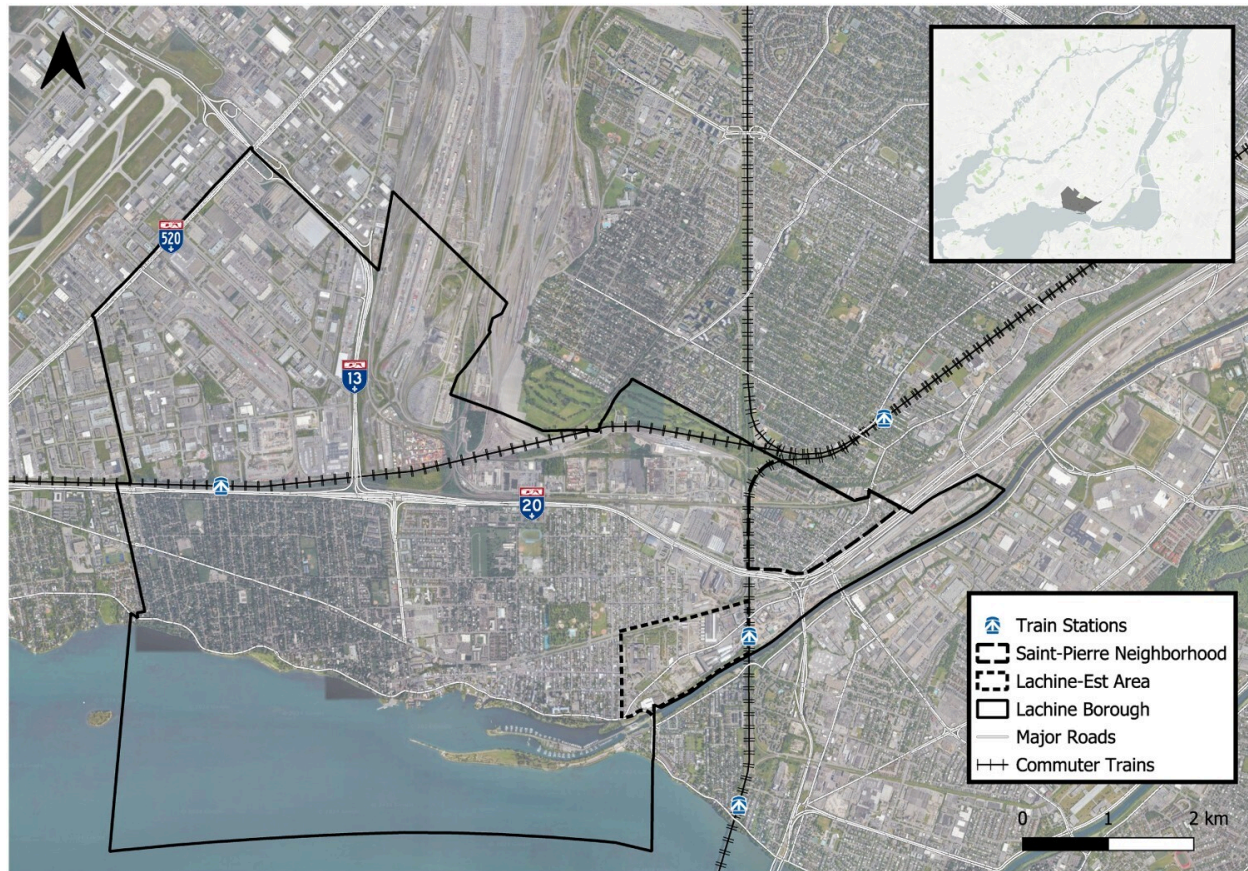
In the second workshop, our scenario of a poorly adapted neighborhood exemplified how the lack of services and shops closeby and uneasy access to transit greatly exacerbated the residents' difficult experience of heatwaves and ice storms. Planners felt uncomfortable discussing this in terms of inequities and increased vulnerabilities to climate hazards. Some participants even described inequalities as "irrelevant," while others were convinced that zoning bylaws would ensure equitable greening and service provision. Although the development of social capital, community support, and access to public transit did worry the planners and municipal technicians, they felt these issues were beyond their scope (in Quebec, governance of public transit and major road infrastructure is the prerogative of other provincial and metropolitan authorities that are difficult to influence). Due to such constraints, a social perspective on climate adaptation, even when deemed important, seemed mostly unrelated to these professionals' everyday practices.

The low consideration of social vulnerabilities is also visible in the socio-spatial inequalities reproduced in the planning process (see Van Neste et al., forthcoming). Innovative green infrastructure for stormwater management was translated in the PPU planning bylaw embedded in the master plan, for the demarcated Lachine-Est area (Figure 2). The adjacent areas also have older apartment buildings adjacent to railways and highway interchanges, thereby making access to services more difficult (in a polluted, heavy traffic and mineral environment). Buildings also tend to be occupied by residents who live alone and have lower incomes (Centraide, 2021). The planning of urban megaprojects often fails to anticipate the impact on adjacent neighborhoods (Anguelovski et al., 2016; Immergluck & Balan, 2018). In this case, access to services could be improved, while we can anticipate a jump in property values and rental costs. The planners stressed that the PPU could not be used to prevent gentrification around Lachine-Est, but that other tools could be developed along the way. However, given that increased greening and other innovative measures like water squares were also focused on this same bounded territory, the risk of creating a well-off eco-enclave is high.

The case of Lachine-Est shows how the selectiveness of resilience choices is associated with how climate adaptation is made tangible and attractive. We tried to highlight the hidden issues

and practices that do not fit into the selective focus on water infrastructure reconfiguration and on the instruments and compartmentalization of planners' everyday practices.

Figure 2. Map of the Lachine borough and Lachine-Est area (Montreal, Canada). Source: made by Émilie Houde-Tremblay.



To empower alternative adaptation practices, we co-constructed a side research project with local community partners to explore what heatwave adaptation meant in their everyday work to support Lachine-Est's most vulnerable populations. We accounted for the practices of community groups in providing resources and help during heatwaves in the Borough, as well as activities to reduce social isolation and improve access to services, shops, food and social housing, thereby reducing local resident vulnerabilities. Recognition of this work as climate adaptation seemed crucial because it targets socio-economic and spatial inequalities with little help from the State. The framing of climate adaptation as a means of safeguarding infrastructure that would be resilient to heavy rainfall needs to be placed in perspective alongside the need for funding and strategic planning of infrastructure of care (Lopes et al. 2018), to assist these "invisible" climate adaptation practices for cool and affordable neighborhoods outside the exceptional site of the Lachine-Est eco-neighborhood.

Next chapter to this story comes almost two years later. Discussions continue between participants of the living lab, with municipal and community groups very much involved in the planning of the ecodistrict. Local community groups who had led the participatory series of workshops mobilized to have funding for participatory planning for the surrounding neighborhoods, explicitly to work on preventing green gentrification and improving life conditions in and around the ecodistrict, with financial investment from the City and the involvement of planners. Hence, if results of the living lab – lasting in total only two years – seemed unsatisfactory, what we are witnessing now is that grassroots and policy actors are developing a new governance arena and planning tools to tackle these issues.

Conclusion

In this paper, we explore how a living lab on the urban governance of climate adaptation offered opportunities to politicize climate urbanism, i.e. to highlight the trade-offs, pitfalls and contradictions involved (Castán Broto, 2015), in relation to the situated and messy fields of political struggles where adaptation lands (Nightingale, 2017; Robin & Castán Broto, 2021). Our contribution is part of a broader endeavor to critically interrogate climate governance experiments and the different means by which they can foster change or perpetuate major obstacles for socially just climate interventions in cities (Bulkeley, 2023; Evans et al., 2016; Turnheim et al., 2018). Now that both the trend and attractiveness of urban living labs and experiments are well established, the importance of providing analytical tools to investigate, challenge and co-produce them seems key.

Drawing on the literature, we outlined two key processes involved in climate governance experiments: first, a process to make the experiments attractive and compelling, which can make it more challenging to voice contradictions and concerns (Bulkeley et al., 2014; Zografos et al., 2020; de Moor et al., 2021); second, a process of framing adaptation in terms of a selective infrastructure reconfiguration (Coutard & Rutherford, 2015; Monstad & Coutard, 2019), which can rapidly become technical and apolitical, ignore key social vulnerabilities, needs and alternative adaptation practices (Van Neste et al., forthcoming; Finewood et al., 2019; Angelovski et al., 2016). Both can exacerbate socio-spatial inequalities, and contribute to the negative trends of climate urbanism. While these two processes certainly drive climate action forward, they also make it more difficult to have critical debates over adaptation choices. As engaged researchers, we were drawn into both of these processes and experienced their ambiguities.

By closely analyzing these processes and the fields of political struggles in which climate experiments take place, we identified and participated in several micro-struggles and political choices involved in the new socio-material assemblage of climate adaptation infrastructure. Although the proposed climate interventions (green infrastructure, catchment ponds as water parks, etc.) seemed consensual and full of co-benefits for everyone, and this is how they are promoted, questions can be raised on the types of greening favored (in terms of the relative

co-benefits between cooling and infiltration, for example) as well as about the selective framing of adaptation, in terms of needs, vulnerabilities and territories considered. Physical infrastructure reconfiguration necessary for real estate development is the focus, as anticipated by Long and Rice (2019) while social infrastructure for adaptation is not tackled in the formal process, invisibilizing grassroots community work in need of more resources, especially for extreme heat and in areas surrounding the ecodistrict. In other words, resilience for whom (Meerow and Newell, 2016)? Nevertheless, the exercises to make sense of climate adaptation and our observations of how practitioners test and design climate interventions showed that some planners are aware of the constraints and structural biases affecting their work, but yet felt powerless to act on certain key issues, and reproduce a hazard bias in favor of protecting property against stormwater floods (Van Neste et al., forthcoming). Yet, for planners, stormwater management is a tactical lever to reach more greening and public spaces for all. For grassroots organizations, gentrification and the improvement of living conditions in surrounding neighborhoods continues to be a key theme of mobilization, with current social infrastructure in need of greater State support.

Overall, it appears that experimental learning by doing and various micro-struggles hide larger-scale political choices and transformative projects for infrastructure and urban development. The intention (of city planners, at least, but also local associations who continued their mobilization) is not to ignore the political dimensions but rather to tactically work through them. At the very least, it appeared that the living lab was helpful in unpacking issues, and showing the particular field of struggles in which they unfold locally. These struggles and the details of how they develop are key to how climate interventions will proceed. Although the trends of climate urbanism identified by Long and Rice are definitely impactful and resilient to small-scale living lab interventions, we feel a homogenous portrait of such struggles is not enough to empower alternative approaches. Situated analyses allow for the identification of specific instruments, discourses and diverse forms of building authority around climate adaptation, which may reproduce or challenge negative trends of climate urbanism, and be promoted or contested with local actors.

This article reflects our explorations into ways of observing, acknowledging and criticizing selective, economic growth-oriented climate intervention trends, while also recognizing the agency of actors and their transformative projects. Researchers are not immune to the contradictions resulting from hegemonic structures and constraints stemming from the political economy. Nonetheless, we believe that we can participate in collective action and community mobilization by openly debating climate interventions and contributing to plausible existing initiatives in order to transform them. Urban living labs are collective action spaces among others that need to be mobilized, critically interrogated, and (re)appropriated in ways that reveal blinkers and hidden choices.

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