2014

Urban design with weather variability

Adaptive capacity approaches towards Northern climate now and in the future

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Abstract

This conceptual paper examines different conceptions of weather variability as a starting point for urban design and planning in Northern climate. It explores the possible over-arching approaches towards weather, mapping connections and differences between them. Thus, the paper forms an intial framework that helps to understand urban spaces' adaptive capacity towards climate.

Weather variability in urban design and planning context is discussed both inductively and deductively, based on a literature review on proposed design solutions in Northern urban design. This is reflected and combined to theories and concepts on adaptive capacity and resilience in climate change adaptation literature. Reacting to current climate and climate change are combined into a dynamic framework, thus finding connections between solutions to current weather variability and future adaptation. *Sustaining, recovering, adapting* and *supple* approaches are proposed as categories for different approaches to framing weather variability and reacting to it.

Three main conditions characterize the proposed framework: (1) a balance between the approaches is needed to achieve both adaptive capacity and maintain the stability and identity of a place. (2) Framing weather variability as a seasonal cycle might have possibilities to act as a mediator in preparing for future climatic changes in urban design and planning processes. (3) When discussing temporary element such as climate, management cannot be separated from spatial adaptive qualities. When taking the climate into account, urban environment should be understood both as a process and a form.

Introduction

Predicted climate change as well as ecological and environmental goals have resulted in an emerging need to connect design and planning of cities with natural processes – climate and weather, among others. Even though climate change has highlighted the need to adapt to changing weather conditions in the urban planning agenda, it should be noted that the issue is not novel: human survival has always been dependent on constant adaptation to surrounding conditions.

Climates are very local by nature and therefore require local, hazard–specific approaches and understanding the context of a certain place or a region (Brooks 2003, 9). The importance of taking climate into account in urban design and planning becomes highlighted in Northern regions characterized by extreme climate conditions.

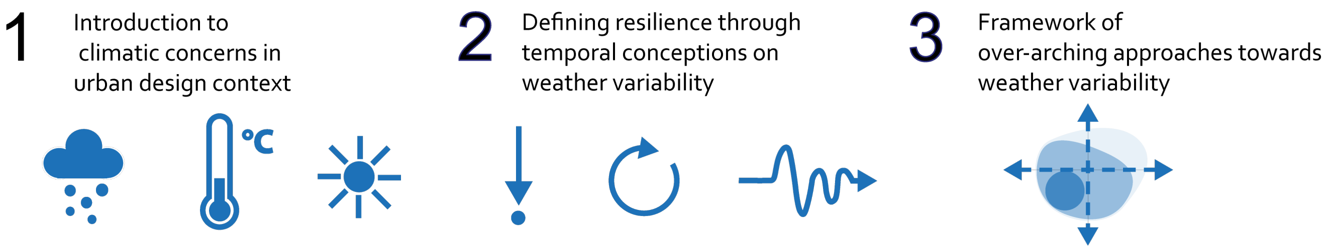

Figure 1. The structure of the paper. The first part discusses the definition and features of northern climate and gives an introduction to climatic concerns in Northern urban environments. The second part of the paper discusses resilience and attributes given to it. In the third part a conceptual urban design framework of over-arching approaches towards current climate and future changes is formed.

Northern cities are to a large extent built based on modernistic, universal planning principles, which do not take local conditions into account. Yet, climate, more than perhaps any other natural process, transcends all the boundaries of nature and human activity (Hough 1995, 245). Extreme weather has secondary impacts on the majority of human activity from people's use of sustainable travel modes such as walking or cycling to economic impacts (positive or negative), tourism, outdoor spaces, recreation, café culture and the 24-hour city (Wilson 2006, 617).

The predicted and growing interest on Northern regions is currently driven strongly by the demand for resources – oil, gas, and minerals – as well as interest on transportation, including establishing new shipping routes. This kind of development poses environmental challenges, as well as makes temporality a central question: how to accommodate temporal workforce in mining communities in a sustainable way, for example? Due to migration, geopolitical changes and globalization, it has been predicted that by the year 2050 there will be a 15 % increase in population in Northern countries. (Smith 2010, 172-174; Arctic Interim Report 2013, 3). In addition to social drivers, Arctic landscapes are also facing challenges on their natural ecosystems due to climatic changes. Thus, Northern areas are facing multiple and simultaneous social and environmental stressors.

The focus of this paper lies on Northern climate as one constant stressor and a context for development. The paper discusses climate a premise for designing and planning Northern urban spaces. The issue has been approached during the recent decades in some contexts, from winter city movement to bioclimatic design. However, a bit surprisingly perhaps, there is no specific discussion on Northern conditions in climate change literature.

There is a gap on *urban* climate knowledge and management in Northern conditions. Vernacular solutions, such as temporary snow structures built by Inuits are often raised as an example of good and natural adaptation to climatic conditions. However, urban processes and environments are more complex than single buildings. Furthermore, contemporary cities deal with climatic phenomena and situations that older cities and vernacular settlements were rarely, if ever, faced with. Vernacular examples can provide ideas, but solutions are not scalable as such.

When taking the climate into account in urban environments, it is central to define what we are reacting and adapting to. The paper maps these possible, over-arching approaches to weather variability and climate. It has been stated, that a good starting point for adaptation to future conditions should involve better managing of risks associated with today's climate already. Appropriating both current and future conditions in the same discussion forms a "dynamic" approach. (Füssel 2007, 159.)

The paper is divided in three parts (see figure 1). (1) In the first part I discuss the definition and features of Northern climate. Also, an introduction to climatic concerns in urban design literature and research is presented. (2) In the second part of the paper I introduce the concept of resilience and attributes given to it. I conclude that there are actually many different adaptive capacities, which respond to different temporal conceptions of weather variability. (3) Third chapter combines the two previous chapters. Design solutions taking the current climate conditions into account are assessed through the attributes given to resilience, leading to a conceptual urban design framework of over-arching approaches towards current climate and future changes. To conclude, I discuss approaches' mutual balance, as well as their inclusive and exclusive qualities.

Which solutions to Northern urban environments?

In this paper, I use the concept 'Northern climate' as a general term including both subarctic and arctic climate, where extreme weather conditions are determinant features and pose more challenges for human well-being than living in more temperate regions. Subarctic and arctic climate are categorisations from Köppen climate classification system, which divides the world climate into five main groups. However, there are some cities that possess similar features to subarctic and arctic regions (i.e. cold winters, snow precipitation) in Köppen's humid, continental climate category. Even within the same climate category conditions differ considerably between regions. Thus, in the context of this paper, climate categorisations are not taken strictly. With 'Northern climate' I refer to a climate characterized by the seasonal cycle of long, harsh, cold and winters with the main type of precipitation being snow, and relatively short, mild and light summers. Snow, ice and darkness are some of the features of the Northern climate, adding temporary, seasonal layers to urban environment – both physically and figuratively speaking. This kind of qualities separate Northern climates from more temperate climate regions: the conditions present challenges as well as opportunities for spatial organisation of urban form and urban life.

Climate as a temporal dimension

There are two public discourses on climate: slow climate and its changes and the fast weather variability, it meaning seasonal changes and changes in daily weather (Stehr and von Storch 1995, 101). Despite the long, incremental time scope of climate change, theoretical models and solutions for climate change adaptation focus largely on uncertainty and point-like extreme weather events such as storms and floods, which are predicted to become more frequent in the future. In that sense, the discussion on climate change is not about adapting to slow changes on a long time frame, but forming a responsive, shock-resistant system towards extreme and uncertain climate variability. Thus, all the discussion on climate can be understood through the concept of weather variability. The issue is only framed differently.

I divide Northern weather variability into three temporal levels: (1) single climatic features and discrete climate events, (2) recurrent hazards and transient phenomena such as the seasonal cycle and (3) long-term incremental change. The last category consists of the elements in two previous categories, yet the exact form, amount and timing of these changes is not certain. These three temporal climate categories do not need to be limited to either climate change or current climate variability, but rather form a connecting, dynamic framework.

Studies on good microclimates

One approach to climate in Northern regions as well as more globally has been to translate the connection between urban spaces and the effects of climate into form-based codes. In a field of so called bioclimatic design, wind, sun and snow assessments and design guidelines based on them have been developed to enhance thermal comfort and energy efficiency of the urban fabric (i.e. Kuismanen 2008; Børve 1988). Knowledge and techniques for analysing climate factors and outdoor comfort have been developing steadily during the recent decades, giving also birth to a field of urban climatology. Densities, land uses, building heights, building placement, outdoor landscaping, green spaces, street dimensions and orientation, materials and surfaces are some of the features to consider in order to form good microclimates. In Northern context, snow storages are to be placed in sunny places and sunny sides of roads to melt snow faster. According to bioclimatic principles, wind and snow must be thought of in tandem – in open places the placement of the house might affect snow to pile in certain sides of the house. Snow can also be used to direct and block winds by building snow walls and other structures.

The impacts of Northern climate to urban dwellers have also been observed for example through patterns of outdoor use and travel habits (i.e. Westerberg 2009, Eliasson et al. 2007, Ebrahimabadi 2012; Knez and Thorsson 2008). Descriptive and comparative studies have provided for example psychological knowledge on humans' relation to climate in different types of urban spaces, but this kind of research has not provided design solutions as such.

Winter city approach

Started in the 1980s as a part of the discussion on ecological and nature-connected cities, there is an approach developing cities in Northern regions as so called "winter cities". Whereas a modernistic solution towards Northern climate was to move all the central activities inside – more colloquially, by answering to challenges posed by winter by turning the radiators on and building indoor public spaces – winter city movement searches for more subtle and profitable reactions towards harsh climate. It aims at enhancing the livability of winter season through better physical design, but also through rearranging activities and proposing winter-related events. For example, snow and ice have aesthetic qualities and are a prerequisite for many seasonal activites, from snow-mobiling to skiing and sleighing. This kind of solutions and propositions have been developed and collected in publications on "winter cities" (Pressman 1995; 2004). This kind of design approaches' significance in scientific terms has been questioned, though (Ebrahimabadi, 2012, 6).

Climate change

Climate change is the most recent and perhaps the biggest issue reviving interest in searching for connections between climate and urban design. It is characterized by uncertainty, contentiousness, multiplicity and complexity (van Buuren et al. 2013), making it a wicked problem with no one single solution (Rittel and Webber 1973). Conventional, "tame" spatial planning does not have tools to deal with wicked climate. Hazard events are more difficult to model than incremental change, yet these uncertainties test the adaptive capacity of urban areas the most and require new strategies. (Roggema et al. 2012).

The impacts of climate change in the North are not clear and the predicted impacts differ regionally. In general, rains and cloudiness are estimated to increase, winters get warmer and extreme weather conditions become more frequent (Haanpää et al. 2008, 99). Snow covered days are estimated to decrease by 20-30 % during the following century (Jylhä et al. 2009, 54). Warming climate is also assumed to generate benefits in Northern context: growing season becomes longer, and heating demand decreases (Hunt and Watkiss, 2011, 19). However, the impact chains are rather long and multiplying, and thus cannot be simplified as purely negative or positive.

There is an apparent gap in solutions proposing to take Northern climate into account in urban design: climate change approaches do not exist, whereas solutions reacting to current climate do not specifically talk about reacting to future conditions.

Climate change literature has not (at least by so far) taken Northern conditions largely into account as a special case when it comes to urban design and planning. Furthermore, climate change literature has by so far focused more on governance and discussing the conceptual basis for adaptation, whereas discussing actual spatial design solutions is more rare. Some design guidelines that have been proposed to warmer climates (i.e. Shaw 2007) present general key points, which could have applicability in the North as well to some extent. However, there is an apparent gap in urban design and planning solutions considering Northern climate: climate change approaches do not exist, whereas solutions to current climate do not specifically refer to future conditions.

Attributes for adaptive capacity

Even though the focus of the paper is not only on climate change, research literature on climate change adaptation provides concepts for examining weather variability. This literature is a rather concept-heavy field. Used concepts have their roots in various disciplines, from ecology to psychology. Thus, same terms have gotten overlapping and even contradictory definitions: differing concepts have been used to contribute to specific research outcomes and to serve different research needs. Vulnerability, sustainability, adaptation, resilience, sensitivity, exposure are some of the concepts used to approach the issue, depicting different viewpoints from adaptation outcomes to its prerequisites. However, defining these concepts is not the core purpose of this paper. Instead, I focus on resilience, which is one of the leading concepts in dealing with change and enhancing adaptive capacity – not only when it comes to climate-related issues.

Broadly defined, resilience is the feature that provides adaptive capacity, which can be shortly defined as the ability to respond to climatic stimuli. The Intergovernmental Panel on Climate Change (IPCC 2014, 1) defines adaptation as "*the process of adjustment to actual or expected climate and its effects"*, which *"seeks to moderate harm or exploit beneficial opportunities".* Resilience focuses on how these responses are formed. Adaptation is actor-oriented, whereas resilience is a feature of a system (Nelson et al. 2007, 395), thus being particularly well suited to describe the built environment.

Resilience approach

Globally changing conditions and situations requiring adaptation have given birth to resilience: it has become the new catchword of 21st century, even titled being *"to 2000s and 2010s what sustainability was to 1980s and 1990s"* (Müller 2010, 1). Resilience has been used to describe transformations of many kinds, for example political, social, technological and biomedical disasters. However, the most often it is combined with climate change. Already by its dictionary definition – "to effectively adapt and bounce back" – resilience has much appeal as a quality of many kinds of systems, and perhaps that is why it has gained foot in many types of reseach discussing change.

In research literature, there are various definitions to resilience relating to climate change. It can be understood as the capacity of a system to cope with disturbance, absorb shocks and quickly return to or maintain its essential function, key processes, identity, structure, whilst also maintaining the capacity for adaptation, feedbacks, learning and transformation (Leichenko 2011, 164; Arctic Interim Report 2013, viii). Adger (2006, 268) defines resilience as "*the magnitude of disturbance that can be absorbed before a system changes to a radically different state*". To Folke (2006, 259), resilience is a continuum from adapting to current situation to transformability. Resilience is a sequence of concepts, from more narrow interpretation to broader socio-ecological context. Some definitions of resilience emphasize opposing risks, describing it with concepts like *'ability to withstand'* (Martin-Breen and Anderies 2009) and *'minimizing potential damage'* (van Buuren et al. 2013), whereas at the same time resilience is given definitions like *'renewal capacity'* and *'ability to shape change'* (Smit and Wandel 2006; Folke 2006). The competing definitions and varying attributes given to resilience imply that there are actually various different resiliences – or rather, different kinds of adaptive capacities. I divide these qualities under four categories, according to their relationship to weather variability, time and change. I call these approaches *sustaining, recovering, adapting* and *supple* (figure 2).

Adaptive capacity qualities like *'reducing potential risks', 'minimizing potential damage', 'ability to withstand'* and '*exposure-reducing'* can be seen as proactive, aiming at resisting the unpleasant and damaging changes in the urban environment. This forms the category I call a *sustaining* approach. It aims at ensuring the same conditions and does not recognize or support change.

Recovering approach emphasizes fast recovery and coping with change – bouncing back quickly from changed conditions back to the old ones, thus relating closely to sustaining approach. *Adapting* approach is similar to *recovering* in its emphasis on coping with change, yet it tries to take advantage of the opportunities the change offers instead of trying to return back to "normal". Both recovering and adapting approach require understanding weather variability as a cycle of different situations.

Supple approach is the most oriented towards change: it aims at reorganization after change. It has an emphasis on renewal, new trajectories, and reorganization when facing change. The approach necessitates transforming

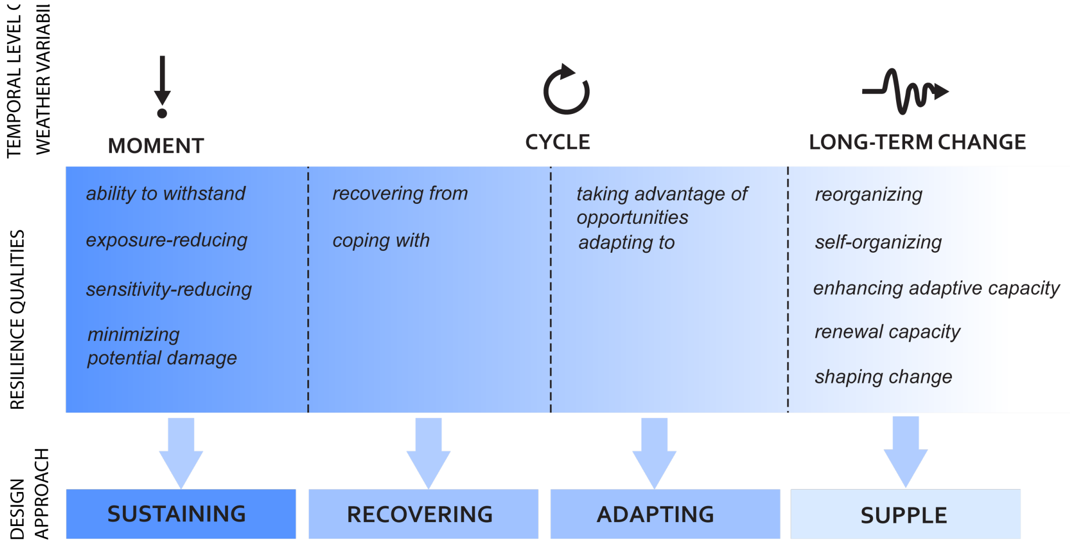

Figure 2. Competing and complementary qualities given to resilience towards climate. The resilience qualities found from climate change adaptation literature (Swart and Raes 2007; van Buuren et al. 2013; Smit and Wandel 2006; Folke 2006; Martin-Breen and Anderies 2011) are categorized into four approaches according to their temporal conception of weather variability and thus, relationship to change.

and accepting a long-term change. Supple adaptation can be seen to have similarities to complex adaptive systems resilience, defined by Martin-Breen and Anderies (2009, 9). The concept derived originally from ecology understands management as a central part of the system in question.

This discussion comes close to comparing sustainability, resilience and antifragility, as posed by Susan Carruth (2014, 57), sustaining approach obviously coinciding with sustainability, recovering and adapting approaches being the closest to resilience and suppleness being a form of antifragility. According to Carruth, these three concepts form a debate among themselves: sustainability is etymologically rooted in sustaining – keeping the system where it is at the current moment. Resilience emphasizes coping with change, whereas antifragile systems thrive with change. Antifragility as a concept developed by Nassim Nicholas Taleb: "*anything that has more upside than downside from random events or certain shocks is antifragile – the reverse is fragile*" (Taleb 2012, 3).

Northern climate context and adaptive capacity qualities

As discussed in the previous chapter, qualities given to adaptive capacity – and more specifically, resilience – in climate change context are rather general by nature: the concepts are intended to serve various disciplines. In the following, these definitions are examined within urban design and illustrated with examples, thus connecting the adaptive capacity qualities with urban space and form and discussing them as outcomes of spatial planning. Whereas the previous chapter discussed adaptive capacities' relationship to time and change, this chapter will build on that through discussing required tactics, information and innovation possibilities in pursuing different adaptation approaches.

Sustaining approach – controlling the extremes

Design solutions that fit the best into the sustaining approach are mainly technical and material, shaping the physical environment, urban form, density and so on. The most obvious way of resisting the changes of weather is to built adequate indoor spaces for urban functions, perhaps the most iconic example being pedways, walkways and other structures protecting from the weather. Structures that resist snow and wind loads, urban forms that are oriented to profit from the sun (both energy production and human thermal comfort), buildings that are placed to block the wind, streets that are measured to enable sunlight approach the street level even on the darkest days are some proposed principles that fit within the concept of sustaining (i.e. Børve 1988; Setoguchi 2008; Kuismanen 2007; Pressman 2004). These solutions aim at minimizing the weather variation and ensuring maximum comfort.

A basis for this kind of solutions lies in measurements. Microclimate analysis and other kinds of assessments of weather conditions are used to map the most extreme conditions or to form mean values, according to which the spatial solutions are given their form. Measurements are often based on the past and current weather variability, though they may also include predictions of future.

The critique towards sustaining approaches lies in their stability: maintaining current conditions is not always regarded as a truly adaptive approach. If conditions change, the system stops working. Extreme weathers becoming more extreme might lead to sub-optimal performance in constructions that were designed to provide thermal comfort or energy passively, using for example principles of bioclimatic design. (IPCC 2014b, 34.) Thus, attention must be paid to the scale of proposed solutions, regarding also the long-term climate changes: the lifecycle of built environment is much longer than that of smaller technical components or devices.

Cyclic approaches – recovering and adapting

In Northern climate context, *recovering*, “back-bouncing” approach can be illustrated with seasonal maintenance strategies. For example, strategies and tactics for snow plowing are planned so that they bring conditions close to the original level as soon as possible after a snowfall. The change happens, but it is taken care of. The speed of returning to previous conditions becomes central in assessing successful solutions, thus turning the focus from physical solutions to design and implementation processes. *Recovering* approaches are planned (on strategy level) and are thus proactive, although their implementation to physical environment has also reactive features.

Adapting approach – in other words, re-thinking of development strategies in the face of changing conditions – can be illustrated with winter city development. The notion of Northern climate as a seasonal cycle is acknowledged and taken as a guideline for development, proposing new activities for the challenging winter season and in relation to snow, ice, and other climatic features. “Winter cities” convert the changing, seasonal, material conditions into a positive asset through enabling wintery activities and organizing events. The focus is on ensuring economic and social sustainability all year round. Innovation potential is centered on proposing new activites and thus developing new (seasonal) land uses. Research data on the usage of outdoor spaces during different seasons and under different weather conditions supports designing and managing *adapting* urban spaces.

Critique towards both *recovering* and *adapting* approach centers on their dependence on weather variability: even though variability is admitted, the amount of variability is supposed to maintain more or less the same. Thus, winter-focused solutions can be pseudo-resilient in the face of climate change, leading to another kind of fragility. For example recreational uses and tourism (i.e. ski resorts) can face challenges: less snow and more unreliable snow cover means difficulties for maintaining the activity. Even though well-prepared for the “hazard” that winter poses, in case another extreme shock happens, the system collapses. These have been defined as ”iconic” environmental changes and are regarded as highly culturally specific (Adger 2006, 276 ref. O’Brien et al. 2005). Preserving the “Northern lifestyle” and maintaining an economy might even lead to using artificial snow and producing ice to maintain the conditions. Thus, winter city approach is inclined to *sustaining* approach, where a single climate condition becomes the center of interest: the amount of snow is the threshold for activities. Seeing climatic features as a resource sets Northern climate apart from many other climate regions and poses ‘social sensitivity’ towards climate as its’ central feature. In climate change literature, the aim of reducing social sensitivity means minimising the dependence of industries and activities on climate conditions and is seen as central in preparing better for future climate.

Supple approach – profiting from the change

As stated, long-term incremental climate change has not been extensively discussed in Northern climate regions’ urban design and planning. Thus, the urban design approaches proposed towards Northern weather do not address the possibility of complete change, but as the previously described categories point out, focus mainly on making the best out of the current variability or tackling it in efficient manners. The research on climate change in the Northen context has pointed out possible challenges that might emerge, yet the practice has not (yet) proposed many solutions.

In other climatic contexts, especially in flood-prone areas, the discussion has evolved further on new spatial and strategic solutions. The main idea lies on not trying to "conquer" water, but instead living with the changes, for example leaving open spaces in the urban fabric on a settelement scale for water to flood at times. In a smaller scale, so-called "water squares" (i.e. in Rotterdam) are shaped to accomodate water, yet when empty, the spaces remain equally usable as multi-leveled squares and recreational spaces. When examining the water approaches, adaptation towards climate change often seems to require more unbuilt and open space (Hamin and Gurran 2008, 3). When thinking of Northern climate, this might also be the case with snow and its' handling: open places are needed to accommodate snow storage and minimize the need for snow transport. However, classifying solutions is not self-evident. Leaving open spaces to urban fabric does not automatically classify as a *supple* approach. These spaces must be designed and situated so that in case of less snow and milder winters, they would have a different usage. In s*upple* approaches the innovation potential lies in management of urban environment.

The adaping approaches are showed in relation to each other in figure 3. The approaches can be placed on continuums of time and type of the tactics required for a desired outcome.

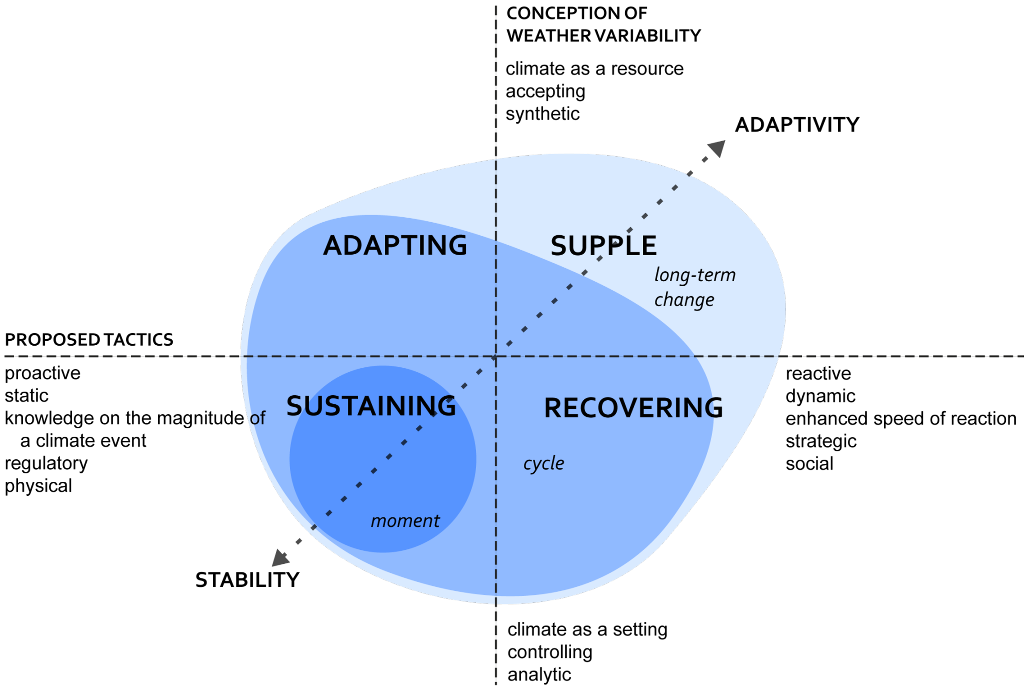

Figure 3. Adaptive capacity categories. The figure presents the four adaptive capacity categories in a matrix of two variables: the relationship to weather variability and the type of tactics it is seen to require. The temporal levels of comprehending climate are added to figure in different shades of blue. Adaptive categories are inclusive: all of the approaches are needed, but achieving a mutual balance is central in achieving adaptive capacity while maintaining both physical and social stability and coherence.

Assessing the adaptive capacities

Balance and inclusiveness

The presented approaches are not mutually exclusive but all contribute differently to sustainable, useable and healthy urban spaces. Qualities from both ends of the temporal and adaptive scale are needed in order to create a sustainable urban environment. There should be a focus on identifying "no- and low regret" measures, which, while contributing to adaptation, do not hinder any other adaptive options. Adaptation approaches should be seen as inclusive, where only all of the approaches in balance can contribute to creation of dynamic adaptive capacity. The presented approaches could be a means to connecting spatiality of urban environment with seeing it as a process. Through examining figure 3, it seems that thinking in cycles and leaning on recovering and adapting approach might act as a mediator between more explored fields of current climate consideration and climate change. This hypothesis will need further examination though.

The different approaches are not easy to categorize. Measuring adequate places for snow storage can be seen as a *sustaining* approach, focusing on the maximum amount of snow. If also the uses for the storage space outside the winter season are taken into account, the approach falls into *adapting* category. Instead of merely focusing on land use, snow can also be taken care of with better snow handling tactics, thus becoming a *recovering* approach. If enough flexibility is given to the possible uses of storage space – both when covered with snow and when not needed for storage purposes – it can be categorized as a *supple* approach. Even though supple solutions emphasize very much the need for empty space with undetermined uses, climate should not be seen merely as a new function requiring space, but a changing condition to which existing patterns of land use and activity need to adapt (van Buuren et al. 2013, 51). Fitting spatial allocations and presumed demand as well as connecting adaptation measures to other agendas make processes both enforcing and enabling (van Buuren at al. 2013, 42 ref. Bulkeley 2000).

Uncertainty – a quality of the supple approach – is difficult to justify in a decision making process. However, a strategy that lacks flexibility and openness, focusing only on sustaining, will minimize design’s adaptive capacity when facing new circumstances. Encountering uncertaintly does easily lead to building in some margins and to taking additional safety measures – in other words, choosing a sustaining approach. At the same time, uncertainty calls for reconsidering decisions when the situation alters. However, too loose a strategy – as might be the case with suppleness – does not necessarily provide identity, organization, and legibility. A minimum level of safety and certainty is necessary for the trust of citizens and investors in long-term tenability. (van Buuren et al. 2013, 42.) Handmer and Dovers (2009) caution that transformative change is not always positive. For example, large-scale rapid changes increase system instability and have the potential to produce irreversible choices, which actually lead to suboptimal pathways and inflexibility on their part. Also, tendency to only maintain the current conditions might result in unsustainability – for example, resorting to artificial snow to maintain winter economy during milder winters. The design solutions that deal with the current climate conditions do ”survive” with it and may even thrive because of it, but potentials and perhaps even the most profitable economic benefits are not exploited.

What adapts?

Who or what is expected to be resilient to changes also becomes a central question. In “momentary”, sustaining approach the demand for resilience concerns the built, physical environment, whereas more transformative, supple approaches require adaptive governance and social adaptability: for these approaches, technology or any other material issue is not a constraint, but too rigid ways of planning can be. Thus, the more climate is seen as an incremental process, the more it requires multidisciplinary approaches, instead of focusing on purely spatial solutions.

Whereas on spatial level Northern regions need to search for local approaches, on management scale references can also be sought from other climatic regions. The adaptive approach categories developed in this paper somewhat coincide with those defined by Woltjer and Al (2007) for water management in the Netherlands. Woltjer and Al mapped possibilities to move from conventional, regulatory and functional water management towards more inclusive, social-cultural and strategic ”new water culture” – aiming for a shift from regulations to strategic, and from functional to socio-economic approach. Sustaining approach developed in this paper can be seen to have similarities with ”conventional water management”, and thus could be attributed as regulatory and functional. Supple approach is strategic by nature, having connections with Woltjer and Al’s “new water culture”.

Spatial planning has been seen as a central “tool” in adapting to climatic changes and adaptive capacity of cities has been seen to depend largely on urban land management systems, because it combines various disciplines (Davoudi et al 2010; Biesbroek et al. 2009). At the same time, adaptation to weather variability is the most difficult in the built environment, which, of all parts of the infrastructure that support life, has the longest physical life and the slowest rate of renewal (Graves and Phillipson 2001). Spatial patterns and land uses are hard to change (Roggema 2012). Therefore, the constructions we erode today will likely work under different climatic conditions than those that they were designed to (Sanchez-Rodriquez 2009). This viewpoint in mind, dynamic considerations ranging longer timespans become especially central when discussing solutions for the built environment. However, the ability to adapt is not dependent on the systems capacity to pursue future adaptation strategies, but it is latent in social institutions: in responses to present day variability and in existing adaptations resulting from the past realization of adaptive capacity (Adger 2006; Brooks 2003).

As a conclusion, it could be stated that a climate-adapted city cannot be fully designed in a single count, but needs to leave places for future adaptation and for others to adapt (Barnett and O’Neill 2010). As a solution to this, van Buuren et al. (2013) propose placing norms and rules as levels of required level, not as definitions on how to produce the level. Thus, norms and rules could be seen as open invitations – calls for others to link their own agendas to adaptation challenge. This proposes a shift from technical solutions towards more holistic schemes. When the temporal span of understanding climate events grows, the focus of adaptive capacity shifts to larger, more comprehensive systems, including both urban form and management.

Conclusions

Adding the dimension of time – thus, shifting the thinking towards processes instead of spatial form – might have potential in broadening the understanding of spatial qualities of Northern urban spaces.

Sustainable climate adaptation emphasizes the need for local approaches and understanding the surrounding climate context. Developing alternatives for the technology-oriented and purely spatial solutions requires novel, more holistic approaches.

The lack of actual design solutions in research literature gives this paper a conceptual and speculative nature. Thus, the paper can be read as a tentative assessment and speculations based on a literature review, rather than empirical findings or fieldwork. The discussion and intial framework presented in this paper can be further tested and developed with case studies.

Reacting to long-term climate change has connections with reacting to current climate. However, these are not one-to-one approaches: sustainable solutions towards current climate do not necessarily mean good adaptive capacity towards climate change as well. Professionals do sometimes have misconceptions about this (see Tøsse 2013). The aim of this paper is to map connections between the two. As pointed out in the paper, there are pontential synergies, yet also trade-offs between different temporal approaches. Approaches dealing with shorter timeframes provide identity, certainty and continuity in uses, whereas a shift towards more supple approaches has better adaptive capacity towards uncertain events. Especially emphasizing cyclic approaches might have a central role as mediator between current climate and uncertain future. The dynamics between the approaches must be examined in further detail.

There are two main points that arise from examining weather variability as a dynamic, temporary continuum. Firstly, the connections between spatial environment and management strategies that guide its development need to be thought of in tandem. In addition to spatial solutions, innovations might be needed also on the level of management. Adding the dimension of time – thus, shifting the thinking towards processes instead of pure spatial form – might have potential in broadening the understanding of spatial qualities of Northern urban spaces.

Aknowledgements

The author would like to thank post-doc researcher Emilia Rönkkö and professor Helka-Liisa Hentilä from University of Oulu, as well as the three blind reviewers for insightful comments on the draft. The paper has been composed within research project *Integrative Urban Development Concept: Case Sustainable Winter City* (INURDECO 2012-2014), which is a collaboration between University of Oulu, City of Oulu and three construction companies (Sonell Oy, Skanska Talonrakennus Oy and Hartela-Forum Oy) and is further funded by TEKES and European Regional Development Fund.

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