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## Is climate a modifier and shape-giver in urban morphology?

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The definition of 'urban morphology' is contentious. Some seek a broad definition, while others promote greater focus to consolidate understanding (Kropf and Malfroy, 2013; Oliveira, 2016). The perspective considered here seeks to add to

this discussion by asking whether climate is a modifier and shape-giver in urban morphology.

The aim is to increase debate around the place of climate in the study of urban form, rather than addressing other physical or biophysical

environmental variables. While the climate influences urban form in all places, the Fennoscandian region of Northern Europe is used as an example because the region's winter season is sufficiently significant to force alternative approaches to climate-sensitive urban design and planning (Chapman and Larsson, 2019).

Such settlements experience significant climate variation across the year, precipitation mainly in the form of snow, long periods with temperatures below 0°C, with limited hours of daylight. All of this can occur for up six months of the year (Pressman, 2004). While these characteristics classify them as winter cities, in summer these settlements can experience 24-hour daylight and temperatures reaching +30°C. This makes them an excellent environment for testing arguments 'for' and 'against' climate being a modifier and shape-giver in urban morphology.

If we take the first part of Conzen's (2012) definition, as being the study of the 'built form of cities', it is easy to say that climate is not an aspect of urban morphology. This is because the built form is not changed by the climate. This conclusion is reinforced by Larkham and Jones's (1990) definition, which states that it is the study of the 'physical (or built) fabric of urban form'.

However, if we apply this logic to other definitions, the answer is less clear; Cowan's (2005) definition describes the 'study of urban form'. Here a broad definition could allow inclusion of climate knowledge in the study of the formation and transformation of urban form. Similarly, Larkham (2005) highlights the study of the 'complexity of physical form', Smailes (1955) focuses on the 'urban scene' and Vance's (1977) on 'This scene of man'. This is important because in winter cities, the climate has a force to remodel a place to a degree that necessitates alternative planning approaches and architecture. For example, Montreal's (Canada) tunnels linking buildings or Hammerfest (Norway), where site planning helps reduce snow impact and wind. In such places, the impact of winter can occur at the detail of the street, with snowdrifts burying ground-floor accesses or the scale of the urban structure, with entire streets and spaces becoming unusable by snow build-up. This is important because during this time, the urban form and its complexity is changed by interactions between the winter season and the built form. Moreover, this form on form creates a seasonal urban form. Here, it can be argued that either climate is a modifier and shape-giver of urban morphology or that the definitions

are unclear. In effect, is urban morphology questioning and seeking to explore 'built form' or 'physical/urban form'? As these are not always the same, this ambiguity also opens the door for the climate to be included within debates about urban morphology.

So far, these arguments have not considered spatial scale and use. When scale is added, for example looking at the scale of the neighbourhood, the arguments for climate as a modifier and shape-giver in urban morphology gain traction. Conzen's (2012) definition continues by stating that urban morphology seeks to explain the layout and spatial composition of urban structures and open spaces. Moudon (1997) also highlights that, in urban morphology, a place can be 'read' via the physical form and that morphological characteristics are defined by the shape of the urban form, density and uses over time. If this is the case, the climate of winter cities is almost certainly a modifier and shape-giver for urban morphology, as it can alter the usability of space, and add, remove, and re-profile a settlement's urban structures and open spaces. In the main, while much effort is placed on keeping spaces and pathway useable, the winter season has a reductive effect on the urban structure and tissue by reducing usability.

Such arguments can also be related to the manner and purpose of studying urban morphology. If we accept that, in winter cities, the winter season is a sufficiently significant actor to modify the form of the urban environment, it is logical that this modality should be studied and planned for (Gauthier and Gilliland, 2006). It also follows that we should seek out principles and rules for the urban design of these places (Gebauer and Samuels, 1981). This has, indeed, happened.

In 1959 the architect Ralph Erskine tabled 11 principles for urbanism in the European Arctic in his 'grammar for high latitude architecture' (Collymore, 1994), with many principles focused on identifying what is good urban form for a winter city. There was also a focus on the design and planning of northern settlements in Norwegian research in the 1980s (Børve, 1988; Sterten, 1988) and, equally, these studies focused on how settlement form and layout can mitigate the impacts of the winter season. From 1982 into the early 2000s, the Winter Cities Association produced numerous publications focusing on winter communities in Canada, Europe, Japan, North America and Russia (Pressman, 2004). In turn, this resulted in many urban design strategies for winter cities. An early

example was the *Winter city design guidelines for Fort St John* (Urban Systems, 2000). A more recent example is the Canadian city of Edmonton's winter design guidelines (City of Edmonton, 2016), which provides extensive supplementary design guidance. Equally, design praxis in the Fennoscandian region is influenced by climate. The design of the relocated settlement of Kiruna (Sweden), for example, addresses how street and public space design will adapt to the winter and summer seasons (Chapman *et al.*, 2019). Other settlements in northern Sweden are also adopting ideas of Green-Blue-White planning strategies (Larsson and Chapman, 2020).

In the end, whether climate is a modifier and shape-giver in urban morphology is unclear in definitions. However, most of us can probably agree that climate, and especially micro-climate, is important in urban design considerations that, in part, shape the urban form by design, planning or nature. If this is the case, climate, seasonal climates and climate change can all be seen as morphological modifiers and shape-givers with respect to urban form. It can also be argued that as part of a wider morphological framework, climate is part of the framework to better understand urban form, its formation and transformation over time.

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