Arctic Architectures

Peter Hemmersam

The Oslo School of Architecture and Design
Pb. 6768 St. Olavs plass, 0130 Oslo, Norway
+4792860924, peter.hemmersam@aho.no

PREPRINT VERSION

Abstract

In 1968 the British/Swedish architect Ralph Erskine published the article 'Architecture and Town Planning in the North' in Polar Record, in which he calls for a particular Arctic approach to the design of buildings and cities that is distinct from mainstream architecture due to conditions such as harsh climate, resident indigenous or sparse population and remoteness. One hundred years after his birth (in 1914), Erskine is still considered the authoritative 'Arctic Architect', and his approach is paradigmatic among many architects dealing with the built environment in the Arctic, sub-Arctic and northern regions.

However, a study of literature on architectural practice and the built environment in the North reveals a number of varying conceptions of Arctic architecture. These different perspectives are social in their nature and construct the architectural technologies, the natural environment, and society in different configurations. This article finds that architectural discourses and readings of the Arctic change under the influence of social, cultural, political, and architectural paradigms. It traces a genealogy of perspectives on Arctic architecture and argues that new conceptions do not necessarily replace previous notions, but often overlap and reconceptualise earlier ideas, and that certain conceptions appear to perpetuate, such as the Arctic as an 'empty space'.

The perspectives identified in the article are seen as critical supplements to Erskine's approach in developing new sustainable forms of urbanism and architecture in the Arctic, and they contribute to widening the range of possible relationships between people and the Arctic environment that guides future thinking on Arctic habitation.

What is the architecture of the Arctic? One answer is that even the remote communities of the North require the services of trained designers, both when it comes to constructing or modernising housing stock and introducing built social infrastructure in existing settlements, but also when it comes to fulfilling the requirements of new industries, settlements and inhabitants. Another answer is that architects are attracted to the North because it represents something they feel is important. One such attraction may be to be able to 'conduct' architecture in contexts in which the sophistication and formal restrains of mainstream architectural practice and contemporary architectural theory is felt to have little or no relevance and therefore offer few restraints for the reconceptualization of architectural practice. An example is the exemption of Svalbard from the provisions of the Norwegian Planning and Building Act (Ministry of Local Government and Regional Development Norway 2005).

Architects have worked actively in Arctic and sub-Arctic territories for more than a century. We are currently witnessing a new wave of architectural interest in the North, exemplified by the Danish contribution to the 2012 Venice Biennale of Architecture on Greenland (Lima *et al.* 2012), and the 2014 Canadian exhibition in the same place celebrating the 15-year anniversary of Nunavut. This interest in imagining the future of the Arctic is mirrored in many other fields: politics, mineral and oil extraction, fishing and maritime law, and social development (Arbo *et al.* 2013).

The Arctic architect

Ralph Erskine (1914-2005) is the most celebrated individual "Arctic architect" (Egelius 1977, p. 783) and is particularly known for his architectural designs and urban plans in Northern Sweden and Canada. His approach aligns with modernist architectural thinking in which "forms result directly from climate and function, and that the doing may be accomplished with some artistry" (Erskine 1961, p. 59). In this mode of thinking, local environmental and climatic conditions can be analysed and rationally understood through scientific methods. Social structures are also accessible to rational analysis, and—according to Erskine—the remoteness of Arctic settlements requires the development of a particular urbanity and should be "planned to offer easy human contacts, but also personal freedom and privacy" (1960).

The most important part of his practice coincided with the late high modernism and early post-modernism in architecture in the 60's and 70's, and in Erskine's 1968 article in Polar Record he warns against the "science-fiction aspects" (p. 169) of the super-buildings propagated by the architectural elite of the time. He argues that technologically advanced superstructures under domes and other enclosed urban structures were unlikely to be psychologically satisfactory to northern inhabitants, and that designs of a "less sophisticated organization" (p. 169) would be more appropriate. He also launches a critique of the imitations of southern architectural styles by the locals that he observes in the North, arguing that they "serve no more useful purpose in this special situation than do city hats or silk stockings at the polar circle." (p. 166).

In the article Erskine claims that "the culture of Lapps or Eskimos, which are excellently adapted for the life of a northern huntsman, degenerate and finally collapse as these native people also feel the drag and fascination of the new ways of the southern cities" (p. 166). While he was fascinated by indigenous structures such as igloos and Sami huts, he felt that they had little relevance to modern technical and functional requirements, and that little would be gained from basing a new urbanity and architecture on indigenous ways. Rather a "northern community culture of the industrial age must be newly invented, and social scientists, artists and architects must help." (p. 166). This should not happen by importing a main-stream modern architecture to the North, which according to him would be anti-climatic, so he set out to create a new "regionalism" (Egelius 1977, p. 748)—a particular architecture conditioned by the northern climate. He argues that this new architecture should consist of "houses and towns [that] open like flowers to the sun of spring and summer but, also like flowers, turn their backs on the shadows and the cold northern winds", and "only by such methods can arise a personal and indigenous Alaskan, Canadian, Scandinavian or North Russian tradition" (Erskine 1968, p. 167).

The international Team X (Team Ten) group of architects, to which he was associated, sought in the 50's and 60's to 'soften' the formal language of modernist architecture, and focused on analysing and designing social spaces and on the possibility for the individual to identify with their dwelling and neighbourhood. This influence is evident in the design of local 'places' as neighbourhood clusters of buildings in his plans for Svappavara in northern Sweden and in the design for the town of Resolute Bay in the North-West Territories (now Nunavut), Canada.

Erskine was, however, criticized by the leading Team X member Peter Smithson for over-exaggerating the formal aspects of the architectural principles he identified and developed relating to climate adaptation—such as the enclosed rounded compact shapes and heat-absorbing dark colours of buildings. These features were visually emphasized in Erskine's designs in order to communicate their

function, something Smithson labelled “Mickey Mouse styling” (Egelius 1977, p. 792). Erskine has also more recently been criticized for a colonialist attitude to the Arctic and its population (Birk 2012; McGowan 2008). He regarded the Arctic landscape as fundamentally empty of inhabitation, and saw the role of northern settlements as supporting resource extraction. Thus, in Erskine’s view, the new towns and buildings of the North “must attract engineers and technicians and their wives” (1968, pp. 166-67).

Ralph Erskine has become paradigmatic as the ‘Arctic Architect’, and has influenced architectural thinking for well over a generation. An example of his lasting influence on architectural thinking is the repetition of his critique of imported architectural styles 44 years later by the architectural critic Kjeld Vindum (editor of the leading Danish architectural journal Arkitektur), who laments recent “poor international mainstream architecture” in Greenland, which he sees as inferior to the works of Danish architects in Greenland in the 50’s and 60’s, which displayed “a sincere effort to address the unique climatic and topographical conditions and the Greenlandic lifestyle and culture” (2012, p. 3). He finds “less of an interest in discovering Greenlandic characteristics and values in architecture than before the implementation of Greenland Self-Government” (in 2009) which to him signals a shift away from an interest in “the unique climatic and topographical conditions and the Greenlandic lifestyle and culture” (2012, p. 3).

Erskine’s influence also extends beyond traditional architectural circles as he is even looked to by space engineers at ESA and NASA as inspiration for the design of lunar and Martian settlements (Arenales-Vergara 2005).

Figure 1. Hotel Borgafjäll (Sweden, 1948-50). The roof douples as a ski slope. Design: Ralph Erskine (photo in public domain).

An Arctic Architecture

In order to critically reposition Erskine’s legacy, this article maps out a number of different perspectives on Arctic architecture that are envisioned and reproduced by architects and other professionals involved in the construction or analysis of buildings and the built environment of the North. It looks at what issues are emphasized and what inherent values and ideologies are reproduced and adapted to the shifting social conditions of the North and to architectural discourse at large. The different perspectives accentuate disparate sources of knowledge and construct the social and natural environment in distinct ways. They differ, for instance, greatly when it comes to the inclusion and role of indigenous populations and tacit knowledge of extreme climate design and construction, and on the role of technology in the design of northern settlements.

The purpose of this mapping is to bring to attention that any notion of an ‘Arctic architecture’ is contestable. In the context of the current renewed interest in Arctic cities and landscapes, it would be questionable to uncritically reduce architecture to—for instance—a standardized and technologically driven design exercise, with little room for improvisation or deviation from strict environmental performance. The mapping of perspectives probes the professional ‘baggage’ of architects operating in the Arctic and it does it by uncovering the “ideologies and hierarchies” and “social subjectivities” (Traganou 2009) that inform an architect’s thinking and practice. The legitimizing values and ways of constructing knowledge in architectural practice often seem self-evident to the practitioner, even though architects evoke potentially diverging “espoused theory” and “theory-in-use” through design (Cuff 1991), often without any particular critical reflection on their difference and relationship. A heightened degree of reflection may be seen as critical prerequisite to developing architectural thinking and new practice with relevance for the climatically, economically and politically changing Arctic. Critical self-reflection of architects can be enhanced by adopting the position that “the production of places is a social process” (Cuff 1991, 248); architecture is a social construct—highly contingent on social processes and history—and thus contestable. The research presented in this article adopts the

position that there are many architectures of the Arctic, and that they are potentially just as varied as architectures in any other context. The Arctic —is not only an 'empty' or 'other' place— it is also home to communities of cultural and social complexities no smaller than those of other inhabited territories. A reading of its architecture from only one position or perspective fails to reflect this complexity.

The adopted approach to selection and interpretation of the identified literature leans on other examples of analysis of the social constructions of space and architecture (e.g. Guy 2009; Steinberg 2001). While the construction of architecture from a socio-cultural perspective is central to the argument of this article, there is no denying the agency of climatic, material and cultural conditions that underlie and inform the design of physical buildings and structures in the Arctic. These include permafrost, snow and windy conditions, but also powerful historical meta-formulations such as colonialism and post-colonialism as well as more recent geopolitical strategic thinking on dominant views concerning resource extraction and territorial sovereignty.

Architectural literature

Different readings of Arctic architecture were identified through a survey of English and Scandinavian language architectural literature. Searches were carried out on BIBSYS (the database for Norwegian college and university libraries) resulting in 16 books (search terms in English and Norwegian/Scandinavian, included: 'Arctic', north, 'Northern, 'Polar "sub-Arctic' and 'Antarctic' with 'architecture' as an added search term). The results included relevant annotated bibliographies on Arctic architecture (Anthony G. White 1987) and indigenous architecture (Wodehouse 1980).

Article searches on the Avery Index to Architectural Periodicals and Art & Architecture Complete (the most comprehensive databases of English language architectural publications) resulted in 165 relevant items out of 967 hits on 'Arctic'. Additional searches were carried out on JSTOR and Google/Google Scholar, and a list of relevant Russian literature was compiled from the Scott Polar Research Institute's Russian North library database.

The variety of books and articles identified represent a range of different topics and epistemological regimes, including architectural monographs and items on architectural theory, engineering, archaeology and anthropology. This survey revealed that little attention has been directed at comprehensively mapping the architecture in the Arctic in the traditional architectural literature and journals. Polar and Arctic journals with a social and human science focus, such as The Polar Journal, Polar Geography and Polar Record, do deal with land use in different ways, but the built environment, planning, and architecture feature only occasionally in these publications.

This survey does not capture all reports of architecture in the Arctic, but was helpful in identifying both dominant and less obvious but distinct categories—'perspectives' or 'logics'—that differ when it comes to how architecture, landscape and the natural environment are perceived. They also differ when it comes to what issues are addressed in analysis and design of spaces and structures, on the role of society, and on what forms of knowledge are considered relevant for an architecture of the North.

The varying geographies of the Arctic

The literature mapping undertaken is by no means comprehensive, and emerging and transforming perspectives can be added continuously. One of the problems of such a mapping is the fact that the geographical delimitation of the Arctic varies according to the individual perspectives, and that architectural approaches established outside the particular geography in mention are also encountered in the Arctic.

The nationality of authors, the places of publication, as well as the geographical regions covered by the identified literature include Alaska, Canada, Norway, Sweden, Greenland, and Iceland but also non-Arctic realms such as Antarctica, New Zealand and Switzerland. It is noticeable that the largest Northern or sub-Arctic nation, Russia, is largely absent from the readily available literature (Some Russian literature on northern architecture and architectural engineering is translated into English by the Canadian Research Council, but was not available at the time of writing). The definition of the Arctic (or any associated delimitation that makes the literature relevant in the context of this paper) varies widely: it may be politically, climatographically, botanically, or socially based. While there are significant differences between sub-Arctic, Polar and Northern territories, in the context of this study 'Arctic' is used as an overall collective description of the geographies involved. In some of the literature, certain identified 'Arctic' attributes are shared with other places: mountains in relation to climate; and deserts or even oceans as comparably empty or remote (Cosgrove and della Dora 2008). Notably, some literature on Antarctic architecture displays perspectives that overlap with discourses on Arctic architecture.

Perspectives on Arctic architecture

Nine different perspectives on Arctic architecture have been identified; several others could potentially have been included. The subject of Arctic architecture, for instance, was recently addressed from an unexpected angle in the monthly design and lifestyle magazine *Monocle* (2013), and readings of Arctic architecture from a cultural history or archeological perspective (Avango 2013; Barr 2000; Waldron 2008) could potentially also have been included as a distinct category. Perspectives presented there are named and described with regards to their view on technology, the environment, local inhabitants, the role of cities, architecture, society and history. Most perspectives also implicitly or explicitly refer to some definition of the Arctic and are illustrated by key works, contexts and a mix of visual and written text from a variety of sources and authors.

The perspectives are presented in a roughly chronological order, starting with the period immediately after the Second World War, in which the Arctic received new attention beyond traditional colonial and early capitalist exploitation of natural resources.

1. ***Arctic as Space***

During the Second World War the Arctic emerged as a strategic territory; it was a secondary Northern flank of hostilities primarily played out elsewhere. During the war years, military installations such as airfields, harbours, and meteorological stations were built in many parts of the Arctic. After 1945, the Arctic was reinforced as a geo-political space and as the detection zone for intercontinental missiles between the Soviet Union and North America during the Cold War.

This military appropriation of land was technological in nature, and the Arctic was perceived as an ultimate frontier in which total life support had to be supplied through technology. This was an approach it shared with the then nascent space/moon program, in which the logic was to develop technology in order to inhabit unliveable environments for strategic purposes.

The landscape of this appropriation of the north is essentially seen as culturally void. Scientific knowledge is the raison d'etre (many military programs were conducted under the guise of scientific research). Architectural structures are entirely imported; they are modular and pre-fabricated and have to be self-sustaining in every way. A prominent example of this perspective is the United States' nuclear powered Camp Century that was buried within the kilometre-deep ice sheet in Northern Greenland in 1958.

The similarities between the Arctic and the extreme environments of space exploitation still leads to science based appropriation of northern landscapes, such as the continued experiments with ground inhabitation technology for Mars carried out by NASA on the Canadian Devon Island (Fox 2006). New architectural structures are also being proposed within this perspective, such as in Umka, a strategic Russian settlement on the New Siberian Islands, designed by Valery Rzhevskiy "to work on any surface, even on the Moon if needed" (Stewart 2011).

Table 1. Arctic as Space - Examples of literature:

Hamilton, L., D. 1963. 'Moon colony' on earth: Camp century beneath Greenland's ice cap. Architectural Forum 117 (December): 98-103.

Department of Defense. United States Army research and development. Progress report no 6. Camp Century. (online movie: http://www.youtube.com/watch?v=8-ZDTqTPBK4, accessed: 7 January 2014).

White, M. 2012. Some recent strata of Sermersuaq: Life on the world's second largest ice sheet. In: Lima, J.D.R.S., Hjemdal, T.I., Melsom, A., Jensen, B.B. and Terroir (editors). Conditions magazine: Possible Greenland: 126-133.

2. ***Polar Extremes***

This perspective follows the overall logic of the Arctic as Space but has a distinct architectural approach that links it to mainstream architectural thinking. Extreme environmental conditions—such as those found in the Arctic and sub-Arctic—renders traditional architecture as untenable, and the fundamental question becomes "How do you make a building liveable in a brutal climate?" (Slavid 2009, p. 7). This condition creates a kind of laboratory for design solutions in which the architecture—due to material and environmental restrains—evolves a technologically radical integration of performance and architectural language. This radical expression of form and function transforms into a visually charged architecture, which is seen to have relevance outside the Arctic area.

The Arctic is defined by the climatic condition, and the challenge posed by extreme temperatures is parallel to those found on high mountains or in Antarctica, as well as other radical climatic regions: deserts or even under the sea. All of these zones are largely seen as void of cultural connotations and indigenous habitation, which would potentially conflict with the technological and hard science-based radicality that the perspective entails. Technological modern and hi-tech solutions are sought and smart technologies, computerized design tools, and advanced composite construction materials deliver radical architectural expressions. The main task of architecture and cities in the Arctic

is to make harsh and psychologically challenging conditions liveable to people. Climate change features heavily in this perspective, and it endeavours to demonstrate the habitability of extreme environments in order to accommodate a migrating population in an age of environmental crisis (Galindo 2009). A paradigmatic project in this logic is the British Halley Research Station in the Antarctic by Hugh Broughton Architects (completed in 2013).

Table 2. Polar Extremes - Examples of literature:
Galindo, M. 2009. Ice architecture. Salenstein: Braun Publishing AG.
Slavid, R. 2009. Extreme architecture. London: Laurence King Publ.
Noal, S. 2003. Cool architecture: Designing for cold climates. Sydney: Images Publ.

3. *Psychological Arctic*

Also here, the Arctic landscape is perceived to be hostile to human habitation, but rather than placing emphasis the exterior appearance or the physiological parameters of architecture, it focuses on its interior. It refers to the literature stemming from environmental psychology, in which physical isolation of individuals or small groups and their exposure to extended periods of either darkness or daylight poses particular psychological challenges that design and architecture can address.

The Arctic belongs to a category of environments in which climatic restrictions and remoteness result in isolation that challenges the psychological wellbeing of inhabitants. Architecture can provide visual stimuli and comfort that mediates this potentially traumatic experience, and can—through spatial means—provide for a differentiation of privacy and communal (indoor) spaces.

Literature in this perspective has studied the effects of the architecture of polar stations on humans, and is in certain cases related to studies of outer space habitation.

Table 3. Psychological Arctic - Examples of literature:
Smith, W.M. 1974. Behavioral design of habitats for man in polar deserts. In: Smiley, T.L. and Zumberge, J.H. (editors). Polar deserts and modern man. Tucson: University of Arizona Press: 161-164.
Zrudlo, L.R. 1972. Psychological problems and environmental design in the north. Québec City: Université Laval.
Yan, X.W. and M.E. England. 2001. Design evaluation of an arctic research station from a user perspective. Environment and Behavior 33 (3): 449-470.
Leon, G.R. 2002. A 1-year, three couple expedition as a crew analog for a mars mission. Environment & behavior 34 (5): 672-700.

4. *Arctic Engineering*

For over a century, architects and engineers have been developing pragmatic approaches to dealing with Northern environmental conditions such as wind, snow and permafrost. This draws on the experiences of military, colonial, and extractions-based activities of the 19th and 20th century, and relies on technical observation, practical experience and pragmatic problem solving. Architecture is seen as an infrastructure and a technical system that can be optimized. This approach is linked to the emergence of a specialized expertise within structural engineering: Cold Climate Design.

The remoteness of many northern settlements means that there is a lack of skilled builders and personnel for technical maintenance of buildings, which conditions the choice of building materials and construction techniques. Typically, this leads to the use of pre-fabricated constructions, but also in some cases to building techniques that can be adapted with simple tools (The University in Svalbard is constructed in wood to allow for on-site adjustments during construction, in a context where replacement or additional building elements are not accessible due to logistical restrictions). Aboriginal populations are seen as an inspirational source of practical experience with climate-adapted habitats, but the actual transfer of knowledge is limited.

In this aspect the Arctic is physiographically defined by climatic and soil-based conditions. The environment is physical in nature and comprehensible to science, and the cities of the North are primarily seen as ‘unplugged’ independent infrastructural systems due to their remoteness and uncertain supply situation. The role of architecture is to adapt local conditions to human habitation and to provide a functional harmony between the inhabitants’ needs and the affordances of the environment.

A contemporary example of this approach to northern construction is the work undertaken by the Cold Climate Housing Research Center in Fairbanks, Alaska, which works with the “development of healthy, durable, and sustainable shelter for Alaskans and other circumpolar people” (Cold Climate Housing Research Center 2013).

Table 4. Arctic Engineering - Examples of literature:
Strub, H. 1996. Bare poles: Building design for high latitudes. Montreal/Kingston: MQUP.
Rice, E.F. 2008. Building in the North. Fairbanks: University of Alaska Press.
Fisher, T. 1982. Cold calculation: Design for cold climates. Progressive Architecture 63: 134-39.

5. ***Arctic Ethnographic***

Here, indigenous architectural practices form the primary source of knowledge and area of study. Technology is not a primary approach to Arctic architecture, which is rather seen as having evolved over time through trial and error. Built structures are optimized for basic climatic functionality—often using minimal amount of resources—and reflect and respond to societal structure, cultural and religious beliefs. Place making, landscape inhabitation, and architectural undertakings are perceived to the results of equilibrium between material (access to food supply and construction material), climatic considerations, and cultural and religious beliefs.

The Arctic is defined by the territory occupied by northern indigenous and often minority populations. This space is culturally constructed and encompasses the inhabited landscapes of the Arctic as well as the individual settlements and dwellings. Landscape is seen as a source of sustenance but also as a mythical structure, and the architecture of the North "evolves in response to aesthetic, spiritual, and social requirements as much as to physical needs" (Lee *et al.* 2003, p. 2). The historic and traditional architectural structures analysed under this perspective reflects an economy of subsistence, and is based on local materials and relies on pre-industrial manufacturing techniques. The primary knowledge regimes of this perspective are those of anthropology and archaeology. Buildings are seen as 'types' with a specific set of technologies, societal and cultural implications, and as structures that cope with local conditions.

In recent years, efforts have been made in various indigenous communities to not only document traditional forms of habitation, but also to actively re-enact their construction as critical manifestations of the preservation of unique identities that are seen to be under threat from modernization and globalisation. These acts are components of cultural empowerment strategies that include the re-enactment of traditional crafts (In Nunavut igloo construction is part of school curriculum (Kielburger and Kielburger 2012)).

Table 5. Arctic Ethnographic - Examples of literature:

Lee, M., G.A. Reinhardt and A. Tooyak. 2003. Eskimo architecture: Dwelling and structure in the early historic period. Fairbanks: University of Alaska Press.

Dawson, P.C. 2001. Interpreting variability in Thule Inuit architecture: A case study from the Canadian high arctic. American Antiquity 66: 453-70.

6. ***Arctic Regionalism***

The arctic is a place that triggers adaptations of architectural modernism in which contextual negotiation and the concept of place is highlighted. This perspective is related to the concept of Critical Regionalism in architecture (Frampton 1983; Tzonis and Lefaivre 1990), which—inspired by Heidegger's phenomenology and notions of 'dwelling' (Heidegger 1927; 1954)—emphasizes the specificity of place and is critical to the reduction of difference in mainstream industrial, capitalist productions of architecture around the world. The architectural theorist, Christian Norberg-Schulz, specifically mentions Ralph Erskine's work as an example of critical regionalism (1993). While traditional architecture is often emphasized as sources of authenticity in critical regionalism, according to Erskine the North is "new country" to be settled, and modern urban settlers in the Arctic regions must strive to create an attractive architecture that offers a possibility to 'dwell' in a context by mediating the local environmental conditions in ways that are specific and unique—and not based on imported ideas of space and design. Specifically, an architecture has to be developed that reflects that "Nature is dominant and the 'human' the exception" (1961, p. 59).

The North is defined as a climatic region, triggering particular architectural responses. The perspective is still active in current discussions of Arctic architecture, and Erskine has continuously been—and still is—referred to as the primary example of an Arctic architectural practice with contemporary relevance, and his ambitions of an architecture that balanced technical requirements and human desires within a strong design language is still perceived by many architects to be paradigmatic (Birk 2012; Bøkestad 1998; Decker 2010b; McGowan 2008; Oshima 2005).

Table 6. ***Arctic Regionalism*** **- Examples of literature:**

Bøkestad, H. 1998. Arkitektur i Arktis. *Byggekunst* 6: 38-47.

Erskine, R. 1961. The sub-Arctic habitat. In: Newman, O. (editor). *CIAM '59 in Otterlo: Arbeitsgruppe für die gestaltung soziologischer und visueller Zusammenhänge.* Stuttgart: Karl Krämer Verlag: 160-68.

Erskine, R. 1968. Architecture and town planning in the North. *Polar Record* 14 (89): 165-171.

7. ***A New Indigenous Architecture***

The *Arctic Regionalism* perspective has a more contemporary descendent in this perspective. However, rather than calling for the development of a new architectural language, it observes and celebrates the

fact that a new indigenous architecture is currently emerging. The North is no longer seen as a cultural void as Erskine did. Rather, this perspective operates from the position that "The North is evolving and growing up" (Decker 2010a, p. 10). This does not imply a revived or revised traditional architecture of pre-colonial inhabitants, but departs from the position that Arctic is to be considered populated by individuals originating elsewhere, but now considering the Arctic their home.

The Arctic is defined as a cultural-geographic region demarcated by regional identities (such as a "North-Atlantic sea culture" (Saunders *et al.* 2012), and like the previous perspective a trans-Arctic character is evident, in which landscape and climate are both the primary source of identity and primary context of architecture. Landscape is seen both physically and psychologically as hostile to man, but architecture can remediate and "provide […] visual stimulation in places that is sometimes offer little more than an endless expanse of white" (Decker 2010a, p. 10).

Arctic cities are no longer a future vision but a fact, and by "bringing practical tradition to contemporary architecture" (Saunders *et al.* 2012, p. 12) "an opportunity has arisen for a new definition of a northern building, one that is extraordinarily responsive to place and, at the same time, visually provocative" (Decker 2010a, p. 10). Architecture is not only a technical exercise in meeting harsh conditions, but is a materialization of local and regional experience and expertise in cold climate construction through local design practices that are developing a variety of new and emerging expressions of form with a strong focus on landscape and place creation. An example of this perspective is the architectural practice Biotope, which has designed a series of visually and functionally innovative shelters, photo hides and other forms of bird watching infrastructure on the Varanger Peninsula in the Norwegian Arctic.

Table 7. A New Indigenous Architecture - Examples of literature:

Saunders, T., E. Stathaki, J. Bell, B.R. Synnevåg and J. Grima. 2012. Todd Saunders architecture in northern landscape. Berlin: Birkhäuser Architecture.
Decker, J. 2010a. Modern North: Architecture on the frozen edge. New York: Princeton Architectural Press.

Figure 2. The Steilnes bird hide (Vardø, Norway, 2012) is carefully located in relation to view, microclimate and bird behaviour. Design: Biotope (photo: T. Amundsen).

8. *Geopolitical Arctic*

The most recent wave of architectural interest in the North sees the Arctic as an economic and political region in a globalized world. This perspective is strongly connected to the climate change discourse in which the Arctic is becoming central in a new colonialist resource grab (exemplified by the current quarrel about the ownership of the North Pole and the surrounding ocean).

The Geopolitical Arctic perspective sees the arctic as 'empty' in the sense that it forms a stage largely devoid of population and with an unsettled regulatory framework where the 'architecture' of

geopolitical space is currently being negotiated and produced. The architecture in this perspective is a matter of reading space and imagining new patterns of settlement, infrastructure, industry, and resource extraction. It adopts a World systems reading of the Arctic as a peripheral location that in the current mode of capitalist dynamics is becoming central in certain ways (Smith 2011).

This architectural appropriation of Arctic territories is inspired by the architect Rem Koolhaas' investigations of alternate states of modernization in non-US/European contexts (e.g. Chung *et al.* 2001; Koolhaas 2000) with the aim of uncovering—in a raw form—the structuring forces of globalization, which is seen as the predominant driver of change. Studies of the Arctic reveal the dynamics of capitalism in the form of resource extraction, communication technology, and transport infrastructure. This perspective plays out the old *tabula rasa* notion of the north, as a space marked by "human resource deficiency" (Strøksnes 2009, p. 58), where a new mobile, temporary, and flexible workforce can be introduced.

In this perspective cities are characterized by radical intensification and urbanization due to the new geopolitical and economic role of northern settlements as trans-shipment facilities, strategic military, and petrochemical installations. At the same time a paradoxical logic is at play in which the area affected by human activity is increasing rapidly, while the intensity of human use and habitation is decreasing, a condition Rem Koolhaas has called "thinning" (2010).

Knowledge in this perspective is constructed through statistics, policy documents and remote sensing, and the architectural language employed is of a generic international style, but also through an urbanism that bears resemblance to nothing else, marked by huge distances, mobile populations, the globalization of culture, and in need of entirely new ideas of planning.

Table 8. Geopolitical Arctic - Examples of literature:
Røyseland, E.R. and Ø. Rø (editors). 2009. Northern experiments: The Barents urban survey 2009. Oslo: 0047 Press.
Gugger, H. 2012. Barents lessons teaching and research in architecture 2012. Zürich: Park Books.
White, M. and L. Sheppard. 2009. Meltdown: Thawing geographies in the Arctic. New Geographies 1: 130-37.

9. *Cultural North*

This perspective shares the underlying premise of climate change and globalization with *the previous logic*, but attempts to counter or supplement the predominant geopolitical discourse on the Arctic by approaching it as a cultural and inhabited territory. This perspective celebrates indigenous minority cultures and the Arctic communities that are seen to be outside the mainstream societal development and thus particularly vulnerable to the negative aspects of modernization and globalization. The Arctic is seen as a fragile ecology that may be disrupted by future exploitation. Through artistic and architectural interventions, communities are empowered to meet the environmental impact of exploitation and other negative social consequences, and indigenous inhabitation and territorial claims are legitimized through claims of ecosystem stewardship.

The architecture of this perspective can be pragmatic, low key, and base itself on local and indigenous knowledge. Sustainable empowerment is sought through open source and community-based knowledge generation, as well as through the communicating, sensing, aggregating, transmitting and sharing of information. Communication technologies, digital tools, distributed sensor systems, new media, and Citizen Science projects are employed as tools to generate and redistribute information through social processes and hereby reinforce empowerment and community building.

Table 9. Cultural North - Examples of literature:
Müller, A. 2010. Architecture: A project of the Arctic perspective initiative. Ostfildern: Hatje Cantz.
Infranet Lab. 2011. Migration intersects: Caribou pivot stations in the high Arctic. On Site 24: 30-31.
Rosenfield, K. Arctic food network / Lateral Lffice. Arch Daily 10 (online article: http://www.archdaily.com/182435/, accessed: 13 December 2013).

A genealogy of perspectives

The perspectives on Arctic architecture described above continuously transform, merge, and disappear. At any given time a range of perspectives are discernable in the analytical and practical literature on architecture in the region, and in practice the perspectives often run in parallel, and overlap in the practices of architects and other professions dealing with construction in the North. They evolve and along a rough genealogy, and while some are intrinsically linked to specific periods, others appear to have a long-lasting influence. *Arctic Engineering* builds on the practical experiences of the *Arctic as Space*. *A New Indigenous Architecture* descends from *Arctic Regionalism*, while *Cultural North* must be seen as an opposing position to the one found in *Geopolitical Arctic*.

Another continuity runs from *Arctic as Space* where military installations were buried in Greenland's inland ice to the more contemporary *Polar Extremes* in which modern science stations are located in situations in the Arctic (and Antarctic) that most closely approximates outer space conditions

on the planet. The differences are that the strategic and military aspects are de-emphasized, and climate change forms a much more important agenda.

The *Arctic Ethnographic* and the *New Indigenous Architecture* perspectives are also linked through the reinterpretation of traditional construction methods in projects such as The Snow Show (Fung 2005) where avant-garde architects and artists explore the expressional limits of ice constructions.

The majority of the perspectives see the Arctic as a culturally empty space and as a technological and architectural challenge, potentially leading to innovation in technology and architectural language with relevance outside the Arctic. Contrasting these readings are the perspectives that focus on 'indigenous' communities and their architecture in various forms.

A key question is how the mapped perspectives on Arctic architecture distinguish themselves from architecture outside the northern region. Mainstream architecture is also found in the Arctic, but one of the most reoccurring notions identified in the mapping carried out in this paper is that there is (or should be) a particular 'arctic architecture', distinct from the main-stream elsewhere. In particular, one architect—Ralph Erskine—embodies this idea of a unique architectural language of the North.

Architecture in the Arctic today

Erskine's role in architecture is unique as he "has been unanimously credited in architectural history for inventing an 'Indigenous Architecture' of the North" (McGowan 2008, p. 248) and he is seen as having had a unique capability to "analyse local environments and cultures and extract their essential qualities." (McGowan 2008, p. 247). One of the reasons that Erskine's architectural approach has retained its status over decades may be that "Critical Regionalism tends to flourish in those cultural interstices which in one way or another are able to escape the optimizing thrust of universal civilization" (Frampton 1985, p. 327). Today, however, cities are once again being constructed in the North at a fast pace, and a new perception of the strategic importance of the Arctic has emerged that no longer relegates it to a peripheral and interstitial role (Arbo *et al.* 2013; Smith 2011). New development in the Arctic will include rapid urbanisation (Smith 2011), and this condition of accelerated modernisation—different from the more stagnant situations in dominating Europe and North America— attracts new attention from architects.

The key principles of Erskine's approach: the climatic conditioning of the architectural language and the mediation between extreme landscapes and their inhabitants through architecture is evident in several of the mapped perspectives, but as the mapping shows it is possible to identify many alternatives to his position. The perspectives each suggest different architectures in terms of materiality and form, and they collectively render a wide range of different perceptions of the environment, the landscape, and society as well as a more extended range of knowledge regimes than a mainstream architectural approach would allow. They are also not discreet Arctic phenomena; they reflect mainstream architectural history and theory in different ways, and in turn inform a wider architectural discourse.

The Arctic is home to a variety of populations in constant flux: indigenous peoples, more recent inhabitants of primarily European decent, and transient populations such as migrant workers in the exploitative industries, researchers at polar and sub-polar research installations, tourists, and military and regulatory personnel from a variety of nations. It is an arena in which conflicting interpretations of climate (change), landscape, and society are played out and is—like the ocean—not just a place, but a space "where social contradictions are worked through, social change transpires, and future social relations are imagined"(2001, p. 209).

In the current situation of uncertainty, in which climate change may have disruptive consequences for Arctic communities, it is imperative to be able to simultaneously imagine a range of possible future relationships between technology, landscape, and society. The recognition of a multitude of perspectives on architecture in the Arctic—including ones that move away from particular fixtures such as the harshness of landscape and climate—points to ways in which these futures may be conceptualized. The architectural discourse that emerges in this space of contestation may also shape perceptions and productions of landscape and territories outside the Arctic, which ceases to be an imaginary space of projection by society (McGhee 2007), to become a critical "component of the space of society" (Steinberg 2001, p. 20), where cultural and social complexities are recognized. Emerging from the architectural literature, the Arctic has been seen as a space visited and largely observed from the outside, but it may now be a place where a multitude of entirely new architectures are born.

Acknowledgements
This article is written as part of the Future North project at the Oslo School of Architecture and Design, which looks into on-going and future landscape changes in the Barents Region (www.futurenorth.no).

Financial support
This work was supported by Research Council Norway (grant number 220656/F10)

REFERENCES

Arbo, P., A. Iversen, M. Knol, T. Ringholm and G. Sander. 2013. Arctic futures: Conceptualizations and images of a changing arctic. *Polar Geography* 36 (3): 163-182.

Arenales-Vergara, O. 2005. Ralph erskine on extreme environments design - an "alternate universe" and a "rich heritage" for the architects of the future. *Architecture and Urbanism* 03 (414): 98-101.

Avango, D. 2013. Arktiska framtider och resurser: det industriella kulturarvet som källa (Arctic futures and resources: the industrial heritage as a source). *Bebyggelsehistorisk Tidskrift* 65: 52-71

Barr, S. 2000. Our common heritage: monuments and sites of the polar regions. *Journal Of Architectural Conservation* 6 (3): 44-59.

Birk, K. 2012. Arctic architecture? *Arkitektur DK* 4: 48-51.

Bøkestad, H. 1998. Arkitektur i arktis (Architecture in the Arctic). *Byggekunst* 6: 38-47.

Chung, C.J., J. Inaba, R. Koolhaas and S.T. Leong. 2001. *Great leap forward/Harvard Design School Project on the city*: Köln: Taschen GmbH.

Cold Climate Housing Research Center. *About us* (online: http://www.cchrc.org, accessed: 09 December 2013).

Cosgrove, D.E. and V. Della Dora. 2008. *High places : Cultural geographies of mountains, ice and science*. London: I.B.Tauris & Co. Ltd.

Cuff, D. 1991. *Architecture the story of practice*. Cambridge, Massachusetts etc.: MIT Press.

Dawson, P.C. 2001. Interpreting variability in Thule inuit architecture: A case study from the Canadian high arctic. *American Antiquity* 66: 453-470.

Decker, J. 2010a. *Modern north: Architecture on the frozen edge*. New York: Princeton Architectural Press.

Decker, J. 2010b. *True north: True Alaskan architecture*. Salenstein: Braun Publishing AG.

Department of Defense. *United States Army research and development. Progress report no 6. Camp Century.* (online movie: http://www.youtube.com/watch?v=8-ZDTqTPBK4, accessed: 7 January 2014).

Egelius, M. 1977. *Ralph Erskine: The humanist architect. A.D. Profiles* 11-12. London: Architectural Design.

Erskine, R. 1960. Building in the arctic. *Architectural Design* 5: 194-197.

Erskine, R. 1961. The sub-arctic habitat. In: Newman, O. (ed.). *CIAM '59 in Otterlo: Arbeitsgruppe für die gestaltung soziologischer und visueller Zusammenhänge*. Stuttgart: Karl Krämer Verlag: 160-68.

Erskine, R. 1968. Architecture and town planning in the North. *Polar Record* 14 (89): 165-171.

Fisher, T. 1982. Cold calculation: Design for cold climates. *Progressive Architecture* 63: 134-139.

Fox, W.L. 2006. *Driving to Mars*. Emeryville, CA: Shoemaker & Hoard

Frampton, K. 1983. Prospects for a critical regionalism. *Perspecta: The Yale Architectural Journal* 20: 147-162.

Frampton, K. 1985. *Modern architecture: A critical history*. *The world of art library*. 2nd ed. London: Thames & Hudson. (Orig. pub. 1980).

Fung, L. 2005. *The snow show*. London: Thames & Hudson.

Galindo, M. 2009. *Ice architecture*. Salenstein: Braun Publishing AG.

Gugger, H. 2012. *Barents lessons teaching and research in architecture 2012*. Zürich: Park Books.

Guy, S. 2009. Fluid architectures: Ecologies of hybrid urbanism. In: White, D. and Wilbert, C. (editors). *Technonatures: Environments, technologies, spaces, and places in the twenty-first century*. Waterloo, Ont.: Wilfrid Laurier University Press: 215-238.

Hamilton, L., D. 1963. 'Moon colony' on Earth: Camp Century beneath greenland's ice cap. *Architectural Forum* 117 (December): 98-103.

Heidegger, M. 1927. Sein und zeit. In: Husserl, E. (ed.). *Jahrbuch für Philosophie und phänomenologische forschung*. Tübingen: Max Niemeyer Verlag.

Heidegger, M. 1954. Bauen wohnen denken (1951). In: Heidegger, M. (ed.). *Vorträge und Aufsätze*. Pfullingen: Günther Neske Verlag.
Infranet Lab. 2011. Migration intersects: Caribou pivot stations in the high Arctic. *On Site* 24: 30-31.
Kielburger, C. and M. Kielburger. *Building an igloo? What Nunavut children learn in school.* (online article: http://www.huffingtonpost.ca/craig-and-marc-kielburger/nunavut-education_b_2279074.html, accessed: 12 December 2013).
Koolhaas, R. 2000. Harvard project on the city, 'Lagos'. In: Boeri, S., Fort, F. and Koolhaas, R. (editors). *Mutations*. Barcelona: Actar: 652, 719.
Koolhaas, R. *Strelka research themes.* (online movie: http://vimeo.com/22666704, accessed: 13 December 2013).
Lee, M., G.A. Reinhardt and A. Tooyak. 2003. *Eskimo architecture: Dwelling and structure in the early historic period*. Fairbanks: University of Alaska Press.
Leon, G.R. 2002. A 1-year, three couple expedition as a crew analog for a Mars mission. *Environment & Behavior* 34 (5): 672-700.
Lima, J.D.R.S., T.I. Hjemdal, A. Melsom, B.B. Jensen and Terroir (editors). 2012. *Possible Greenland.* Oslo: Conditions Magazine.
Mcghee, R. 2007. *The last imaginary place: A human history of the Arctic world*. Chicago: University of Chicago Press.
Mcgowan, J.M. 2008. Ralph Erskine, (skiing) architect. *Nordlit* 23: 241-250.
Ministry of Local Government and Regional Development Norway. 2005. *NOU 2005: 12, mer effektiv bygningslovgivning* (More efficient building legislation). Oslo: Ministry of Local Government and Regional Development, Norway.
Monocle. 2013. *The race to the top of the world — who's turning up the heat and why?* Vol. 07. London: Monocle.
Müller, A. 2010. *Architecture: A project of the Arctic perspective initiative*. Ostfildern: Hatje Cantz.
Noal, S. 2003. *Cool architecture: Designing for cold climates*. Sydney: Images Publ.
Norberg-Schulz, C. 1993. *Nattlandene: Om byggekunst i norden (On Nordic architecture)*. Oslo: Gyldendal Norsk Forlag.
Oshima, K.T. 2005. Ralph Erskine - living legacy. *A+U* 3 (414).
Rice, E.F. 2008. *Building in the North*. Fairbanks: University of Alaska Press.
Rosenfield, K. *Arctic food network / Lateral Office.* Arch Daily 10 (online article: http://www.archdaily.com/182435/, accessed: 13 December 2013).
Røyseland, E.R. and Ø. Rø (editors). 2009. *Northern experiments: The Barents urban survey 2009.* Oslo: 0047 Press.
Saunders, T., E. Stathaki, J. Bell, B.R. Synnevåg and J. Grima. 2012. *Todd Saunders architecture in northern landscape*. Berlin: Birkhauser Architecture.
Slavid, R. 2009. *Extreme architecture*. London: Laurence King Publ.
Smith, L. 2011. *The new North: The world in 2050*. London: Profile Books.
Smith, W.M. 1974. Behavioral design of habitats for man in polar deserts. In: Smiley, T.L. and Zumberge, J.H. (editors). *Polar deserts and modern man*. Tucson: University of Arizona Press: 161-164.
Steinberg, P.E. 2001. *The social construction of the ocean*. Cambridge: Cambridge University Press.
Stewart, W. *Welcome to ice city: Russia plans to build frozen community 1,000 miles from north pole... As race for arctic minerals heats up.* Daily Mail (online article: http://www.dailymail.co.uk/news/article-2052862/Russia-plans-build-frozen-community-1-000-miles-North-Pole.html - ixzz2pJupAM8r, accessed: 03.01.2014).
Strub, H. 1996. *Bare poles: Building design for high latitudes*. Montreal/Kingston: MQUP.
Strøksnes, M. 2009. The Inner Space of Barents. In Røyseland, E.R. and Ø. Rø (editors). *Northern experiments: The Barents urban survey 2009.* Oslo: 0047 Press.
Traganou, J. 2009. *Travel, space, architecture*. Farnham, Surrey: Ashgate.
Tzonis, A. and L. Lefaivre. 1990. Why critical regionalism today. *Architecture and Urbanism* 236: 23-33.
Vindum, K. 2012. Greenland revisited. *Arkitektur DK* 4: 48-51.
Waldron, A. 2008. Canada's distant early warning line. *Docomomo Journal* 38: 56-60.
White, A.G. 1987. *Architecture of Arctic regions: A selected bibliography*. Monticello, Ill.: Vance Bibliographies.
White, M. 2012. Some recent strata of Sermersuaq: Life on the world's second largest ice sheet. In: Lima, J.D.R.S., Hjemdal, T.I., Melsom, A., Jensen, B.B. and Terroir (editors). *Conditions magazine: Possible Greenland*: 126-133.

White, M. and L. Sheppard. 2009. Meltdown: Thawing geographies in the Arctic. *New Geographies* 1: 130-37.
Wodehouse, L. 1980. *Indigenous architecture worldwide Art and architecture information guide series*. Detroit: Gale Research Company.
Yan, X.W. and M.E. England. 2001. Design evaluation of an Arctic research station from a user perspective. *Environment and Behavior* 33 (3): 449-470.
Zrudlo, L.R. 1972. *Psychological problems and environmental design in the North*. Québec City: Université Laval.