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BEYOND THE PHYSICAL: CONCEPTUAL MODEL OF INTANGIBLE COMFORT IN RUSSIAN ARCTIC CITIES

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Abstract. Larger than similar settlements in other polar countries both in terms of climatic extremes and population size, the Russian Arctic city is a unique phenomenon - a product of the Soviet period of colonial urbanization. Its architectural environment does not provide a comfortable everyday interaction (physical and emotional) for citizens with the natural and artificial environment. At the same time, modernist utopian ideas, transformed under the influence of the urban mainstream, still largely determine the present and future of Arctic architecture in Russia. The current paper presents a theoretical model that conceptualizes the urban lived space as an object of architecture. The notion of lived space is based on Lefebvre's idea of space production and is seen as a phenomenological field in which architecture, context and individual perception are in empirical interaction. The proposed model attempts to integrate the key factors of Arctic urbanism into a coherent system, including aspects of the human-city nexus, such as year-round soft mobility and emotional perception; the challenge to the colonial view of the region and the potential of architecture to establish a strong human-city relationship.

Keywords: *Arctic architecture, Arctic cities, urban environment, city space, urban experience, environmental perception.*

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1. Introduction

In the era of global environmental changes caused by human activity, the goals of architecture as a tool for shaping the living space are shifting from exclusively creating a physically comfortable and aesthetic realm towards the systemic formation of the artificial environment, including work with conceptual and sensual perception of the surroundings. The rationale for turning to architecture in order to achieve the goal of transition towards a more "caring" approach lies in the fact that it embodies society's attitude to space in the physicality of the urban environment. The environment then conveys emotional and semantic content, dominant values and narratives that influence the daily life of individuals and society within the city. This idea, which is based on the critical urban theory research (Harvey, 1989; Lefebvre, 1991; Castree *et al*., 2008), has laid the foundation for the conceptual research work presented in this article.

The current paper develops an argument that the "coldness" of the Arctic city is manifested at different levels of urban space: physical (objectively extreme climate and

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functionally “unresponsive” space), conceptual (lack of a sense of attachment) and perceptual (emotionally “cold” image of the city). Therefore, context-sensitive architecture, in our view, extends beyond the physical and structural adaptation of buildings to winds and precipitation and beyond visual beautification. We attempt to structure in one conceptual model the design issues found in research on cities in the polar region, e.g., the connection of year-round well-being and the urban environment (Chapman *et al*., 2019; Hemmersam, 2023; Hidman, 2018; Oikarinen, 2020), the challenge to the colonial view of the region (Bolotova, 2012; Gunko *et al*., 2022; Hodgson, 2023; Kinossian, 2017), the Arctic-specific urban design practices (Beaulé & De Coninck, 2018; Hemmersam & Morrison, 2016) and the use of climate knowledge in urban planning (DiNapoli & Jull, 2020; Eliasson, 2000; Eliasson *et al*., 2007; Pressman, 1994; Westerberg, 2009).

It is clear that a new theoretical ground is needed for working in the climatically harsh and environmentally vulnerable conditions in the Russian Arctic (Western Siberia in particular, Figure 1), considering the lack of systematic knowledge on architectural environment adaptation in domestic studies. The reasons for such deficiency can be seen in the previous and current exploration of the Siberian High North: the previous stages in the development of the region can be characterized as colonial appropriation (Bolotova, 2004; Laruelle, 2019; Hemmersam, 2021).

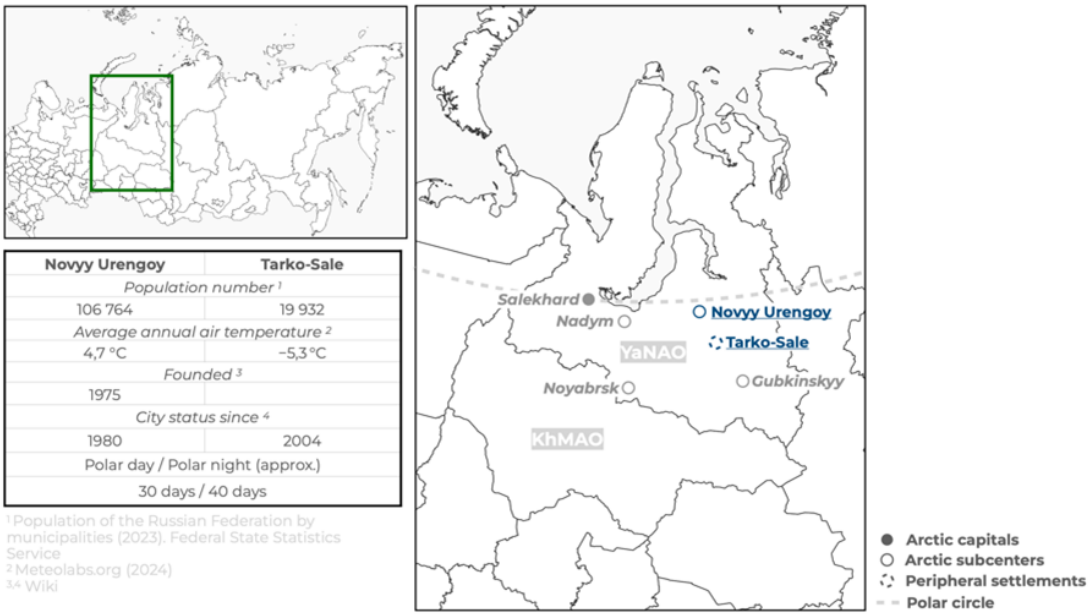

Figure 1. Map of northern Western Siberia. Compiled by the authors based on Map of Russia with Regions - Outline © Free Vector Maps https://freevectormaps.com/russia/RU-EPS-01-0006?ref=atr
Source: The typology of cities is retrieved from Goncharov et al. (2022)

Researchers note the extensive Soviet urbanization of the last century to be a form of internal colonial expansionism, resulting in large industrialized cities being built in the Arctic “emptiness” (as seen from the modernist perspective) (Kalemeneva, 2018; Hodgson, 2023). Other Arctic countries also experienced large-scale urbanization in the high latitudes; however, they were “less concerned with settling large numbers of southern colonizers” (Hemmersam, 2021). It was for the hyper-centralized Soviet state, which allowed for the construction of new “planned” cities, that to this day remain the

largest in the circumpolar region (Hemmersam, 2021; Laurelle, 2019; Vaguet, 2013). Before this, settlements of the "modern society" were to be found in the south of Siberia (along the Trans-Siberian Railway), while the current Autonomous Okrugs of Khanty-Mansi and Yamalo-Nenets were the territory of indigenous peoples (Vaguet, 2013), who were already under pressure from the central state's collectivization (Hodgson, 2023).

The first wave of Arctic urbanization was connected to the massive transfer of labor from the heavily populated European parts of the Union to the Northern areas: both voluntarily (government-sponsored campaigns) and involuntarily (the gulag system) (Vaguet, 2013; Reisser, 2017). The gulag system created several cities in different parts of the Soviet Arctic, e.g., Vorkuta (1932) in the European part of Russia or Norilsk (1935) in Eastern Siberia. The situation was different for Western Siberia, which was happening later - during the post-Stalin "Thaw" period. The discovery and initial development of oil and then gas fields in the early 1960s triggered the urbanization of this region (Stas', 2014). The internal colonization here could not rely on the creation of prisoners' monotowns due to the elimination of this system. The "Northern benefits" and ideological calls to move to the "construction sites of socialism" became the new way of attracting citizens to the North (Kalemeneva, 2018). The formation of full-fledged cities provisioned the newcomers (usually coming from developed urban areas) with "all the basic elements of a Soviet town" (Kalemeneva, 2019). Thus, in the oil and gas-bearing areas of the Far North, cities served as a base for the intra-regional fly-in-fly-out (FIFO) working method (Stas', 2014). These processes led to the island-like character of these cities, disconnected from the "materik" (mainland or continent), which is evident to this day, e.g., through locals' verbal expressions (Bolotova *et al*., 2020).

The livability of northern cities was vital for preserving the workforce flow (Laurelle 2019). Linked to the colonial perceptions of the Arctic, architecture symbolically represented the appropriation of the region through transferring mainstream expressions of material culture to the colonized region (Kalemeneva, 2018). The modernist model of urbanization of cities was generally based on the thesis that the problems of cities in the North and the South were similar and therefore, that universal solutions could be applied (Hemmersam, 2021). The main principle for architectural adaptations was "central institutions for local needs" (Kalemeneva, 2019). The urban environment was expected to be comfortable based on the fact of its "Sovietness"; thus, the essence of comfort stemmed from ideological reasoning and modernistic planning, not from human experience (Kalemeneva, 2019). The issues of architectural adaptation were reduced to the technical component of permafrost construction - the creation of northern modifications of standardized architecture, as well as changes in the layout of settlements aimed at climate mitigation (Jull, 2017). As a result, the material environment of these "planned" settlements (Jull, 2017; Zamyatina, 2023) was essentially structured as a modernist Soviet city with a regular street layout, a predominance of concrete-paneled prefabricated apartment buildings and standard types of public open spaces (parks, squares and pedestrian streets).

The modern form of colonialism is represented by a centralized view of the "empty" and "peripheral" Arctic (Hemmersam, 2016) as a "northern Eldorado" that can enrich the country's resource base (Martyanov, 2015). The connection of the city with fly-in-fly-out (FIFO) work increases the mobility of the population through the migration flows, making the city "pulsating" (Zamyatina & Goncharov, 2022). Such "uncertainty" is mediated both by natural (e.g., seasonal dependence on transportation accessibility) and economic fluctuations and forms a unique subculture. This subculture implies a great

diversity of cultural attitudes temporarily united by the Arctic space without the need to merge with the original local identity-the culture of the indigenous peoples (Usenyuk-Kravchuk *et al*., 2020). Such high mobility is usually associated with the extinction of the embeddedness and rootedness of social relations within localities, which leads to a decrease in the degree of mental attachment to a place (Bolotova *et al*., 2017). However, studies show that in the Russian Arctic this rule does not work directly: "newcomers" develop an attachment to the place and get used to Arctic urban living (Bolotova *et al*., 2017). This may be due to the remoteness (more often mental than real) of a place with its "mainland" as opposed to physical or objective distance (Bolotova *et al*., 2020). This attachment pertains specifically to the Arctic's natural space, while the standardized Soviet cities often face criticism from locals (Bolotova *et al*., 2020).

Here, a gap between the local practices and design representations is found. The Russian Arctic architecture emphasizes visual "beautification", predominantly using urban design as a sign of "modernization" for the "empty" and underdeveloped Arctic, which is a subject of the global discourse on city branding, technology and space design (Gunko *et al*., 2022). Researchers point to the internal colonialism conducted through beautification practices, which are related to the rigid vertical decision-making on beautification and in the case of our country, to the "residual" spread of "aestheticization" and "comfortization" from Moscow to other regions (Lähteenmäki & Murawski, 2023). In contrast, researchers have noted that the region's harsh climate does not favor the idea of citizens acting as flâneurs; however, it is precisely such standard city behavior (e.g., slow walks or sitting on a bench) that the "beautified" public spaces are designed to encourage (Zamyatina, 2023). Addressing this contradiction between mainstream public spaces and the Arctic conditions, enclosed megastructures have also been suggested as a method of architectural adaptation. These range from dome-covered cities in the Soviet era to commodified multifunctional centers and walking galleries today. We argue that such a perception of the Arctic is simply another way of recreating familiar conditions in the face of the harsh climate by "roofing" a city (Oikarinen, 2020). In other words, rather than researching the urban experience, architecture and design here provide settings "that could only function as planned had the architect also designed the inhabitants" (Coleman, 2015) and in the case of the Arctic, the natural flows.

The Arctic is often perceived as "underdeveloped, under-performing or deficient" in terms of urban planning (Hemmersam, 2016). This perception has been shaped by modernist-era architecture, colonial narratives and Russia-specific current asymmetrical relationships between the central and peripheral regions, which conceptually separate the Arctic from the "developed" urban networks (Hemmersam, 2016; Gunko *et al*., 2022). The mainstream common belief that adopting practices successful in central regions is key to developing or modernizing the Arctic accounts for the lack of architectural visions that deviate from the current status quo, disregarding the natural Arctic conditions. According to Hamelin (1979), such perception is justified by the lack of comprehensive knowledge about "northernness" (Beaulé & Coninck, 2018). In Russia, the Arctic cities are thoroughly studied from historical, economic and ecological perspectives, but their architectural environment as a design object remains largely unexplored. Therefore, it can be concluded that the Arctic remains externally determined (Huggan, 2016).

Conversely, in other polar countries, an extensive research base allows architects to seek more adaptive approaches, embracing "northernness" rather than opposing it. This is evident in movements like the Winter Cities initiative (Pressman, 1996; Stout *et al*., 2018) and the work of organizations such as Lateral Office (L. Sheppard and M.

White, Canada), Arctic Design Group (L. Cho and M. Jull, USA), Arctic Urban Planning and Design (R.K. Calay, Norway), Oslo Center for Urban and Landscape Studies (Norway) and other research groups and individual researchers. However, Arctic architecture is still evolving and the process is complicated by the historical orientation of the design disciplines towards temperate climates and the prevailing images of mass culture (Beaulé & De Coninck, 2018; Hemmersam, 2023). Similarly, Pressman (1996) described the search for Arctic architecture as characterized by "turmoil rather than constancy," reflecting the tension between "organic regionalism" and internationalism, which involves functional pragmatism and reliance on technology.

It is evident that we urgently need a more cautious approach to the Arctic, as the region is warming twice as quickly as the global average (Pechsiri *et al*., 2010). This necessitates architectural adaptation, embracing the "northern paradigm" instead of battling against it from the perspective of the dominant mainstream "southern paradigm" (Beaulé & Evans, 2018). Our research aims to establish a theoretical framework for transitioning from fragmented "beautification" projects in the Arctic to a systematic application of design principles scientifically justified for creating tangibly and intangibly comfortable urban environments.

The data presented in this study yield a deeper understanding of key aspects of Arctic-specific urban development, as well as the role of architecture and urban design in shaping sociocultural perceptions. Specifically:

- Arctic cities have a strong industrial and economic orientation, which has historically been the basis for their "planned" development. This remains a significant factor, driven by new state megaprojects (such as the Northern Sea Route) and a high dependence on raw material industries. As a result, these settlements function as spatial-temporal concentrations of support and management services, as well as bases for fly-in-fly-out migration flows. Their present and future development is highly dependent on economic and political conditions.

- Climatic extremes fundamentally shape the urban experience in the Arctic, but are not perceived by locals as a deviation from the "norm." Rather, they are seen as a special condition requiring particular adaptations.

The interconnections between natural and urban spaces, as well as individual and social attitudes toward them, were conceptualized using the theoretical framework of city space production (Lefebvre, 1991). This provides a conceptual basis for the study, which is discussed further in Section 3. Before that, in the next section, we elaborate on the research data and methods employed.

2. Materials and methods

The research encompasses two types of data collected through the following methodological combination:

- The main body of secondary data comes from a literature review that delves into the rich pool of critical urban theory research and more specific historical studies on extensive Soviet urbanization (Bolotova, 2004; Hemmersam, 2021; Hill & Gaddy, 2003; Hodgson, 2023; Kalemeneva, 2018, 2019; Laruelle, 2019; Reisser, 2018; Stas', 2014; Vaguet, 2013) and contemporary urban research on shrinking and developing cities of the Russian Arctic (Far North) and Siberia (Bolotova, 2012; Bolotova *et al*., 2020; Crowley, 2015; Goncharov *et al*., 2020; Gunko *et al*., 2022; Heleniak, 2009, 2010; Orttung, 2016; Petrov *et al*., 2021; Zamyatina & Goncharov, 2019, 2022). This review

was conducted to cover the historical, socio-cultural and socio-economic context of these cities, with a focus on the Western Siberian region. It further informed the focus and methods of collecting empirical (firsthand) data.

- Firsthand data were collected during three field trips to the Yamalo-Nenetsky Autonomous Okrug (YaNAO), the northern part of Western Siberia (in 2019, 2022 and 2024). We employed a comparative approach by choosing two typically different settlements in YaNAO to provide a nuanced understanding of the diverse urban landscapes in the Russian Arctic: (1) the city of Novyy Urengoy, a major industrial and economic center of YaNAO with increased transportation accessibility and (2) the town of Tarko-Sale (150 km from Novyy Urengoy), a sub-peripheral settlement with a rapidly developing economy. Novyy Urengoy serves as an example of an Arctic subcenter with a medium-sized area of influence, while Tarko-Sale, despite its growth, lacks a significant zone of influence due to its relative proximity to the larger city of Novyy Urengoy. This comparative analysis provided a nuanced understanding of the diverse urban landscapes in the Russian Arctic.

The body of firsthand data consists of semi-structured and unstructured interviews (n=24, with 6 male and 18 female participants, aged 25 to 52 years) as well as researchers' personal observations in the form of audio records, travel blogs and diaries. The interview guide encompassed topics such as residents' personal experiences in using open public spaces, engagement in recreational activities, distinctive characteristics of the cities, recent changes and preferred directions for developing the architectural environment. Overall, this pool of data was analyzed and converted into 5 data-narratives according to the main semantic domains revealed through thematic analysis: personal physical comfort (favorite sites and places), soft mobility, nature in the city, personal weather adaptation strategies in open public spaces and visual qualities of the built environment.

3. Theoretical framework and conceptual model

Our main objective is to conceptualize the architectural environment of the Arctic city as a holistic system of materiality, representations and perceptions. Such conceptualization allows us to articulate principles, the implementation of which is aimed at holistically creating a tangibly (physically and functionally) and intangibly (conceptually and sensually) comfortable life in extreme environments. To do so, we turned to the concept of space production by Lefebvre (1991), who defines city space as a fusion of the perceived (the city as a material embodiment of social processes), the conceptual (the system of thoughts about space) and the lived (the space of everyday life of a city dweller).

In our research, we propose the latter - lived space, as an object of architectural research and practice. This notion encompasses the sensations, imaginations, emotions and meanings experienced by people from day to day in a form of one’s concrete, practical urban experience (Castree & Gregory, 2008; Schmidt, 2012). Combined with the architectural connotation of city space, where the built environment is seen as a merge of materiality with conceptual ideas and human perception (Rappoport, 1979), the concept of lived space expands the borders of design processes. As a design object, urban lived space is viewed as a phenomenological field where architecture (the material spatial dimension), context and individuals interact empirically. Such conceptualization allows focusing the design process on the dwelling experience, rather than on a detached attention to buildings and open spaces as “objects” on isolated building plots, resulting

in the fragmentation of the urban environment and "widespread disregard for the everyday life" (Coleman, 2015).

The focus on how one dwells in space brings the proposed model in line with other human-centered approaches, motivated by the prediction of how the design results will be applied to serve human needs, rather than by the "abstract logic" of the discipline (Woods & Winograd, 1997). In particular, the attempt to combine tangible and intangible aspects of human-city interaction can be paralleled with service design, studying the invisible "glue" around which our lives are structured (Penin, 2018). For our research, this concept unfolds in the urban environment (the service provider), allowing the citizen (the service user) to perform a certain activity withing its boundaries, resulting in concrete experience (Penin, 2018). Referring to psychology and sociology as "the engineering tools for the service encounter" (Cook *et al*., 2002), these research optics focus on the sensations and knowledge acquired from the interaction (Zomerdijk & Voss, 2010).

It is the design disciplines that transform surroundings into environments that enhance human experience (Buchanan, 2019). Therefore, it is not technical skills or aesthetic visions that determine the quality of design, but the moral and intellectual objectives that guide the design process (Buchanan, 2001). Design is seen as a tool for embodying this principle through the transformation of abstract ideas, e.g., human rights and values, into concrete manageable forms through a comprehensive understanding of human needs (Buchanan, 2001). Similarly, concerned with "human pathways," systemic design highlights the concrete problems one encounters and the possible ways to improve them (Buchanan, 2019). Such first-person perspective allows adaptively and sensitively improving the situation while continuing to learn about it (Ryan, 2013). Thus, the limited focus on technocratic skills and spatial morphology (Schmidt, 2012; Coleman, 2015) is replaced with the design formation of how the environment is perceived and conceptualized in the course of everyday interaction with it, resulting in a holistic urban image, stemming from the values embedded throughout the design process. In particular, these values could include adaptability as a recognition of the urban environment's dynamics; contextual relevance, meaning that values in design should be informed by the specific historical, cultural and social contexts of the urban area and innovation, addressing current challenges and anticipating future needs and values in urban living (Stone, 2021).

We have thus identified four levels of architectural adaptation to the Arctic. These levels correspond to the identified spheres of urban "coldness", conceptualized based on research on the socio-cultural and socio-economic aspects of the Russian Arctic cities, together with empirical data from the cities in the north of Western Siberia:

1) Objective - extreme climate and emotional stress associated with the geographical and climatic features of the region.

2) Operational - functionally "unresponsive" urban environment due to the lack of opportunities for all-season activities.

3) Conceptual - a lack of a sense of attachment, reflected in the urban materiality and confrontation with the "Southern" mainstream design ideals.

4) Perceptual - an emotionally "cold" city image, stemming from visual/sensual content of the urban environment.

Each of the identified levels has its own goal of creating a dwelling potential, seen as the inherent ability of the environment to be used, felt and conceptualized; in other words - to be lived. These conceptualized potentials serve as a guide for the design

process. The exact design outcomes are to be built from the analysis of human needs and environmental/social conditions in a particular place.

The overarching principles of the model are: context-sensitivity as an opposition to universal design approaches, based on urban mainstream and adaptability, ensuring the adaptation of the environment to changing conditions due to cyclical and singular changes. Concretized at each level of the model, these principles are used as a tool for fixing conceptual research results and can be seen as directions for further practical and theoretical investigation.

Context-sensitive approach in the interpretation of N. Garin (Usenyuk-Kravchuk *et al*., 2020) considers the specific requirements of the extreme environment in the context of denying universality. It emphasizes the necessity of tying designed objects strictly to their location through a thorough analysis of both the object and context. This principle is closely linked to decolonial optics, built on breaking down the strict vertical hierarchy between design and end-users and between "modernized" and "undeveloped" areas, giving design a basis for adaptive and decentralized methods (Begum, 2015; Irani *et al*., 2010). Postcolonial/decolonial perspectives question the universalizing paradigms, stemming from Western culture, by "depicting particular places as international and cosmopolitan as well as local and provincial" and reading into "uneasy negotiation between sameness and difference in particular locales" (Hosagrahar, 2012). Context sensitivity is aimed at highlighting this dynamic and multifaceted nature of meanings, forms and landscapes in order to understand a place, not universalize or the opposite - exclude it from the "norm".

Adaptability can be seen as a result of context-sensitive analysis and is based on designing "together" with the natural and social space, rather than in spite of it. This idea is represented in the international search for Arctic urban environments (e.g. in the "Winter City movement") (Pressman, 1996; Stout *et al*., 2018; Chapman *et al*., 2018). However, it cannot be transferred unchanged to the Russian context due to the climatic, cultural, socio-economic and urban differences. Besides, in our research, this principle is understood as a process, rather than the end result. In this process, the environment is designed to be adapted for creating sustainable comfort in specific conditions, while remaining adaptive to the changing context.

Both principles accentuate the difference, striving to work with the peculiarities of a given environment. However, it is of crucial importance to avoid seeing "Nordicity" as a brand or as a justification of exceptionalism (Browning, 2007), referring to a "romantic" and "exotic" way of perceiving the region (as something outside of the "norm") (Käpylä & Mikkola, 2015). Rather, the Arctic should be seen as a particular lived space of a local community. Thus, the source of insights can be found not only in context-sensitive analysis of the given environment, but in the existing adaptations and identities of local communities, which call for anthropological field research aimed at connecting architecture and local practices. This allows designers to escape from universal approaches, since the "southerner's" vision is still perceived as universal and often leads northern development projects (Beaulé & De Coninck, 2018).

The model is summarized in Table 1.

Table 1. Conceptual model of Arctic cities architectural formation

<table>
<tr><td colspan="3">Lived space as a design object
a phenomenological field where, context and individuals interact empirically</td></tr>
<tr><td>Material space (level of architecture).</td><td>Conceptual space (level of sociocultural context).</td><td>Perceptual space (level of human perception).</td></tr>
<tr><td colspan="3">Levels of architectural adaptation:</td></tr>
<tr><td>(1) Basic level:
- engineering adaptation of buildings and structures, construction technologies and city’s service infrastructure to the climatic and geographical conditions of the region;
- climate mitigation by means of architecture (e.g., wind shielding, managing precipitation).</td><td rowspan="2">(3) Conceptual level: environment as a material expression of place-making and architecture as an expression of local identity, as a tool for forming attachment to a place.</td><td rowspan="2">(4) Perceptual level: design of sensual content, the atmosphere or character of a space, based on the results and process of passing information from the materiality through sensory perception.</td></tr>
<tr><td>(2) Operational level:
response of the environment to communication within a system of “human need - environmental affordance”.</td></tr>
<tr><td colspan="3">Dwelling/experience potential:</td></tr>
<tr><td>(1) A physically comfortable space inviting for interaction.
(2) Functionally rich urban experience, adapted in two directions: time (cyclical changes and linear bifurcations, which lead to changes in functionality) and space (specific routes of travel through the environment with highlighted points of attraction).</td><td>(2) Urban environments as meaningful places, embodying key elements of local identity and/or taking part in identity formation.</td><td>(4) A program of perception as a holistic urban experience, which unfolds in two directions: time (cyclical changes and linear bifurcations and the following adaptation of sensual content to augment or compensate for these dynamics) and space (specific routes of travel through the environment, infolding into a sensual experience).</td></tr>
<tr><td colspan="3">Design principles:</td></tr>
<tr><td>Geographical and functional context-sensitivity:
(1) analyses of local climate and its cyclical changes (e.g., with quantitative climatographic methods) in order to pinpoint the need for climate mitigation and engineering adaptation;
(2) analyses of local practices (qualitative anthropological methods) in order to adapt designed spaces and/or get insights into local adaptation strategies.</td><td>Conceptual context-sensitivity:
- capturing and reinforcing existing identity (with research on sociocultural conditions and qualitative anthropological methods, e.g., mental maps, interviews and other participatory methods);
- formation and reflection of a new identity, embodied in the architectural environment, which becomes a tool of place-making.</td><td>Perceptual context-sensitivity:
emotional and imaginative connection to the natural and social landscape (with psychological and anthropological research on how the environment is sensed in order to correct or reinforce the emotional image).</td></tr>
</table>

Seasonal/operational adaptability: dynamic system of transformation to provide seasonal urban practices and maintain all-year activity due to the changes in objective characteristics of a given space (the change in natural environment like wind, precipitation and temperature patterns).	**Conceptual adaptability:** understanding of the complex flows of cultural identities colliding in the space of the Arctic city to form a diverse place identity.	**Sensory adaptability:** understanding impressional/imaginative changes occurring in the environment during seasonal changes in order to highlight the peculiarities of natural dynamics in the emotional perception of the urban environment or to compensate for its problematic aspects.

Source: Compiled by the authors

4. Objective and operational level

The extremeness of the Arctic natural realm sets the context for architectural environment formation apart from the mainstream design conditions. In a harsh climate, comfortable habitation relies on an artificial spatial environment's ability to protect against the extremes of natural surroundings. However, while focusing on fencing against the climate, architecture and urban design often overlook the importance of creating environments that promote health and well-being. What is more important, there is a lack of architectural/design reflection on how to maintain physical activity during all seasonal manifestations of the Arctic without enclosing citizens in multifunctional spaces with winter gardens. In some projects, ice slides, skating rinks and a ski track are suggested as such tools; however, these elements are usually restricted to a particular type of open space and do not capture the urban environment as a whole system of soft mobility. At the moment, there are not enough examples of systematic integration of soft mobility into the interaction with the city (one such rare exception is the master plan of Kiruna, where the redevelopment of the city has enabled a shift to more organic ways of interacting with the environment) (Sjöholm, 2016).

This could be due to a lack of integration of other disciplines' knowledge into the artificial environment formation, while the built environment significantly affects both the physiological and psychological health of individuals (Salingaros, 2024). The elements of urban surroundings collectively form a "life support module", comprising technological objects and artificial environments (Usenyuk-Kravchuk *et al*., 2020). Ideally, such a module consists of components with specific quantities and qualities designed to protect against negative environmental impacts and ensure sustainable comfort (Usenyuk-Kravchuk *et al*., 2020). Deviating from these ideal conditions, when the module fails to perform its necessary functions, can lead to a negative perception of the surroundings.

Analyzing a city's spatial environment in this way allows us to conceptualize architecture as a medium, which actively envelops our interaction with the world, "revealing" and "concealing" various aspects of reality (Kittler & Griffin, 1996; Arnold, 2003). In our study, the process of highlighting and hiding aspects of reality can be illustrated by the physical sensations of climate and emotional responses to it. Thus, for instance, wide streets can intensify the feeling of wind chill (Jull & Cho, 2013; Sheppard & White, 2019), failing to create conditions for close/friendly communication with the space. From a broader perspective of the intangible, the ability of the architectural environment to "highlight" is seen in the mainstream design principles brought to the

high latitudes and emphasizing the inappropriateness of the Arctic conditions to the climate familiar to such architecture. This results in a summer-oriented environment, which inevitably perpetuates the "frustration" associated with winter by reducing the diversity of urban practices for the vast majority of the Arctic year (Beaulé & De Coninck, 2018).

In our research, we label the two levels of physical comfort and functional content as basic - relating to safety and physical comfort and operational, focusing on the ability of the urban environment to maintain year-round activity in the Arctic urban spaces. We argue that the existing open public areas in Russian northern cities do not encourage people to engage in outdoor activities, failing to create infrastructural affordances or establish thermal and emotional comfort. The latter is achieved through the imagery content of space and is closely related to the perceptual outcomes of the human-city interaction.

4.1. Basic level: climatic comfort

In the urban development of the Soviet/Russian High North, architectural research and practice have seen an excessive bias towards the aspects of engineering/construction adaptation, to the point where the whole idea of architecture for the Arctic merged into the ways of creating climate comfort by means of architecture along with the adaptation of construction technologies, service infrastructure, etc. The main objective of the architectural research in the Arctic in the Soviet period was to create a more or less fenced urban environment by a minimal engineering adaptation of standard multistory buildings (Jull, 2016; 2017).

Today, the design and architecture practice is mainly aimed at the "blagoustroystvo" of the Arctic cities, leaving engineering issues in a separate realm of research. This practice implies the policy to make the territory "equipped and convenient" through a set of basic infrastructures and public services together with a visually attractive environment (Gunko *et al*., 2022). However, the concept of fencing against the climate remains influential, which is evident in design proposals that suggest relocating entire public spaces or parts of them into controlled artificial microclimates in the form of multifunctional centers, "super-houses" with pedestrian galleries or individual pavilions. In our view, this bias can be related to the absence of a further strategy for the urban environment adaptation.

In our model, the level of physical comfort and engineering adaptations is seen as a basic one, with the dwelling potential lying in the creation of climatic comfort not as an independent goal of architecture but as the promotion of the citizens' interaction with the city's open space. This level's design strategy should hinge on the principle of context-sensitivity, which targets local conditions by using both quantitative and qualitative field research methods in climatology and anthropology to analyze a specific environment, its local climatic features and the way the citizens interact with and perceive it. Based on the collected data, optimal means of artificial protection should be selected. These could be planting or artificial landscaping and other spatial organization tools, including reconsideration of the structure of streets and open public places. The key idea is to achieve a balance between what is necessary and what is sufficient: climate mitigation tools should create a sufficiently comfortable outdoor environment without unnecessarily enclosing citizens in an artificial climate.

Figure 2. Memorial Square, Novyy Urengoy. Courtesy of (1) Ustinov K. and Raeva A. August, 2022; (2) Ustyuzhantseva O., May, 2024

The issue of adapting existing urban morphology to Arctic conditions can be illustrated by standard open public spaces of post-Soviet cities in the Arctic. These large-scale open spaces were designed to create an ideological and artistic image of great impressive power, which was embodied in significant size and monumental proportions (Lebedeva, 2016) (Figure 2). It was part of the "general model of the Soviet city", formed as a result of rational principles of economic planning and ideological content (Lebedeva, 2016). Together with the change in social practices, these places became "deeply unpopular" among citizens (Paukaeva, 2020).

Figure 3. Tarko-Sale (on the left: July, 2019; on the right: May, 2024). Courtesy of Prokopova S. and Myasnikova I.; Ustyuzhantseva O.

In the Arctic, apart from the lack of functional/imaginative content, this could be a result of the objectively cold microclimate in such large-scale open spaces. For instance, respondents interviewed in Tarko-Sale on the city's embankment noted that this space is not used during the winter due to the wind (Figure 3). It is a space stretching along the river and lined with granite, which creates a feeling of the parade squares in historical cities, where emptiness is part of the architectural idea, carrying both functional and imaginative/impressional meaning, irrelevant for a small, young Arctic city like Tarko-Sale. Moreover, as seen in the Figures 2 and 3, these spaces remain predominantly empty even in good weather conditions. For instance, Figure 1 shows the observation on how people visit the square during National Memorial Day and leave it immediately after, due to the harsh wind.

There is no single model for the development of such "emptiness" in city environments; however, there is an obvious need for its transformation in terms of potential for social activity, especially in Russian cities due to the change in the functionality of the Soviet parade squares (Paukaeva *et al*., 2020). For example, research on one of the most problematic public spaces in post-Soviet cities - squares, suggests

introducing temporary design interventions (Paukaeva *et al*., 2020). Such tools include events and temporary structures used to enhance pedestrian activity and improve the appearance of the city environment.

Although the cold and harshness of nature pose certain challenges, local residents develop specific adaptations and find pleasure in active lifestyles in nature and open space, which is supported by research (Bolotova *et al*., 2020). Hence, the task for architecture on this level is to analyze the built environment to pinpoint places in need of climate mitigation and to conceptualize possible ways of creating a holistic system of physically comfortable urban spaces. Thus, we suggest the level of climatic comfort as a basis for the functioning of other levels - functional, conceptual and sensual, not as an ultimate goal of arctic architecture.

4.2. Operational level: environmental affordances

The urban environment allows for functional interaction through what is known as environmental affordance. This term refers to an awareness of the potential for physical action that the environment offers, as described by Heft (1997) and Gibson (1979). In this view, the design practice is tied to human cognitive systems by prioritizing the interconnection of the brain and the environment (Salingaros, 2024). The qualities of the environment and the opportunities it presents shape the relationship between the observer and the observed, connecting together human needs and environmental affordances. This concept is adopted in our model as a basis for the operational level of adaptation.

Figure 4. Pedestrian street Internazionalnaya, Novyy Urengoy. Courtesy of (1) Ustinov K. (July, 2022) and (2) Ustyuzhantseva O. (May, 2024)

A notable feature of the relationship between the Arctic and the urban environment is the incorporation of northern nature attributes into urban spaces (Chapman *et al*., 2018).

During winter and seasonal transitions, the Arctic space is physically transformed by snow, slush, ice and puddles, making the climate and seasonality integral to spatial organization. By impacting the physical environment, seasonal changes alter human behavior within it, highlighting affordances and limitations for action. This is evident in the current state of the Arctic city public spaces: standard city squares and wide embankments turn into white “emptiness,” modernist streets and wide squares transform into “corridors” for Arctic winds, public spaces change or become inaccessible due to flooding or snow (Figures 4 and 5) and parks with numerous benches are unused during the long winters as they are designed for slower-paced activities unsuitable for winter, as seen in research (Zamyatina, 2023) (Figure 6).

Figure 5. Playgrounds. On the left: Novyy Urengoy, July, 2022 (courtesy of Ustinov K. and Raeva A.); on the right: Novyy Urengoy, May, 2024 (courtesy of Ustyuzhantseva O.)

Notably, as was observed, key activity points for citizens are located along their daily routes (home-work-school), especially for families with children, while public spaces and recreation are used by residents in two cases: city festivals and good weather conditions. In the seasonal transitions, however, virtually the entire city becomes unsuitable for pedestrian mobility due to both inefficient utility services and functional content. As for the second reason, it can be seen in the spatial organization of the city, which is based on the modernist system of road hierarchy and car mobility, so that urban design considers the city "from a traffic" perspective (Marshall, 2004) (Figure 7). Even in projects that involve systematic shaping of the urban environment (e.g., master plans), attention to interaction with the city outside of designated public spaces – on the sidewalks on which people move in their daily lives – is often overlooked.

Figure 6. Park "Druzhba", Novyy Urengoy. Courtesy of (1) Ustinov K. and Raeva A. (July, 2022); (2) Ustyuzhantseva O. (May, 2024)

The frequent lack of such systematic attention to public open spaces outside of restricted landscaped points is a problem not unique to Arctic design. In contrast to comprehensive modernist planning, which, however, creates an environment that is "disconnected" from the individual (Norberg-Schulz, 1971), the implementation of "comfortable city" policies is mostly done through selective "aesthetic interventions" (Gunko *et al*., 2022).

Therefore, a northern city's comfort on the operational level could be tied to the year-round availability of various activities and recreation, promoting a healthy lifestyle and active outdoor time. For that reason, in international Arctic architecture research, soft mobility is seen as one of the key factors in northern urban development. It is seen as one of the ways to form close relationships with the city as well as a way of maintaining thermal comfort while being outside (Chapman *et al*., 2019). Spatial practices, in turn, comprise a basis for forming attachment to place and shaping lived experience through behavioral patterns (Chapman *et al*., 2019; Eliasson *et al*., 2017; Shi *et al*., 2024). The

formation of positive lived experience is related to "humanized places," understood as places full of "good self-experiences" (Shi *et al*., 2024). It is the quality and affordances of the environment that are decisive in preserving soft mobility (Oikarinen, 2020) and thus provide space for lived experience. Therefore, the urban environment should be adaptive and change with the seasons, working with the contents, both functional and figurative (see the level of perceptual space).

Figure 7. Sidewalks of Novyy Urengoy. Courtesy of (1) Ustinov K. and Raeva A. (July, 2022); (2) Ustyuzhantseva O. (May, 2024)

5. Conceptual level

In our study, architecture is considered to be a tool of placemaking (Seamon, 2000), aimed at the organic and productive merging of architecture with the context and shaping the human living environment. The notion of place is represented as a central ontological structure of being-in-the-world (Seamon, 2000) and is connected to architecture and urban design in the disciplines' function to form the environments we live in. Such great responsibility creates a risk of expert appropriation of placemaking (Schneekloth & Shibley, 2000), which is on the contrary "a collective effort by individuals living within a specific setting" (Strydom *et al*., 2018). As a counteraction, an "implacement" of built structures within a broader human endeavor is suggested, emphasizing the dynamic aspects of how individuals and communities engage with their environments (Schneekloth & Shibley, 2000). Here, the constructive power of place is highlighted. While being seen as a stable location for memory or nostalgia, place, "both as a concept and as a discrete space on the earth", is an active and conflicted cultural process (Schneekloth & Shibley, 2000). Architecture and design, thus, should address the process, rather than an end result, by the discovery of the "detailed diagnosis of specific situations" and invention of the ways design disciplines merge in the given dynamic context (Boys, 2016).

In case of Arctic "planned cities," the question of placemaking becomes significant due to the combination of uncertainty, diversity and temporality. The fly-in-fly-out (FIFO) work method and industrial/economic orientation transform Arctic cities into a "space of flows" (Zamyatina & Goncharov, 2022), allowing a variety of cultural attitudes to coexist without merging with the local indigenous culture. Migrations blend into daily life, becoming part of every northerner's existence (Zamyatina & Goncharov, 2019). Hence comes the creation of a new "open code" culture in the North, not tied to any ethnic identity (Garin *et al*., 2017; Usenyuk-Kravchuk *et al*., 2020). The challenging Arctic conditions foster new ways of coexistence in the form of "fluid communities" where fluidity offers a more adaptable, mobile and comfortable way of life (Usenyuk-Kravchuk *et al*., 2020). In the Arctic context, this concept of a fluid spatio-temporal

constitution embodied in architecture prompts speculation on how architecture can adapt to the dynamics of socio-spatial communication.

Urban identity can be understood as a combination of community's social and cultural characteristics, embedded into physical shapes and forms of the urban locality (Ziyaee, 2018). The concept of "flowing" identity (Zamyatina & Goncharov, 2022) with reference to Arctic industrial cities is comparable to Castells' perspective of the space of flows. Castells (2009) describes the space of flows as the dominant spatial logic of the network society (with constant flows of capital, information and images), challenging traditional physical boundaries and inevitably shifting design disciplines towards a disconnect from place, community and the individual. With the recognition of the reality of existing in such a globalized capitalistic entity, for the critique of which the "space of flows" concept was originally constructed, when conceptually applied to the design field, the flowing state reveals the complex interaction of immaterial flows and physical space. It is these complex, decentralized spatial flow patterns that reveal the dynamic and unstable nature of space, allowing for alternative geographical imaginations (Castree *et al*., 2023). The principles of conceptual context-sensitivity and adaptivity may serve as a basis for the implementation of the methods of ethnography, social/urban anthropology, sociology and psychological interpretation - the approaches aimed at immersing the researcher in the sphere of socio-cultural and individual perceptions.

Figure 8. Indigenous ornaments in urban environment (1) Novyy Urengoy; (2) Tarko-Sale. Courtesy of Prokopova S. and Myasnikova I.

As was discovered, for residents of the Arctic cities, an important part of comfort is a sense of belonging to the local community. They emphasize the openness and friendliness of the local community, which creates a sense of security and confidence in the support of society. There is no reference to indigenous northern culture as a part of local identity for citizens of industrial cities in Western Siberia. On the contrary, possibly due to the lack of another articulated identity, architecture often refers to indigenous cultures as a means to make the urban environment "more organic" (Figure 8).

We argue that the task for architecture on this level is to understand the urban identity, which can represent itself in particular northern climate, love for northern nature, cultural diversity and local "warm" community, found in interviews with locals and socio-cultural research (Bolotova, 2012; Bolotova *et al*., 2020). A peculiar illustration of locals' sincere love and attachment to place in the form of material spatial assembles is dachas (summer cottages). Instead of escaping from the north to southern regions for holidays, owners of dachas spend their free time growing food and building houses on their private land in the natural landscape outside but near the city. This kind of house is an extremely common form of property in Russian regions with a temperate climate. However, no one would expect "dachas on the permafrost": in "Novyi Urengoi, one of

the authors could not believe his eyes seeing people working on a potato plot with imported soil from the south, poured onto the permafrost" (Stammler & Sidorova, 2015). This practice is seen by locals as adding meaning and human value through material engagement in the environment (Stammler & Sidorova, 2015). As was found in the interviews, citizens in Western Siberia also engage with nature by picking berries and mushrooms in the vicinity of cities, fishing, going for short hikes, or making off-road vehicle trips as major recreational activities.

Thus, there is an identified need for connecting the built environment to human adaptation practices aimed at cultivating placemaking and attachment. The context-sensitive approach can be used as a creative way to gather experiences and space production practices outside the mainstream paradigm.

6. Perceptual level

The perceptual level in our concept is seen as a system of sensory qualities of the city's built realm, which has a significant impact on the emotional image of the environment. A similar idea is reflected in the notion of the lifeworld, which refers to "the tacit context, tenor and pace of daily life to which normally people give no reflective attention" (Seamon, 2000). It is both the routine, mundane and the unusual or surprising impressions gained from the built environment that form a cohesive emotional/sensual image of a city.

The master's thesis by Myasnikova I., supervised by Garin N.P. and Kravchuk S.G. (Ural State University of Architecture and Art, 2020), explains the emotionally "cold" image of Novyy Urengoy (Figure 5). The study was carried out following a joint expedition with one of the authors of this research work in 2019. It employs the composition key method (Garin *et al*., 2017), which involves creating a formal composition that conveys the basic perception of the depicted phenomenon through compositional means like plasticity, color and relationships between elements. The perception of visual content and spatial configuration as "cold" is based on the relationship between body and cognition. This is exemplified by the use of metaphors of bodily sensations to describe emotions - intangible products of our consciousness - which is a familiar practice in speech (Lakoff & Johnson, 1980).

However, the perceptual content of the urban environment goes beyond static formal characteristics. Two research perspectives are found to be the most useful in working with the perceptual level in our research. Firstly, it is a phenomenological approach to architecture as a "study of human experience" (Seamon, 2000) with an emphasis on sensuality and bodily cognition. This approach considers architecture to be a perceptually accessible complex folding into a "body-schema" – the spatiality of the lived body (Tiemersma, 1982). For phenomenologist Merleau-Ponty, it means the unconscious ability of our bodies to grasp the environment in a holistic way through motor-perceptual routines (Hale, 2013).

Figure 9. Master's thesis by Myasnikova I. (supervised by Garin N.P. and Kravchuk S.G., Ural State University of Architecture and Art, 2020). Courtesy of Myasnikova I

This interpretation of reality is closely related to Gibson's (1979) concept of ecological perception and Heft's (1997) interpretation of affordances theory, which explores the inherent relationship between action, perception and environment. In the same vein as functional affordances and perception are united in this concept, in our model, phenomenological cognition is inseparable from operational and basic levels. This can be exemplified by the emotional content of large-scale spaces, where, as hypothesized, their functional and climate inadaptability add to the overall bodily sensation and emotional attitude towards this space. This phenomenon was observed in interviews with residents. When describing their interaction with the city, in addition to the physical objects and places in the environment, they also noted emotional evaluations of different areas (e.g., pleasant, safe, dangerous or uncomfortable places). This highlights the needed focus on psychological comfort and well-being, which are provided by both cozy and safe public spaces and opportunities for various types of recreation and leisure activities.

The second approach for the perceptive level is service design, which can be interpreted as a more practical direction of phenomenological ideas. Here, the process of user – design object encountering is made up of "individual experiences that flow through time" (Cook *et al*., 2002). The result of such experience is presented in a summary assessment, which then affects the decision "whether or not to repurchase the service, but also how we approach the next encounter" (Cook *et al*., 2002). The elements which constitute this summary are embodied in an "experience profile," collected from the trend of the experience (the change in intensity), peak moments, end moments and cohesiveness (Ariely & Carmon, 2000). Thus, the time element can be potentially embedded into the way we experience the environment through a designed program of perception.

Here, time is seen as a design category that inevitably impacts the architectural environment through cyclical (seasonal and diurnal) or unidirectional changes (such as

the aging of materials or changes in the environment) (Seamon, 2018; Pallasmaa, 2000). Flexibility of nature is taken as an example of ultimate adaptiveness to counteract the static perspective on our built environments. As shown in the vivid architectural metaphor by the Arctic architect Erskine (1968): "towns should 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, offering sun-warmth and wind-protection to their terraces, gardens and streets". We thus hypothesize that architecture could form a holistic urban experience which unfolds in two directions: time (cyclical changes and lineal bifurcations) and space (specific routes of travel through the environment). Each direction reveals the operational and emotional environmental content, which, taken together, form an integral conceptual image.

Detailed field studies are necessary to analyze city dwellers' perception of the sensory qualities of specific environments; however, based on architectural phenomenology studies (Pallasmaa, 2000), which delve into the sensory aspects of modernist architecture and its potential negative mental effects (Joye, 2007; Pallasmaa, 2012), we can infer how the modern Arctic urban environment is perceived. This environment, characterized by regular geometry, may limit the availability of emotionally meaningful sensory information (Joye, 2007), potentially leading to sensory deprivation (Evans & McCoy, 1998) (Figure 10).

Figure 10. Modernist environment of Novy Urengoy. Courtesy of (1) Ustinov K. and Raeva A

Research shows that short and small streets in the dense street networks tend to be perceived as livelier, while wide streets are seen as boring or even depressing (Zhang *et al.*, 2018). We argue that the correspondence of the city space to the human scale becomes especially important in an Arctic city. According to Pallasmaa (2012), we experience pleasure and security when our bodies resonate with the surrounding space.

A rare example of a successful merge of functional and perceptional content of the environment can be seen in the newly formed part of a park in the Tarko-Sale's embankment ensemble, which includes an eco-trail in the form of a fairly narrow wooden path through the forest (Figure 11). In contrast to the older part of the embankment (Figure 3) – a large-scale empty space, this new spot attracts visitors despite weather conditions and receives positive feedback.

Figure 11. Park “Pribrezhny” (“Coastal park”), Tarko-Sale, March 2024. Courtesy of Ustyuzhantseva O.

Therefore, the dwelling potential at this level lies in creating an emotional and sensory experience of a city by “tuning” the environmental sensory qualities like light, color, texture, etc. This image gradually evolves and changes through human interaction with the city, forming a program of perception. Context sensitivity here means that the sensory (emotional) qualities of the environment should cohere with the conceptual (place identity) and material (geography, climate and existing urban fabric) spaces. Sensory (imagery) adaptability is as important as functional seasonal operational adaptability. While the operational aspect deals with the functional/infrastructural content and its seasonal changes, the sensory adaptability element focuses on the imaginative/figurative changes occurring in the environment.

7. Conclusion

Russian Arctic cities present a unique phenomenon in the polar region, unparalleled in terms of climatic extremes and population sizes compared to other northern settlements. Given the lack of architectural research on the Arctic cities in Russian science, there is a pressing need to apply design principles to the climatically harsh and ecologically vulnerable Arctic territories. The aim of the suggested conceptual model is to provide a theoretical/conceptual basis for the transition from fragmented “beautification” projects for the Arctic to the use of a system of design principles, the application of which is scientifically justified for the integrated formation of a comfortable urban environment. Furthermore, this study aims to reveal the inadequacy of applying mainstream design principles and insists on the need for a deeper understanding of “northerness” in design and architecture. In particular, the model justifies why climate-sensitive architecture for the Arctic should go beyond beautification and physical protection from the cold. It is also flexible. Based on context sensitivity, the architectural results of the suggested principles may vary significantly across different northern cities. Therefore, these principles should be seen as directions for future practical and theoretical explorations, focusing on both tangible and intangible comfort, and linking the design object to a specific space. The dwelling potential can be seen as a representation of what an Arctic city might be like, serving as a guideline for design practices.

Moreover, the concept of interconnection between the qualities of the architectural environment and attitudes towards space is aimed not only at creating human comfort in the urban space, but also at going from resource-based to creative and flexible development in the Northern region of Western Siberia, where cities are traditionally focused on the extraction industry. We recognize that architectural intervention alone cannot facilitate this transition. However, by way of challenging the traditional

boundaries of the design disciplines, we suggest a systemic approach grounded in critical urban theory that allows architecture to be examined as both a product and a source of social narratives about space. Emphasizing the current architectural environment as a source of conflict in itself, we believe that systematic work with the material space can change the perception of the cities and the region. This can be achieved only by promoting a shift from the restricted architectural focus on materiality towards a lived city space as a systemic design object, where the spatial environment is a container for perceptual and conceptual levels.

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