Faculty of Design

2021

Arctic Design: The systemic development of a new domain

Usenyuk-Kravchuk, Svetlana and Korgin, Nikolai

Arctic Design

The systemic development of a new domain

Svetlana Usenyuk-Kravchuk, Nikolai Korgin

The paper presents the early stage of developing Arctic Design as a general theoretical framework for design/development actions in extreme environment. The main strands of research include (1) the self-definition of the domain through compiling a subject area ontology; and (2) modelling strategies for sustainable interaction between humans and technologies in an extreme environment through developing artistic/imagery characteristics corresponding to the environmental/climatic, socio-cultural and psychological peculiarities of use. The paper outlines the research basis, expected results and a brief report of what has been done to date.

Keywords: Arctic Design, methodology, subject area ontology, complex evaluation mechanism, work-in-progress

Introduction

The paper presents the early stage of developing Arctic Design as a general theoretical framework for design/development actions in the extreme environment, focusing on human adaptation, safety, and wellbeing. In the Anthropocene epoch, when any environment is under the probability of becoming extreme over the next decades (Smith, 2012), the very concept of the Arctic goes beyond its geographic boundaries. From the Arctic as a world's periphery, we move towards the Arctic as a natural lab to observe anthropogenic climate change, accelerating resource extraction, mass tourism, and other manifestations of Arctic modernities (Körber et al., 2017). This lab provides a testing ground for new life-support solutions and further perspective for a radical reconsideration of the existing technology-augmented way of living.

However, at its current state, on both national and international scale, Arctic Design exists in the form of heterogeneous (mainly educational) initiatives (Jokela & Coutts, 2018; Tahkokallio, 2012; Usenyuk-Kravchuk et al., 2018) and often understood to onlookers as a set of methods and approaches to the "acclimatization" of existing products and services. Considering the relevance and existing demand for Arctic Design expertise, there is a need to develop a comprehensive theory by structuring and analysing the practical and methodological experience to date.

Research Basis

At the heart of the study, there is the consideration of Arctic Design as an individual's activity to organize autonomous life support in an isolated/extreme environment through creating technologies. The research team that brings together designers and mathematicians is focused on the development of an Arctic Design methodology, the potential for synthesizing mathematical models to analyze the empirical material collected during fieldwork 2017-2021, as well as testing proposed models on the example of a new transport unit for the conditions of the Russian North.

To create a new domain of theory and practice, namely Arctic design, two complementary strands of the inquiry are outlined as follows:

(1) Theoretical, that stems from the need to "pack" existing disparate methods and approaches to design for the extreme environment of the North/Arctic into a single methodology with the possibility of subsequent application

in interdisciplinary search for solutions to global problems related to the interaction between human, technology, and nature (Usenyuk-Kravchuk et al., 2020).

(2) Practical, that stems from the need to develop and implement sustainable interaction strategies between human and technology in the context of large-scale development of northern territories accompanied by an influx of non-indigenous population and ex-situ technologies (technologies created outside the territory of main use) (Usenyuk et al., 2016).

Based on the considerations above, there are two groups of research objectives, which, when achieved, would lead to the creation of a coherent theory of Arctic design with a practical application.

(1) Sectoral self-determination and interdisciplinary collaboration:

The challenge of "packing" existing disparate methods and approaches to design for an extreme environment (the North) includes an analysis of Arctic design for the availability of structural components in the methodology (as the organization of activities): subject, object, form, means, methods of activity and its outcome, and the process of carrying out these activities. Through the definition and specification of these components, the analysis will also make it possible to draw conclusions about the possibility of creating an Arctic Design methodology and formulate a list of research areas needed to be explored to identify any missing components.

(2) Developing and implementing strategies for sustainable human-technology/technology interaction in the Arctic/North environment:

Practical solutions to the problems of northern development related to the use of ex-situ technologies (technologies created outside the territory of main use) include promoting the emergence of locally relevant technologies to improve the lives of people living in remote, sparsely populated areas with a harsh climate; promoting self-organization of local communities of innovators; developing and supporting cooperation within and between these communities with an underdeveloped production, transportation, and digital infrastructure. The empirical material collected during fieldwork 2017-2021 suggests that ingenuity, self-organization and cooperation are the hallmarks of northern communities defined by harsh climatic conditions, reflected in the design as autonomous life support activities in an isolated/extreme environment. Within this task, the influence of the cooperation factor within the philosophy of competitive cooperation (coopetition) will be simulated, and the self-organization of these "communities of invention" will be described.

Expected results

The novelty of the study lies in a combination of humanitarian and artistic tools of technical aesthetics with mathematical methods of the theory of management of organizational systems. This project proposes to "test harmony by algebra" – that is, by making a qualitative leap from empirical data to a set of mathematical models that formalize the subject area and support forming a holistic methodology of Arctic design. Expected results include establishing a new "Arctic Design" domain with both practical and applied meaning. The understanding and description of this domain at the level of activity organization (methodology) will be conducted for the first time in international research and design practice. Interdisciplinary cooperation guarantees both an increase in scientific knowledge and the practical implementation, i.e. testing theoretical outcomes on a new type of small-sized cross-country vehicles.

The theoretical significance of the expected Arctic Design methodology is based on its possible application in searching for solutions to global problems related to the interaction between human, technology and nature in various extreme contexts. The practical significance of the results is that they would open the way to developing and implementing sustainable human-technology interaction strategies in the context of large-scale development of the North. This includes assisting in the emergence and introduction of locally appropriate technologies to improve people's lives in remote sparsely populated areas with a harsh climate and assisting in cooperation between users to create technological innovations in the undeveloped production, transport, digital infrastructure.

In addition, the expected results provide opportunities for further theoretical and methodological research both within the established direction and in interdisciplinary cooperation, including the writing of dissertations on relevant topics. Also, the research results can be used in the development of curricula, courses, seminars in the

system of professional education of designers, including retraining programs and professional development of specialists in the system of non-degree additional education.

First year report

In the first year of the study, the team worked on developing an integrated methodology of Arctic design, in two directions, as follows: (1) the self-definition of the domain through compiling a subject area ontology; and (2) modelling strategies for sustainable interaction between humans and technologies in an extreme environment through developing artistic/imagery characteristics corresponding to the environmental/climatic, socio-cultural and psychological peculiarities of use.

Within the first strand, the team worked on compiling the ontology of the subject area of "Arctic design" and synthesizing basic mathematical models that formalize the interaction of subjects and objects of Arctic design in the framework of the developing ontology. Our sampling logic guided by our analytical aims represents a specific range of variation on dimensions of interest: from geographical to cultural. We focused on three areas/countries representing different parts of the Arctic and, consequently, different approaches to Arctic design, namely Russia, Finland and Canada. To ensure the possibility of comparing the terminological structures in different languages, the information technology used (originally developed to work with texts in Russian) has been refined for the multilingual presentation of the analysis results. The results of the extraction of key terms for further analysis are available at the following links on the Internet:

1. The results of the analysis of the corpus of texts centred on the Finnish/Scandinavian Arctic (in English): https://lab57.shinyapps.io/arctic/

2. The results of the analysis of the corpus of texts centred on Canadian Arctic (in English): https://lab57.shinyapps.io/arctic_na/

3. The results of the analysis of the corpus of texts on the Russian Arctic (in Russian): https://lab57.shinyapps.io/arctic_rus/

4. Results in Russian translated into English (optimized, refined): https://lab57.shinyapps.io/arctic_ruen/

The subject area experts from Russia, Finland and Canada are currently conducting a comparative analysis of the lists of key terms to develop their detailed definitions.

As part of the task of synthesizing a set of basic mathematical models that formalize the interaction of subjects and objects, parallel to the process of building an ontology of the subject area, work was carried out to formalize the factors that influence the success of Arctic design projects with the help of the method of identifying mechanisms of complex evaluation currently being developed at the Laboratory 57 of the ICS RAS.

As an experimental, analytical material was presented a sample of student projects of equipment, housing and vehicles designed for environmental extremes of the Russian North at the Department of Industrial Design of the Ural State University of Architecture and Art for 40 years of existence Arctic/northern thematic focus (Fig. 1).

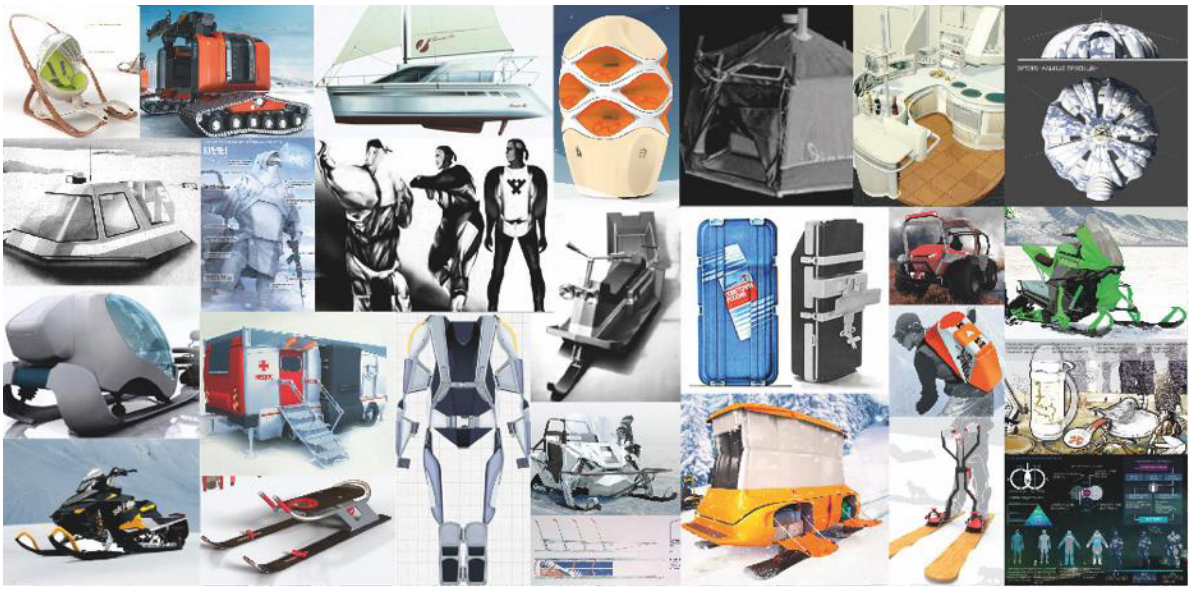
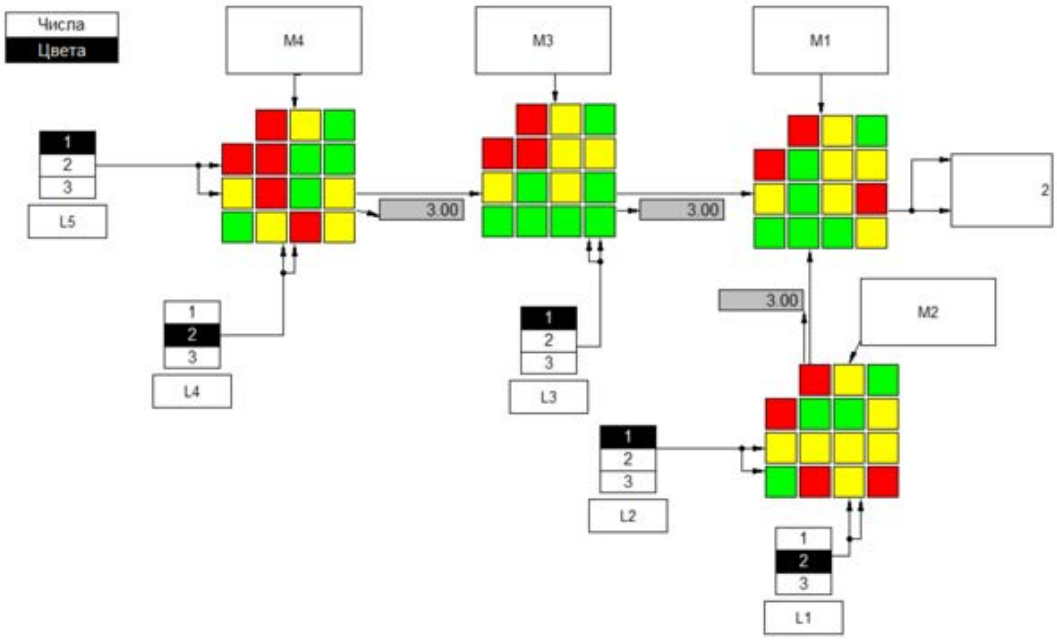


Figure 1. Examples of student projects selected for identifying the mechanisms of complex evaluation. Arctic Design School, Ural State University of Architecture and Art, 1987-2019.

The development of the comprehensive evaluation mechanism was carried out as follows: initially, 5 criteria traditionally used in assessing educational design projects (without considering the specifics of the Arctic design field) were identified as components of the multidimensional assessment. They were as follows: relevance/topicality, economics, ethics/ecology, aesthetics/imagery, and the technological part. Based on the list of projects, unified representation of their characteristics and evaluation of their success, all binary tree structures of aggregation of values of initial characteristics of projects in evaluating the projects' implementation success were identified (Fig. 2).



L1	L2	L3	L4	L5
relevance	economics	ethics/ecology	aesthetics/imagery	technology

Figure 2. The complex evaluation method: Possible convolution tree structures. N. Korgin and V. Sergeev, ICS RAS, 2021.

In identifying the specifics of the subject area, the team revised the list of criteria, and 6 concepts/criteria critical for the Arctic design objects were proposed, as follows: geography, resource, culture, ideology, technology, aesthetics. Calculations on these six criteria are planned for the second year of the project.

In the second direction, the project team used the described approach to building structural models of the subject area to formalize the principles of evaluating the applicability of the methods developed by the Arctic design school: artistic composition, the factor method, and the co-authorship method. In this direction, we performed the following types of work during the first year:

To iterate the cycle "empirical data – project proposal – approbation – feedback", we made two field trips: to the Northern Caucasus and Kola Peninsula. The concrete object of our designerly investigation (and further action) was a prototype of a small-size electric-powered cross-country/over-snow vehicle – "electric snowbike" or "e-bike" – jointly developed by E-max Laboratory, Moscow, and ICS RAS on cooperation in the field of experimental electric-powered platforms. Initially, this electric snowbike is a constructive "skeleton" of a vehicle made through small-scale/"garage" production (Fig. 3).

Figure 3. Left: 3D scan and 3D model of the snowbike, N. Korgin and N. Klyusov, 2021. Right: N. Korgin on the test drive in Kola tundra. Photo: A. Raeva, 2021.

The research task for the project team was to transform the specific results of the experimental creativity of DIY-makers into a full-fledged "transport product" with the necessary marketable characteristics, using the methods of arctic design.

The expeditions included running tests in potential target (both climatic and infrastructural) conditions of the vehicle application, as well as analyzing the requests of potential target audiences: from tourists and scientists to representatives of the indigenous population of the North, employed in traditional industries (reindeer herding), using the methods of structured and semi-structured interviews, and participant observation. The obtained data were synthesized in the series of design propositions for the prospective shape of a snowbike, developed using the Arctic Design School methods (Garin & Kravchuk, 2020) (Fig. 4).

Figure 4. Design propositions. N. Klyusov, A. Raeva, 2021.

Discussion and conclusion

Within the systemic framework, where design is understood as “an advanced practice of rigorous research and form-giving methods, practices of critical reasoning and creative making, and sub-disciplines and deep skillsets” (Jones, 2014), the Arctic vector suggests applying them to facilitating non-biological human adaptation and wellbeing in the extreme environment. This vector provides an alternative sensibility to the established concepts and approaches in the design domain and yields fruitful insights into tacit issues of human-nature-technology interactions usually concealed in the milder climates and more “civilized” environments.

The systemic and dynamic understanding of the Arctic/Northern sites under study opens up a unique window “on the universe, revealing only at this place something that cannot be moved or replicated in the laboratory” (Gieryn, 2006, p. 6). Furthermore, the Arctic/North becomes a useful and inspirational metaphor pointing to remote, sparsely populated and relatively isolated areas with a lack of urban industry and infrastructure and a harsh, challenging, and fragile environment. However, the overall meaning of “arcticness” in design may be contradictory. On the one hand, it may enhance general credibility for developing reliable technology that could also work in less extreme contexts (becoming literally “placeless”, i.e. beyond the certain place), and, on the other, it challenges the very concept of “placelessness”, which is unachievable, useless, and even harmful in case of the Arctic applications, because the Arctic in general and its Russian part, in particular, is very patchy and climatically diverse and thus requires highly specific place-based design solutions.

The Arctic design concept yields several implications for practice joined into two main groups (with the example from the transport vehicle design sector):

First, the attention to locally originated / place-based design solutions which generate enduring design principles – from traditional artefacts facilitating the indigenous nomadic way of living to DIY objects and practices of making locally adequate vehicles from industrial scrap (Hyysalo & Usenyuk, 2015; Usenyuk et al., 2016; Usenyuk-Kravchuk & Hyysalo, 2021) – helps to clearly distinguish "true Arctic design" from “acclimatization” of existing products/services and use of imported ex-situ technologies. The locally originated/modified objects, when seen as a tangible embodiment of the features and requirements imposed by both the user and the environment of use – from ergonomics and cultural identity to climatic factors and landforms – indicate to manufacturers means and ways of being mobile on a particular territory. Here designers' task is not to improve/embellish the observable shape but to carefully examine it for "what, why and how to make" for developing a locally adequate yet industrially manufactured product (Usenyuk-Kravchuk & Hyysalo, 2021).

The second implication is in line with the systemic focus of this conference: the Arctic design comes out as a conscious attitude to the design process that “reinforces the self-organization of co-created content and purposeful interaction within the boundaries and norms of the social system” (Jones, 2014). Our empirical data from the field provide learning examples into the so-called competitive cooperation (coopetition) and the self-organization of “communities of invention”. Here coopetition is understood as the systematic pursuit of being the best within the established and regularly exercised intra-community collaboration to achieve a comfortable living in a particular locality. This should be clearly distinguished from the pure competition where the aim of “bestness by all means” can destroy the originally cooperative and adaptational character of design/making endeavours in the extreme environment. The competitively augmented collaboration between actors in the design process strength-ens the spatial and socio-cultural embeddedness of both makers/users and their objects that leads to design solutions and design strategies that are in long-term possession and control by local makers and users (Botero & Hyysalo, 2013; Usenyuk-Kravchuk & Hyysalo, 2021).

Acknowledgments

Funding for this work comes from the Russian Scientific Foundation, grant No. 17-78-20047.

References

Botero, A., & Hyysalo, S. (2013). Ageing together: Steps towards evolutionary co-design in everyday practices. *CoDesign*, *9*(1), 37–54. https://doi.org/10.1080/15710882.2012.760608

Garin, N., & Kravchuk, S. (2020). *Design for roadlessness: Sketches on methods of designing small-size all-terrain vehicles (album-monograph) [Electronic resource].* Kravchuk, S.G. (USUAA).

Gieryn, T. F. (2006). City as Truth-Spot: Laboratories and Field-Sites in Urban Studies. *Social Studies of Science*, *36*(1), 5–38. https://doi.org/10.1177/0306312705054526

Hyysalo, S., & Usenyuk, S. (2015). The user dominated technology era: Dynamics of dispersed peer-innovation. *Research Policy*, *44*(3), 560–576. https://doi.org/10.1016/j.respol.2015.01.002

Jokela, T., & Coutts, G. (2018). The North and the Arctic: A Laboratory of Art and Design Education for Sustainability. In *Relate North. Art & Design for Education and Sustainability* (pp. 98–117). Lapland University Press.

Jones, P. H. (2014). Systemic Design Principles for Complex Social Systems. In G. S. Metcalf (Ed.), *Social Systems and Design* (Vol. 1, pp. 91–128). Springer Japan. https://doi.org/10.1007/978-4-431-54478-4_4

Körber, L.-A., MacKenzie, S., & Stenport, A. W. (2017). Introduction: Arctic Modernities, Environmental Politics, and the Era of the Anthropocene. In L.-A. Körber, S. MacKenzie, & A. Westerståhl Stenport (Eds.), *Arctic Environmental Modernities* (pp. 1–20). Springer International Publishing. https://doi.org/10.1007/978-3-319-39116-8_1

Smith, L. (2012). *The New North. The World in 2050*. Profile Books.

Tahkokallio, P. (Ed.). (2012). *Arctic Design—Opening the Discussion*. University of Lapland. http://www.ulapland.fi/loader.aspx?id=e253ba11-dcd0-41ce-b394-f6530226eb82

Usenyuk, S., Hyysalo, S., & Whalen, J. (2016). Proximal Design: Users as Designers of Mobility in the Russian North. *Technology and Culture*, *57*(4), 866–908. https://doi.org/10.1353/tech.2016.0110

Usenyuk-Kravchuk, S., Akimenko, D., Garin, N., & Mietteinen, S. (2020). Arctic Design: Basic Concepts and Practice of Implementation. In *RELATE NORTH: Tradition and Innovation in Art and Design Education* (1st ed., pp. 14–44). InSEA. https://doi.org/10.24981/2020-7-1

Usenyuk-Kravchuk, S., Garin, N., Gostyaeva, M., Konkova, Y., & Mingaleva, A. (2018). Arctic dimension in design education: How the place matters. In *RELATE NORTH:Practising place, heritage, art and design for creative communities* (pp. 56–85). Lapland University Press.

Usenyuk-Kravchuk, S., & Hyysalo, S. (2021). *Local adequacy as a design strategy in place-based making* [Article under review].