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# Arctic InfraScapes: Mobilizing Arts, Science, Local and Indigenous Knowledge to Understand Infrastructure Imaginaries

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**ABSTRACT**

The Arctic region is a complex and dynamic environment, inhabited by Indigenous and non-Indigenous communities and non-human species. Understanding and engaging with the Arctic requires interdisciplinary approaches that integrate sciences, arts, local knowledge, and Indigenous perspectives. The exhibition *Arctic InfraScapes* (2023) and other multimedia projects initiated by the international platform ArtSLInK (Arts, Science, Local, and Indigenous Knowledge) used an audio-visual language and recent digital realms to express concepts and ideas about the future of the Arctic *hard* and *soft* infrastructures affected by the climate change. The article presents the Indigenous scholar and curator's perspective on the form and process of creating multimodal narrative(s) based on the ArtSLInK methodological approach. It seeks to showcase how this approach provides grounds for analyzing the possibilities and challenges associated with converging diverse knowledge systems. (OZ and VK)

**KEYWORDS**: Arctic, infrastructure, ArtSLInK, transmedia storytelling, exhibition

> "The function of art is to do more than tell it like it is—
> it's to imagine what is *possible*." Bell Hooks (2008)

Over the course of the past several million years, Earth's climate has exhibited alternating periods of warmth and cold, driven by a multitude of natural factors. Yet, the contemporary era finds humanity at a crossroads, where anthropogenic activities have reached a scale at which they wield the potential to trigger profound and potentially catastrophic global consequences (Morton; Burtynsky et al.). Moreover, Indigenous communities have little access to subsistence resources both due to climate change, and infrastructure-driven industrial development. To address these

ambiguities, we need "some way to register, communicate and address these changes in natural–cultural worlds" (Gabrys and Yusoff 2). Art, literature, and media have the power to raise awareness, evoke emotions, catalyze conversations, and inspire collective action. Creative expressions can bridge the gap between complex scientific data and public understanding, making climate issues more relatable and urgent for a wider audience. Cultural narratives, traditions, and Indigenous knowledge systems can provide invaluable insights into sustainable practices that have stood the test of time. By highlighting the ArtSLInK (Arts, Science, Local, and Indigenous Knowledge) methodological approach, the article seeks to showcase possibilities and challenges associated with converging diverse knowledge systems. It employs a combination of theory and practical engagements to map interconnected phenomena and methods of inquiry and identify potential areas of synergy and collaboration between art, science, and Indigenous knowledge. The article presents the Indigenous scholar and curator's perspective on form, process, and analysis of creating various multimodal narratives based on ArtSLInK's methodology that was originally formulated by authors in collaboration with Andrey Petrov. It emphasizes the role of transmedia storytelling as a means to bridge diverse knowledge systems and explores how digital media can be utilized to communicate and express the convergence of different ways of knowing.

In our efforts to bring together diverse narratives, we draw insights from experiences in the Arctic, a region traditionally depicted as an empty space with harsh climates and polar bears (Shields). Only recently has this public imagination begun to shift, thanks to the challenges posed by Indigenous communities, who rightfully consider the Arctic as their home (Watt-Cloutier). Exploring polar aesthetics, scholar Lisa E. Bloom links racial, sexual, and gendered violence to environmental destruction. While contributing the least with traditional lifestyles, these Indigenenous communities became the first ones to experience the effects of climate change as the Arctic is warming four times faster than the rest of the planet (Rantanen et al.). Shortening ice and winter road seasons hinder transportation accessibility for communities in the continents, while permafrost degradation leads to coastal erosion and infrastructure damage (IPCC). However, infrastructure issues are the ones that play an ambiguous role in the Arctic that require close attention. Melting ice opens up access to resources and maritime transportation across the Arctic Ocean—which is what led to the colonization of the Arctic and settlers' migration in the first place. As this colonization was formulated as an endeavor to "conquer the

permafrost" (Shiklomanov et al.) and "Mastering the North" (Slavin), the ultimate efforts were made to isolate humans from the environment (Jull). One of the outcomes resulting from such framing, which we witness today as most Arctic residents live in cities, is the estimated several billion dollars of infrastructure damage caused by climate-induced permafrost degradation (Streletskiy et al.). The multidimensional and intricate human–environment relations embedded in Arctic infrastructures provide an opportunity to focus on frozen infrastructures that remain misunderstood and inadequately explored (Kuklina et al.). Deep cultural foundations underlying the notion of infrastructure require us to engage in discussions about environmental humanities.

In this paper, we provide a larger context of relations between Arctic infrastructures and future imaginaries' understanding, which require convergence of diverse sources of knowledge. Moreover, we underscore the notion and relevance of digital environmental humanities as a methodological tool essential for navigating the complexities of these relationships. Subsequently, we share our insights gained from organizing the Arctic InfraScapes exhibition, where our endeavors focused on uniting Indigenous and non-Indigenous scholars, artists, and community representatives to collaboratively generate knowledge. The lessons derived from this experience hold significance not only for grasping the intricacies of infrastructures, but also for delving into alternative human–environment relationships that must transform to effectively address climate change and other environmental injustices.

**Arctic infrastructure(s) and future imaginaries**

Infrastructure is a critical way for humans to engage with each other and the natural environment. According to Brian Larkin, it consists of built networks facilitating the exchange of goods, people, and ideas, and their ontology based on the fact that "that they are things and also the relation between things" (329). Infrastructure encompasses both hard or built structures, and soft elements, such as social, economic, and cultural relationships, including the arts. Infrastructures serve as the foundation for various activities and are studied across multiple disciplines (Furlong; Easterling; Petrov). Moreover, nature and non-human life forms are considered as infrastructure in recent research (Carse; Barua).

Recently, digital technologies have become essential components of both hard and soft infrastructure, particularly in the post-digital era (Negroponte; Cascone). In this context, Digital Environmental Humanities

(DEH), an emerging interdisciplinary field, offers a compelling approach to the study and understanding of the complex interactions between human activities, cultural contrasts, and the natural environment using digital tools and methodologies. It is primarily rooted in the broader realm of Environmental Humanities (Nye et al.). DEH's domain encompasses an array of dynamic interactions between nature and culture, which vary across different societies and historical eras. These interactions extend beyond mere physical structures; they also encompass the intricate social fabric woven from a tapestry of artifacts, language, artistic expressions, ideas, attitudes, and an ever-evolving sense of place.

The concept of infrastructural imaginaries, building upon Sheila Jasanoff and San-Hyun Kim's notion of sociotechnical imaginaries, delves into the interplay between infrastructure planning, lived experiences, and potential futures (Jasanoff and Kim). Imaginaries are not merely abstract ideas; they are also actively constructed and wield significant influence over cultural norms, societal values, and policymaking. They are also linked to the role of technology within infrastructure, traditionally seen as a blend of nature and human-made elements. The envisioning of the future holds a prominent place within the realms of social sciences and humanities; however, the role of the arts in this context is intricate and demands further theoretical exploration and practical engagement.

While conventional discourse on the relationship between science and the arts often views the latter as a means of communicating scientific results, we advocate for a new methodology, since, as Gunther Kress explains, the world of communication has changed and is changing still because of a vast web of intertwined social, economic, cultural, and technological changes. Another reason for revising relationships between art and science is connected with the growing interest in sustainability science, where the key is the "involvement of actors from outside academia into the research process" (Lang et al. 25).

We argue that no single perspective or knowledge system can adequately address the complex issues associated with infrastructure development in today's world. However, when artists, scientists, local communities, and Indigenous people collaborate, they bring their unique perspectives, expertise, and ways of knowing the world around them to the table. This collaboration enriches the discourse surrounding infrastructure development and its implications for society and the environment, advocating for more inclusive and sustainable solutions. By involving multiple stakeholders, this approach emphasizes the convergence of diverse

perspectives and knowledge systems, promoting infrastructure projects that are not only functional, but also culturally sensitive, environmentally sustainable, and socially equitable.

**In search of new approaches: art, science, and arts-based research (ABR)**

The idea of the inherent disparities between art and science often finds its roots in Charles Percy Snow's renowned *The Two Cultures'* perspective. Nonetheless, an alternative perspective posits that arts and sciences are co-dependent phenomena, emphasizing that scientific knowledge alone remains insufficient for addressing the multifaceted challenges facing humanity (Bullot et al.; Gabrys and Yusoff). Throughout history, art and science have mutually complemented each other to understand the world and engage diverse audiences, thereby instigating motivation for change. Furthermore, both art and science draw upon common cognitive approaches (Bullot and Reber). In her 2002 TED lecture, Mae Jemison eloquently expressed that "our mission is to reconcile, to reintegrate science and the arts." In her opinion, the divide originated centuries ago, now reaching a critical juncture, and persisting in the belief that the arts and sciences are separate, and fashionable disinterest in either domain could potentially lead to grave consequences.

In recent years, the discourse on the communication between science and art has become more important than ever. Scientists and engineers are increasingly adopting art and design methodologies to enhance their creative and critical thinking. Similarly, artists and designers are assimilating knowledge emanating from experimental, theoretical, and computational sciences into their research. This fusion is commonly referred to as ArtScience (Edwards). Its historical evolution is rooted in the natural sciences, where scientists have sought to employ artistic techniques and practices to conceptualize their work in more innovative and imaginative ways (Malina). Representatives from the social sciences have also ventured into the realm of ArtScience, viewing it as a hybrid form that ultimately yields an emergent synthesis between art and science.

Another approach involves fostering communication between science and art through the method of arts-based research (ABR).[1] Coined by Elliot Eisner, ABR is presently characterized as an approach that employs the arts to explore, understand, portray, and even question human actions and experiences (Baden and Wimpenny; Wang et al.). Art is not seen merely as a tool for observing and describing empirical processes, but as a

dynamic and innovative method that pushes the boundaries of integrating artistic practices with traditional research methodologies.

ABR, as a diverse qualitative research method, employs various artistic mediums to explore and grasp research problems, subjects, or texts. It enriches qualitative research by emphasizing the construction of meaning in data collection and involving participants through artistic expressions (Barone and Elsner; Leavy). It often integrates art creation with conventional research methods like interviews, focus groups, or ethnography. ABR can be utilized for generating, disseminating, or interpreting research, frequently manifesting through exhibitions, installations, or performances. Its methods often embrace participatory approaches, empowering participants as research collaborators. They engage in creative self-expression using various art forms, such as poetry, drawing, mapping, collage, photography, participatory video, digital storytelling, and performance at any research stage. Empowerment may engage participants in making decisions about various aspects of the art-making process, including data selection, analysis, and guiding research to explore topics relevant to their experiences.

Consequently, ABR facilitates more profound dialogues than traditional qualitative methods and supports discussions on complex or sensitive issues. By utilizing narrative, visual, audio, and experiential art forms, ABR unveils latent knowledge as participants attribute meaning to their experiences in non-verbal and non-written ways. The emotional resonance of art encourages audiences to engage in profound, empathetic, and unconventional reflections on others' experiences.

As a relatively nascent field of inquiry, ABR's terminology and definitions vary among scholars. While numerous artistic forms and methods are available, there often exists a dearth of guidance on their practical application within a research context. This can pose challenges for newcomers to ABR seeking a comprehensive understanding of available options, their interrelationships, and their practical utility within the research community (Finney and Cresswell). Consequently, the conceptualization of this research approach remains a challenge, and the editors of the volume titled *Critically Evolving: Critical Approaches to Arts-Based Research* emphasize the necessity for more thoroughly theorized and critically informed approaches to ABR, despite some notable advancements in the field (Harris et al.).

Nevertheless, it is important to acknowledge that regarding art as a formal methodological approach in academic research is a relatively recent

development. We are still in the ongoing process of formulating and refining our positions and understanding how art can be systematically applied as a method in the realm of academic research (Greenwood; Norström et al.).

**Arts, science, local and Indigenous knowledge (ArtSLInK)**

As noted earlier, the discourse on converging diverse knowledge systems has gained attention across scientific disciplines and creative domains. Additionally, there is a growing recognition that Indigenous knowledge cannot be treated as an extractable resource separated from the place, people, and culture that gave rise to it (Thomas). Simultaneously, the deep and holistic human-environment relationships developed by Indigenous peoples are crucial for understanding the current climate crisis and for restoring balance, harmony, environmental sustainability, and societal well-being (Odora-Hoppers).

In the US context, rapid Arctic changes proved the necessity of collaborative work between scholars and Indigenous communities, leading to the creation of one of the National Science Foundation's 10 Big Ideas dedicated to the Navigating the New Arctic program. One of the program's requirements is engagement with at least two knowledge domains to be eligible for participation. While this requirement meant that any two knowledge domains could be present, for instance, social and natural sciences, it sparked multiple research projects engaging with Indigenous communities in the Arctic. This and other initiatives prove that co-production of knowledge between Indigenous and non-Indigenous scholars and communities is becoming one of the critically important practices of research in the Arctic (Yua et al.; Degai et al.).

Even less collaboration between different knowledge systems has been done in the field of Indigenous arts (Hauck). There are efforts by Indigenous artists to critically examine colonialism and extractivism, such as works by Annie Pootoogook to explore colonial trauma (Bloom) and Sami artists protesting against dam construction (García-Antón et al.). An example of arts-based research for knowledge co-creation is the combined efforts of water monitoring and management practitioners with Indigenous youth in the Grand River and nearshore Lake Erie in Canada (Ho-Tassone et al.).

Founded in 2019, ArtSLInK actively addresses this knowledge gap as a cross-arts and knowledge co-production platform. Devoted to fostering collaborations among various knowledge systems, ArtSLInK engages in

community-based research and organizes events, exhibitions, performances, and participatory cultural initiatives. A primary objective is to map and unite diverse perspectives and knowledge systems through various media, thereby facilitating open discussions on the topic. The overarching goal is to create shared understandings and solutions for addressing the challenges of climate and environmental change.

ArtSLInK began its exploration of converging dissimilar knowledge systems with meetings and workshops before the COVID-19 pandemic. The global crisis necessitated a swift transition from physical gatherings to virtual meetings, resulting in limited tangible outcomes. However, this challenge spurred us to embrace digital means. Utilizing a multifaceted approach that incorporates ABR methods, storytelling, and various digital media outlets, we embarked on a journey to cultivate the realm of transmedia storytelling.

Transmedia storytelling, also known as transmedia narrative or multiplatform storytelling, remains a relatively recent and evolving field with an open definition. According to Henry Jenkins and Renira Gambarato et al., transmedia storytelling is not only about replicating content across different media platforms but rather creating immersive world-building experiences that unfold, evolve, and generate new and relevant content. While TS has mainly been associated with entertainment and fictional narratives, it is important to note that the same evaluative criteria applied to fictional transmedia projects can also be effectively used to assess nonfiction transmedia endeavors (Kerrigan and Velikovsky). Nonfiction transmedia storytelling represents largely uncharted territory, inviting exploration and innovation to inform, educate, and engage audiences in entirely novel and impactful ways (Scolari 49).

Storytelling has been a fundamental aspect of human communication throughout history and serves as a tool to bridge contemporary information technology and ancestral wisdom. Indigenous communities have adopted digital storytelling to revitalize their cultures and languages (Baloy; Degai and Thom). It has also become a crucial instrument for creating new artistic representations rooted in Indigenous perspectives, which offer a distinct understanding of humanity's place in the world (Wallner and Jandl). From the outset, the ArtSLInK team incorporated transmedia storytelling into its methodological toolkit. Faced with limited mobility and communication during the COVID-19 pandemic, we placed a significant emphasis on digital storytelling as an innovative form of ABR that combines storytelling, teamwork, and technology. Digital storytelling

seamlessly blends various media elements like photography, text, audio, voiceover, hypertext, and video, making use of rapidly advancing digital tools and software to create compelling narratives (Dusi et al.).[2]

Our initial digital storytelling project, "Domesticating Landscapes: Re-considering Settlers' Perspectives on Arctic Cities," was showcased at the 10th International Congress of Arctic Social Sciences (ICASS X 2020).[3] The next venture, undertaken as part of the scientific project "Informal Roads," continued to harness the power of digital storytelling. In the summer of 2021, we combined in-situ artist observations with rigorous physical geography measurements and in-depth interviews conducted with the local and Indigenous communities during the expedition in the Baikal region, significantly expanding the project's scope. Integrating local and Indigenous knowledge into our art-science collaboration framework offered a holistic understanding of the environment, cultural sensitivity, and the preservation of invaluable cultural heritage (Agrawal "Dismantling"; Battiste and Henderson).

The project's outcomes, a digital presentation titled "Remote Roadscapes and Beyond," along with the photo exhibition "Martian Taiga," were well-received during the Arctic Social Science Week (ASSW) in Tromsø, Norway, initiating discussions on the role and significance of Indigenous knowledge in artscience explorations.[4]

As we continue our journey at ArtSLInK, we remain committed to contributing to this unexplored frontier, recognizing its potential to shape the future of storytelling and knowledge convergence. In our pursuit of pushing boundaries, we actively seek additional methods, particularly those proposed by digital environmental humanities, to further enhance and refine the approaches that ArtSLInK represents. Our dynamic and inclusive program incorporates workshops, hands-on field experiences, and exhibitions, all designed to bridge the gap between scholars, artists, and the public. The multi-year exhibition program, "Arctic StoryWorlds," transcends traditional exhibitions; it is a living narrative unfolding over several years. Through this program, we aspire to create immersive, multi-sensory experiences that transport visitors into the heart of the Arctic, exploring its diverse cultures, ecosystems, and challenges. Each installment of the program serves as a chapter in our ongoing exploration and collaboration, inviting the public to join us on a journey as we uncover the hidden depths of this unique region.

**Arctic InfraScapes 2023**

The exhibition "Arctic InfraScapes" was installed during the Arctic Science Summit Week at the University of Vienna, Austria, on February 18–24, 2023. Alongside our other multimedia projects, the exhibition employed the power of audio-visual language to convey the concepts and ideas regarding the future of Arctic infrastructures profoundly impacted by the climate-induced degradation of frozen structures.[5] The exhibition itself stood as a collaborative endeavor, uniting scholars and artists engaged in various scientific and artistic projects pertaining to the Arctic region.[6]

**Figure 1.**
Arctic InfraScapes–2023.
View of the exhibition at the Vienna University in Austria.
Courtesy of Olga Zaslavskaya.

While developing the exhibition concept and its display layout, we critically evaluated several theoretical frameworks. Infrastructure can be analyzed from at least three distinct perspectives: as an object, a network, and a system (Zandvoort and van der Vlist). Given that this marked the inaugural exhibition in the series of "Arctic StoryWorlds," we accorded primacy to artistically representing the infrastructural objects. Whenever feasible, we sought to illustrate the intricate web of relationships and interdependencies inherent in the infrastructure network, where nature, humanity, and the built environment coexist and interact.

The term "infrascapes," in this particular context, serves a multifaceted purpose (van der Wal et al.). Firstly, it directs our attention to landscapes that can be scrutinized as material, social, or mental constructs. Irrespective of the analytical approach employed, landscapes are invariably regarded as products of dynamic interactions between the natural world and human agency. The human impact on landscapes becomes particularly evident when considering infrascapes. The second consideration is based on our reliance on ABR methods and our position at the inception of the "Arctic StoryWorlds" project. Therefore, we resolved to concentrate on a foundational method shared by both art and science: in situ observations. This approach enabled us to capture discourse and initiate discussion on the multifaceted issues of Arctic infrastructure. The relationship between humans and landscapes, especially in the Arctic context, defies conventional research methodologies. Thus, we embraced artistic methods to illuminate the complex amalgamation of materials, emotions, values, and desires enmeshed within the landscape, delineating the transformative process that led to the emergence of infrascapes.

Finally, to succeed with the creation of the exhibition's multimodal narrative, we turned to the concept of the "polyphonic assemblage" (Tsing 24). This concept refers to intricate networks composed of diverse and heterogeneous elements engaged in nonlinear and dynamic interactions. In her work, Anna Tsing elaborates on this concept to illustrate the entanglements between various human and non-human modes of existence, each characterized by distinct temporalities that converge only contingently, giving rise to indeterminate transformations. The notion of polyphony, often employed in music theory to depict the simultaneous amalgamation of multiple independent melodies or voices, finds a parallel in the realm of social and cultural analysis, where polyphonic assemblages denote the interplay between an array of social, cultural, political, and economic elements that generate complex and multi-layered structures. These elements encompass individuals, organizations, technologies, media, and ideologies, all engaged in interactions that influence each other across various dimensions, shaping a dynamic and ever-evolving system. What sets polyphonic assemblages apart is their capacity to engender emergent properties that cannot be discerned in any of the individual components alone. This concept proves invaluable in deciphering the intricacies of contemporary societies and the interplay among diverse social, cultural, environmental, and technological facets. It emphasizes the need to adopt a holistic and transdisciplinary approach to the study of complex phenomena

while acknowledging the importance of diversity and heterogeneity of actors shaping social structures and processes (Leavy; Lang et al.; Bernstein; Hansson and Polk).

The exhibition begins by showcasing the natural infrastructure elements that define the Arctic region: snow, ice, and permafrost (Laptander). These components of the Arctic environment were represented through a series of captivating installations created in collaboration between artists, scholars, and local and Indigenous people.

Beili Liu's work "Arctic Mending/Snow Mandala" is deeply rooted in her ongoing research within the Circumpolar North. Through the lens of handcraft, labor, and the experiences of Arctic Indigenous people, Liu delves into pressing environmental concerns and geopolitical shifts.[7] In a fragile Arctic landscape, Liu combines human action with the urgency of the climate crisis, weaving together a narrative of hope and healing through on-site performances. The focus on the act of weaving, as one of the oldest surviving crafts in the world, allows her to extend its meaning beyond the simple act of producing garments; it weaves together the tapestry of human existence itself. In the context of Arctic clothing, the intricate relationship between weaving and garment construction takes on a particularly vital role. Diana R. Ewing and Christyann M. Darwent emphasize the critical importance of understanding how thread technology influences the engineering of Arctic clothing. This understanding is indispensable when it comes to ensuring the protection of individuals in the unforgiving and harsh environmental conditions that define year-round habitation in the Arctic. In this context, the failure of a seam could prove not just inconvenient but potentially fatal. The connection between weaving and survival, in this case, becomes abundantly clear. It is a testament to how human ingenuity and creativity have been harnessed to adapt to even the harshest of circumstances, turning the act of weaving into a tool for survival.

Liu's installation highlights the interplay between words and the deep-rooted meaning of weaving and mending in traditional culture. This interplay underscores the idea of care and survival on a global scale. Weaving, in this context, symbolizes more than just the physical act of creating clothing; it represents the interconnectedness of humanity. It illustrates how the threads of culture, tradition, and craft are interwoven, binding societies and generations together. In essence, weaving transcends its utilitarian purpose, becoming a powerful symbol of resilience, cultural continuity, and the indomitable human spirit. It weaves together not only

threads and fabrics but the stories, history, and wisdom of generations, ensuring that they endure, much like the fabric of Arctic clothing, in the face of the most challenging conditions.

Quite a different representation of the Arctic environment is offered by Andrey Petrov and an Indigenous Sakha scholar Stanislav Ksenofontov, who emphasize that Arctic Indigenous communities have long relied on natural cryogenic resources—ice, snow, and permafrost. Their collaboration with Indigenous Sakha artist Maryana Marakhovsky resulted in an art object "Snowflake" that visually represents Sakha culture and its reliance on snow. It serves as a unique visual representation of text data, akin to word clouds, highlighting culturally and socio-economically important traditional terms interwoven together in the Sakha ornaments.[8]

The frozen world narrative deepens with the addition of *The Bull of Cold*, a story rooted in three Sakha legends that symbolize the ancient beliefs of the Sakha people. These tales are shared by Indigenous Sakha scholar Vera Solovyeva.[9] They depict the bull of winter, an underworld inhabitant carrying illness and greed, as a symbol of the universe's dark side. In contrast, the horse, an inhabitant of heaven, represents wealth and prosperity. The Middle World of humans is the only place where these mythical beings from different realms can intersect. This narrative weaves a tale of the ongoing struggle between life and death, drawing connections to natural phenomena throughout the calendar year as observed and inscribed by the Sakha people in their ecological knowledge. This knowledge is passed down through generations in the form of poetic legends. For instance, the annual short-term warming in February is explained as the *Bull of Cold* losing one horn. Subsequent sharp cold snaps and blizzards occur when the *Bull of Cold* fiercely resists retreating. Spring finally arrives when the creature loses its second horn and heads back toward the Arctic Ocean.

Continuing the exploration of the underestimated value of the frozen matter, the authors of the other three installations examine the qualities of permafrost—the frozen ground of soil and water persisting for extended periods. It has long remained an invisible component of the Arctic's frozen infrastructure, providing essential support for landscapes and the built environment (Kuklina et al.). The artworks centered around permafrost offer a diverse range of perspectives, blending both artistic and scholarly approaches, highlighting its important ecosystem services, and shedding light on the profound transformations within this frozen terrain due to the relentless advance of climate change. They capture the essence of permafrost's metamorphosis in unique and thought-provoking ways.

One such example is "Mosaic" by Yulia Levykina, a poetic representation of the permafrost structure, which the artist likens to "shards of ice or colored crystals in a child's kaleidoscope," emphasizing how these fragments complement and overlap, creating a dynamic and ever-evolving pattern.[10] Levykina perceives it as a reflection of human activity, extending not only across the surface but also delving deep into the Earth. Here, natural processes intertwine with the impact of human presence, resulting in a mosaic that embodies the unique amalgamation of soil, rock, and ice. By deliberately selecting transparent materials, the artist allows viewers to peer through layers of light, unveiling a captivating transformation of colors: from the cold, wintery transparencies of blue, indigo, and amethyst to the penetrating heat, melting, and metamorphosis embodied in ochre, orange, and ruby hues. The mobility and mutability of each layer give rise to a multi-dimensional mosaic, enabling viewers to perceive one layer through another. The pulsation of cooling and heating creates a captivating polygonal pattern, an intricate dance that mirrors the dynamic interplay of forces within the permafrost landscape.

Artist Nikki Lindt, on the other hand, approaches the permafrost through a sensory journey that combines visual and auditory elements. Lindt's art captures the in-situ thawing process through both brush strokes and underground recordings. This immersive experience invites visitors to witness the gradual transformation of this frozen landscape, urging them to slow down and listen deeply. Lindt's underground soundscape, which features the melting of snow and ice in the Arctic soils, emphasizes the need for a more intimate connection with this sonic ecosystem to foster a profound sense of interconnectedness, stewardship, and hope.[11]

Meanwhile, Olga Lo's installation, "Zombi Fires," serves as a stark reminder of the evolving challenges facing the Arctic due to climate change. After particularly hot summers, peatlands that were formerly protected by permafrost, become so dry that if a fire ignites, it can penetrate underground and continue to smolder beneath the snow throughout the entire winter. In the spring, these fires rekindle and resurface, hence the name "zombie fires."[12]

**Figure 2.**
Arctic InfraScapes–2023.
Installation "Zombi Fire" by Olga Lo.
Plexiglass, 70×40×20 cm, 2022–2023.
Courtesy of Olga Zaslavskaya.

Wildfires, ignited by lightning strikes or human activities, are currently sweeping across the Arctic at an unprecedented pace. Although wildfires have traditionally played a role in the natural dynamics of Arctic boreal forest and tundra ecosystems, rising temperatures have escalated their frequency and magnitude. At the exhibition, we showcased a series of art books titled "Tempus Ignis," crafted by Zosya Leutina, drawing inspiration from the narratives and research undertaken by a local scholar Natalia Krasnoshtanova in collaboration with a research team of "Informal Roads" project (Kuklina et al.). These art books were complemented by a performance titled "Under the Dome," designed to encapsulate the harrowing tale of a forest encroaching upon a village:

> It is engulfed in smoke, visibility is lost, and transportation links are interrupted. The inhabitants guess by the remains of ash burned in the rapid flames, by its shape, how far the fire is from the village, and from which side it comes. The village disappears from the route map, from the satellites, and perhaps relocates to another realm, a deaf world of smoke and fires, awaiting transformation or, perhaps, its conclusion.[13]

First encounters with wildfires can leave unforgettable impressions. During the expedition to the Siberian boreal forest in 2021, while navigating the intricate web of informal roads, the team witnessed wildfires along their path. The fusion of smoke and the reddish dust created an otherworldly Martian landscape, which subsequently became a central element in the digital exhibition "Red Taiga." This exhibit featured photographs captured by photographer Stanislav Podusenko and accompanying text by Vera Kuklina. Some of the photographs became a part of the exposition in Vienna, telling the story of the relationships interweaving extractive industries, humanity, and landscapes.[14]

**Figure 3.**
Arctic InfraScapes–2023.
Photographs from the series Red Taiga by Stanislav Podusenko.
Digital print, 3 pieces, 80×120 cm, 2021.
Courtesy of Olga Zaslavskaya.

The exhibition team comprised artists, scholars, local and Indigenous knowledge holders, curators, and designers. In ArtSLInK, our goal is not to transform scholars into artists but to provide them with an opportunity to unleash their creativity and explore alternative modes of expression when presenting their scientific work to colleagues and the wider public. As a result, the artworks featured in this exhibition vary across several parameters. For instance, some have developed through long-standing collaborations, while others are an outcome of emerging research initiatives. One such example is an album created by an international team

of scholars, who participated in an expedition to Northern Mongolia to build collaborations with Indigenous Dukha and Darkhad communities and gain insights into their relationships with animals, informal pathways, and the landscape.

The album was meticulously crafted and tailored for these communities to share the impressions and discoveries of the expedition. The use of the Mongolian word "МӨР" as the title of the publication and installation added depth and cultural relevance to the work. This word encompasses various forms of imprints, including animal trails, vehicle tracks, ground-level building footprints, and rock surface carvings.[15] For researchers, these images serve as indispensable tools for documenting observed landscapes, forming the basis for further scientific analyses (Moreau et al.). For instance, the utilization of drone imagery has offered the means to capture some moments that narrate the evolving cultural landscapes of the Indigenous people. An exhibited print of the mosaic of drone imagery of the Bayanzürkh village demonstrates the precarious position of the settlement on the confluence of two rivers in the area, which is particularly susceptible to floods. In the lower river vicinity, the imagery captures gers, that is, more traditional nomadic dwellings designed for easy relocation. They represent adaptation strategies to respond to environmental challenges developed over multiple generations. Conversely, in the upper reaches of the river, one encounters the presence of newer, more permanent structures, which, while symbolizing a level of modernization, are concurrently exposed to heightened risks in the event of natural hazards.

**Figure 4.**
Arctic InfraScapes–2023.
A print of the mosaic of drone imagery of the Bayanzürkh village taken by Dmitrii Kobylkin, orthorectified by Oleg Sizov. 2022–2023. Resolution 10.4 cm, 2023. Courtesy of Olga Zaslavskaya.

Meanwhile, the artists employ these images to convey broader narratives that delve into the layers of history imprinted on these landscapes. For instance, the presence of khirigsuurs or deer stones, ancient rock carvings, serves as evidence of the ancient traces left by nomadic civilizations (Bayarsaikhan). Inspired by these original deer stones, artist Lo created several linocut stamps, establishing a tangible connection between art, history, and the exhibition's visitors, enabling them to immerse themselves in the culture of the Mongolian world.

In the context of our rapidly urbanizing world, a significant portion of the Earth's land surface bears the indelible marks of human activities. Roads, in particular, serve as distinctive features that connect remote Arctic regions and form a crucial component of Arctic infrastructure. These roads, ranging from informal pathways traversing boreal forests to the Mongolian steppe and urban thoroughfares, offer a rich subject for analysis through various scientific methodologies, including the utilization of space imagery and remote sensing. Within Arctic cities, roads can be scrutinized further by employing specialized software applications.

Collaborative efforts between artist Leutina and an international team of geographers have yielded two art projects. The journey began with an exploration of informal pathways in the city of Nadym in the Northern Russian Federation and extended to Fairbanks in Alaska. This artistic endeavor culminated in the creation of ceramic ornamental tiles featuring reimagined motifs inspired by urban paths. In addition to the artifacts, a zine was produced, offering insights into the stages of the project and showcasing graphic works that depict entire neighborhoods and intersections, complete with schematics illustrating the movements of city residents. As the artist emphasizes, in this work, she studies the morphology of pedestrian flows in the city using drone imagery, Google Maps, OpenStreetMap, and the Strava app. The goal was to highlight the key visually representative nodes and intersections of the paths of city dwellers and to rework this into an ornament that could be a kind of the face of the city, reflecting both parts of its individuality and its similarities with other cities.

Continuing her work with Arctic cities and their paths, the artist together with remote sensing specialist Victoria Miles and a student Diana Khaziakhmetova took a close look at the streets from the pedestrian perspective, thus changing the focus of analyses and observations, describing their approach and art object. As a person traverses a city, occasional glances at their surroundings reveal the city's character—whether it is lush and inviting, or stark and concrete. This assessment hinges on the prevalence of trees throughout the urban landscape, such as in alleys, roadside plantings, and parks. Thus, the city unfolds as a dynamic, ever-changing canvas, where colors, emotions, shadows, sunlight, temperature, and the interplay of open spaces and cozy corners all play their part. For the artist "this proportion and this dynamic picture . . . is unique in every city."[16] The flipbook is an attempt to show this picture, in which all of the impressions of a pedestrian are represented by the frequency and shades of colors; it can be flipped to make a cartoon depicting the holistic color impression of the city route.

Urban infrastructure was explored more in detail in the other four installations. The shifting focus of analysis is a distinctive characteristic of another collaborative project "South of No North." This project centers around a series of photographs captured by Max Sher in the northern Swedish cities of Luleå and Kiruna. The photographs underwent manipulation and interpretation from both cultural and geographical perspectives. As Kelsey Nyland and Jacob Tafrate have emphasized in the

description of their installation, the objective was to transform the viewers' perceptions, shifting their gaze from conventional depictions of the cities' everyday built environments to aerial representations derived from satellite images that extend beyond the visible spectrum, capturing electromagnetic ranges imperceptible to the human eye.[17]

Yet another view and approach were used in the installation and performance by Aleksandra Ianchenko in collaboration with scholars Robert Orttung and Johan Sandström. Participation in the field studies in the Sweden Arctic and close work with the project team helped Alexandra to capture the palimpsest nature of the Arctic cities resulting in the blog "Sketching Atmospheres of the City," a series of urban sketches and a performance CITY-ON-LINE conducted simultaneously by the participants being physically in three different countries—Estonia, Sweden, and the US.[18] Digital artistic performances emerged as a result of the integration of digital technologies. Incorporating a wide range of media (sound, video, animation, and interactive elements), they allow artists to explore and combine various forms of expression, pushing the boundaries of what art can be.

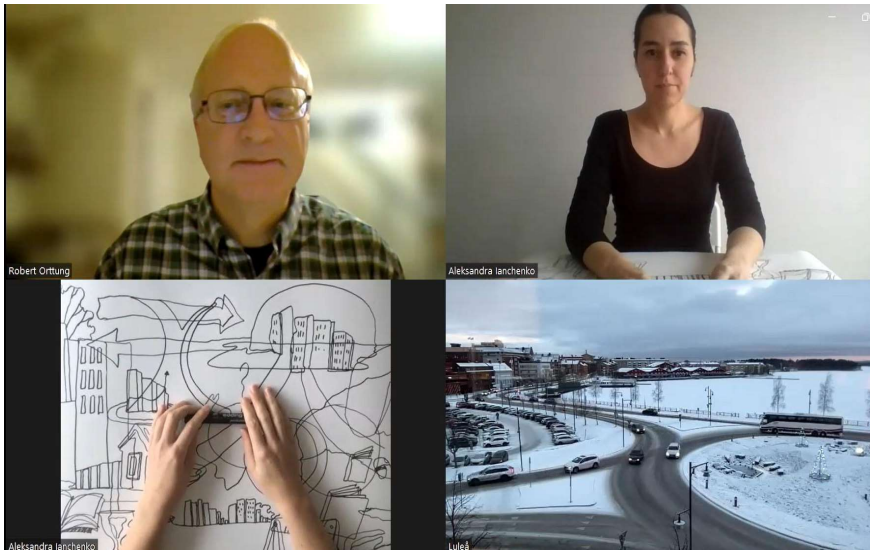


**Figure 5.**
The CITY-ON-LINE performance by Aleksandra Ianchenko, Robert Orttung, and Johan Sandström (2023). Courtesy of Olga Zaslavskaya.

Closely intertwined with the overarching theme of Arctic urban landscapes and their future is a collaborative project *Organizing Rocks.*[19] Sandström, along with his colleagues Tommy Jensen from Stockholm University and Magnus Fredriksson, a local artist in Kiruna, offered a distinct perspective in the analysis and representation of Arctic cities. The project explores the profound impact of human interventions in the landscape and the subsequent alterations to the ecological dynamics of these regions. Its main focus centers on the Kiruna mine in Sweden, located on the traditional land of a Finnish-speaking minority and the Indigenous Sami community. This state-owned mine serves as the nexus within a vast infrastructural mega-system in the northern region and thus raises questions regarding the delineation of a mine's boundaries—where it begins and ends—and the allocation of responsibility for its environmental and societal impacts.

This theme was continued by a social anthropologist Olga Povoroznyuk, who presented in her installation the Arctic maritime infrastructures in Kirkenes, Norway; Nome, Alaska, USA; and Tiksi, Russian Federation. In the description of her installation, she writes:

> For a long time, the Arctic has been constructed as a region experiencing unprecedented climate and environmental changes, resource extraction, Indigenous movements, and growing connectivity, with the Arctic Ocean often referred to as "the new Mediterranean." . . . Geopolitical tensions and security concerns might soon become the main drivers of infrastructural change along the Arctic coast affecting the futures of transport infrastructure projects and Arctic coastal communities entangled with them.[20]

**Conclusion**

The exhibition works with different types of layers in space and time that allow artists and scholars to create new meanings in the form of visual narrative as a part of a transmedia storytelling project "Arctic StoryWorlds." Collaborations between scholars, artists, and local and Indigenous community members continue to be the backbone of this program, ensuring that it remains a vibrant and evolving tapestry of perspectives.

By focusing on the infrascapes—the subtle and essential elements that underpin the Arctic environment—the exhibition "Arctic InfraScapes"

aimed to foster a deeper understanding of this fragile ecosystem and its significance to the global community. The intersection of art and scholarship in addressing the Arctic infrastructure and consequences of climate change not only raises awareness, but also offers a deeper understanding of the complex issues at hand. Through creative expressions, we gain insights into the evolving Arctic landscape and the challenges posed by climate change, ultimately fostering a sense of responsibility and the hope for a more sustainable future.

In addition to textual communication, it is crucial to utilize the power of multimedia culture to convey information about climate change and its impact on the Arctic and the world. Visual images and audio elements effectively complement texts in this regard. What sets "Arctic InfraScapes" apart is its ability to transcend traditional exhibition formats. It is not just about showcasing art and research; it is about inviting the audience to actively participate in the narrative creation. Visitors are not passive observers but active participants, engaging with the stories, ideas, and knowledge presented. This dynamic interaction fosters a sense of connection and ownership, encouraging individuals to become stakeholders in the ongoing conversation about the Arctic's past, present, and future.

"Arctic InfraScapes" is an immersive exhibition that explores the hidden, intricate, and often overlooked aspects of the Arctic region. Transmedia storytelling serves as an ideal aesthetic form for an era of collective intelligence, where new social structures facilitate knowledge co-production and dissemination within networked societies, as proposed by Pierre Lévy. In this context, art functions as a cultural attractor, uniting like-minded individuals to form knowledge communities (Lévy).

Starting with discussions of the ArtSLInK idea of transdisciplinarity and knowledge convergence and co-production, we continue with the creation of art installations to demonstrate the possibilities of transdisciplinary collaboration between scientists and artists to mutually reinforce both research and creative process through the application of different methods of knowledge production. By shifting the focus from the outcome to the process of the arts, science, and communities' collaboration, it is possible to discover in more depth value-added contributions of collaborative place-based context-specific experiences (for instance, new ways of knowing and thinking, understanding of materials and processes, and learning).

We firmly believe that the integration of methods from digital environmental humanities holds the key to unlocking innovative ways to

explore, analyze, and communicate pressing environmental issues. One area of specific interest is digital mapping and visualization, powerful tools that can transform complex environmental data into compelling visual narratives. Digital storytelling is another cornerstone in our approach, recognizing its potency in conveying complex narratives in a comprehensible and engaging manner. Looking ahead, ArtSLInK is eager to explore the untapped potential of augmented reality (AR) technologies to create immersive experiences that blur the lines between the physical and virtual realms (Hedley et al.). This exploration aligns with our commitment to pushing the boundaries of conventional storytelling, offering users a unique and interactive perspective on environmental issues. These methodologies are not merely theoretical aspirations; they are actively being integrated into various projects within ArtSLInK.

To continue our journey into the Arctic, we plan to expand the "Arctic StoryWorlds" scope and content by inviting Indigenous artists and craft-makers to co-create representations of the frozen worlds through crafty storytelling and proceed with more focused interpretations of the non-human and more-than-human world in the Arctic. We hope that the experience we gained through previous experiments with transmedia storytelling and teamwork will lead to collaborative practices of knowledge and imaginary co-production.

Indigenous arts hold rich symbolism that reflects the reciprocal, respectful, and responsible human–environment relationship. By promoting cross-cultural understanding and appreciation, the platform paves the way for sustainable practices that honor the delicate balance between human cultures, nature, and the remarkable ecosystems of the Arctic. ArtSLInK's work is a testament to the potential of unified efforts, fostering a future where cultural heritage and biological diversity thrive in harmony for the benefit of all living beings in the Arctic and beyond.

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## Notes

1 Since it is a relatively recent field of study, scholars use a wide range of terms and definitions to describe ABR. Thus, Claudia Schnugg has proposed terms like "arts-based initiatives" or "artistic interventions." (5). Researchers in Canada introduced a notion of a/r/tography, which stands for (a)rtmaking, (r)esearching, and (t)eaching (Schultz and Legg). It is a unique blend of practice-based research, situated at the intersection of education and the arts (Springgay et al.).

2 The expansion of new digitally mediated disciplines, such as Digital Humanities (Gold and Klein; Ramsey), software studies (Manovich *Software, Clinical*), digital sociology (Orton-Johnson and Prior), digital art, as well as advancements in machine learning (ML) and Artificial Intelligence (AI), contributes to the growth of both digital storytelling and transmedia storytelling (Berry). During the roundtable organized in conjunction with the exhibition, a small experiment with the AI program MidJourney was presented by Olga Lo. More at https://artslink.space/2023/02/20/roundtable-during-the-arctic-infrascapes-exhibition. Since these innovative approaches are still evolving, we can expect further progress in developing collaborations across diverse scientific disciplines.

3 The project "Domesticating Landscapes" brings together representatives of natural and social disciplines and humanities along with artists and curators to present their works and experiences on the history and current status of the process of Arctic domestication. The digital presentation was put together by the authors of the article with the help of Stanislav Podusenko and other project team members. The presentation is uploaded to the ArtSLInK YouTube channel www.youtube.com/watch?v=XUYCYoC0QeQ&t=771s.

4 "Remote Roadscapes and Beyond" is a digital presentation that amalgamates several ongoing art-based projects, conceived through the collaborative efforts of scholars and artists engaged in on-site investigations within the Siberian taiga. A central focal point of these collaborations is the exploration of informal roads and their overarching influence on the forested landscape. The artistic interpretation of these roadscapes serves as an evocative and thought-provoking medium, inviting the audience to contemplate the indelible human footprint left behind by extractive practices in these remote and ecologically sensitive regions. See the full presentation on the ArtSLInK YouTube channel www.youtube.com/watch?v=2mdzsyxlgsU.

5 The exhibition was held in February 2023, on the premises of Vienna State University in Austria in conjunction with the Arctic Social Sciences Week (ASSW). For more details, visit the e-catalog https://arcticinfrascapes.com and the ArtSLInK website https://artslink.space/2023/04/26/arctic-infrascapes-2023.

6 The representatives of the following projects took part in the exhibition in various capacities: Frozen Commons: Change, Resilience and Sustainability in the Arctic (National Science Foundation, #2127364); Arctic Cities: Measuring Urban Sustainability in Transition (National Science Foundation, #2127364); The Impact of Unofficial Transportation Routes on Remote Arctic Communities (National Science Foundation, #1748092); Building Socio-Ecological Resilience through Urban Green, Blue and White Space; ERC Advanced Grant Project InfraNorth—Building Arctic Futures: Transport Infrastructures and Sustainable Northern Communities (PROJECT-ID: 885646). For more

information about the scope and content of the projects see https://arcticinfrascapes.com/about/ and the respective projects' websites.

7 About Beili Liu's artworks, see https://beililiu.com; for more information about her installation: https://arcticinfrascapes.com/arctic-mending-snow-mandala.

8 Practically all installations and art objects were created in collaboration between scholars and artists as highlighted in the exhibition e-catalog https://arcticinfrascapes.com.

9 The hand-made art book was illustrated by Vera Solovyeva. For more images and details, see the e-catalog at https://arcticinfrascapes.com/the-bull-of-cold.

10 The process of creating this installation was first presented in the digital presentation "Remote Roadscapes and Beyond" at www.youtube.com/watch?v=2mdzsyxlgsU&t=1046s. Also see https://arcticinfrascapes.com/mosiac.

11 More about Nikki Lindt and her projects at www.nlindt.com and https://theundergroundsoundproject.com/about; about the installation *Thaw and Melt. Underground Sonics and Visions* at https://arcticinfrascapes.com/thaw-and-melt-the-underground-sonics-and-visions.

12 More about this work at https://arcticinfrascapes.com/zombie-fire.

13 E-catalog entry for these two artistic works: https://arcticinfrascapes.com/under-the-dome.

14 The digital version of the exhibition is accessible at https://redtaiga.artslink.space. More about the installation: https://arcticinfrascapes.com/red-taiga.

15 The publication is compiled in English and Mongolian. It is downloadable at https://artslink.space/2023/04/24/following-nomadic-tracks-and-trails-in-northern-mongolia-about-2022-informal-roads-expedition-to-mongolia.

16 "Winterly Patterns" https://arcticinfrascapes.com/winterly-patterns is a continuation of the work presented in the digital presentation "Domesticated Landscapes" under the name "Winterly patterns: landscape domestication in footpath meshworks." The art book "Walking, Seeing, Feeling" https://arcticinfrascapes.com/walking-seeing-feeling is part of a new project on cultural biodiversity in the Arctic.

17 The scholars emphasized that while traditional maps provide a geographical reference for the collection of photographs and delineate the extent of the satellite images featured in the exhibition, analysis of satellite images utilizes ratios of segments of the electromagnetic spectrum that lie beyond the visible color spectrum. These remote sensing indices offer a surreal perspective of the ordinary, unveiling hidden elements of the landscape that escape naked-eye observation. The images are generated using the Normalized Difference Vegetation Index (NDVI) and the Ferrous Minerals Ratio (FMR), both of which rely on the shortwave infrared and infrared light reflectance of the Earth's surface to discern specific environmental characteristics. More information at https://must.artslink.space/south-of-no-north and https://arcticinfrascapes.com/south-of-no-north.

18 In her blog https://must.artslink.space/sketching-atmospheres-of-the-city, Aleksandra Ianchenko describes the method of sketching in situ that recently has garnered attention within academic circles as a potent instrument for visual ethnography and the documentation of field observations (Brice). Such drawings provide a physical, emotional, and sensory connection with the observed environment and fuse observation and description within a singular gestural act (Ingold 222).

19 *Organizing Rocks* is a research project about power relations in the mining industry, with case studies from Malmfälten in Sweden and Saskatchewan in Canada. The results were presented in video and sound installations, photographs, and serigraphs at Kiruna City Hall, 11–24 March 2017 and at Luleå City Library, 9–30 Sept. 2017. More at www.organizingrocks.org.

20 The work "Arctic Maritime Infrascapes" combines several approaches to present scientific research: video presentation, infographic poster and the art object "InfraCube." The prototype and scale model were prepared in collaboration with artists Stanislav Podusenko and Olga Lo. https://arcticinfrascapes.com/arctic-maritime-infrascapes.

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