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**Melting Glaciers and the Aesthetic of Sound in
the Age of Global Warming: New
Ecomusicological and Aesthetic Perspectives**

RMA Musicology — thesis

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Abstract

This thesis investigates the sonic dimension of melting glaciers from an ecomusicological perspective. This thesis builds on and extends Jeff Todd Titon's sound ecology, arguing that natural sounds can offer reflections of temporality in addition to attuning ourselves to nature. The central research question of this thesis is: What is the aesthetic worth of these melting glacier sounds, and how does the sonic dimension of melting glaciers contribute to sustainability and ecological resilience? By using the concepts of slowness, hyperobjects, and specters, this investigation takes on a hermeneutic approach to investigating the glacier sounds through the lens of these concepts. Two case studies are introduced. First, recorded by Erin Pettit and her team, bubble sounds escaping the melting ice of glaciers are introduced. It will be argued that these bubbles are aesthetic sounds themselves, offering mediations of temporality. Second, the score of the documentary *Song of Earth*, composed by Rebekka Karijord, will be introduced. As the orchestral music and field recordings of glacier sounds are intertwined and mimic each other, Karijord uses the recordings as musical material. Overall, we can qualify these glacier sounds as musical material, showcasing that we start to see value in different sounds by listening to the world not from a textual but a sounding perspective. Titon's plea to listen to the world with "musically-informed ears" offers understanding and added value to hearing the aesthetic worth of glacier sounds.

Keywords: Ecomusicology, environmental humanities, sound ecology, slowness, hyperobjects, specters, glaciers

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Introduction:

A broad ecomusicological exploration of sounding glaciers

As a humanities scholar living in the current ecological crisis, it feels paralyzing not being able to contribute to finding solutions and advocating for change actively. Writing about natural phenomena like melting glaciers may seem far-fetched or disengaged from Musicology. Yet, from the moment I witnessed a glacier's calving event at age eight on a summer holiday with my parents, I became fascinated with glaciers, especially their groans, sizzles, rumbles, and cracks. I never forgot the tremendous sounds of the ice blocks breaking off and falling. Since then, these sounds have touched me and have been the subject of my show-and-tell in primary school and a geography project in high school. I have never been able to combine my allure to glaciers with my passion for music; the two have always been treated as separate enchantments in my head. This thesis seeks to bridge this personal gap between musicology and glacier studies, exploring the aesthetic worth of glacier sounds.



Me, age 8 trying to save a piece of glacier ice after witnessing a calving event at the Briksdalsbreen glacier in Norway

The climate change conundrum impacts lives worldwide and receives much cultural and scholarly attention across most disciplines. Scholarly inquiries provide research on phenomena associated with climate change and propose solutions, which have, until recently, mainly originated from the beta sciences. Because data, models, and technological advancements are more straightforward in explaining and processing information on climate change, seeking solutions in the beta sciences is candid. Yet, for the past decade, a plea for musicologists to investigate the current environmental challenge from a cultural standpoint has emerged: “Can we scholars in music and sound studies do more than just sound sustainable?”¹ As the origins of global warming and our current grappling with these themes are cultural phenomena, it stands to reason that the humanities have much to contribute to the current discourses on climate change. This thesis contributes to the challenges

¹ Aaron S. Allen, “Sounding Sustainable; or, The Challenge of Sustainability,” in *Cultural Sustainabilities : Music, Media, Language, Advocacy*, ed. Timothy J. Cooley (Champaign: University of Illinois Press, 2019), 62.

posed by environmental catastrophes by investigating the aesthetic worth of the sound of melting glaciers.

Imageries of melting icebergs have become an allegory of climate change and current environmental catastrophes. The ever-growing rifts in these icebergs symbolize the cracks in our ecosystem. Yet, while the *imaginaries* of melting glaciers are omnipresent in news coverages and documentaries, their sounds still must be the subject of critical inquiry. This research project examines the sonic dimensions of melting glaciers and how they have turned into the subject of both scientific and musical material. Drawing upon perspectives from ecomusicology and the environmental humanities, this project argues that the sonic dimension of melting glaciers is a productive focal point for studying the complex relationships between sound, ecologies, and prevalent anthropocentric ideas.

At the heart of this thesis lie two case studies: Glaciologist Professor Erin Pettit's recorded underwater sounds for data analysis and Rebekka Karijord's score of the documentary *Songs of Earth*.² By recording underwater sounds in a glacier bay in Alaska, Erin Pettit's research presents the sounds of melting ice, collapsing shards of ice, bubbles, and trickling water. These sounds will serve as the leading sonic quality of this research project, arguing that these glacier sounds are aesthetic as well as data. Pettit's research provides a varied-sounding database, both in public and closed data repositories. Rebekka Karijord's score of *Songs of Earth* connects field recordings of melting glaciers with orchestral music. Karijord bridges the ecological sounds into the musical domain by transcribing the field recordings into the Western musical system. The soundtrack of *Songs of Earth* will serve as a productive focal point to connect the sonic qualities of glacier sounds to musical analysis. Ultimately, this thesis asks: What is the aesthetic worth of these melting glacier sounds, and how does the sonic dimension of melting glaciers contribute to sustainability and ecological resilience?

This thesis will build on and extend the scope of ecomusicological perspectives, especially Jeff Todd Titon's concept of sound ecology, to emphasize the analysis of these two case studies. Ecomusicological scholarship—as a subdiscipline of musicology and sound studies—aims to determine the boundaries of the field and its objects of study. However, as will become apparent in this alinea, the subjects and entry points are so vast and varied that a more precise definition proves challenging to provide. In 2012, Alexander Rehding distinguished between two distinctive

² Erin C. Pettit, "Passive underwater acoustic evolution of a calving event," *Annals of Glaciology*, 53 no. 60 (2012): 113–122; Rebekka Karijord, *Songs of Earth (Original Motion Picture Soundtrack)*. OONA Recordings AB, 2023, Spotify, <https://open.spotify.com/album/0o8KF0PGGNz60kmRvl60He?si=M-sk7EUkQxOTUkHzaFTL2A>.

categories of ecomusicological inquiry: one based on ‘apocalyptic’ ecomusicology, focusing mainly on research translating into academic activism, and ‘nostalgic’ ecomusicology that focuses on the ‘nostalgic’ cultural memory of nature in musical works.³ This division is helpful in the context of this thesis as Rehding posits that by deconstructing music, we better understand the rhetoric and authority of the term ‘nature.’ Yet, this deconstructing seems to conflict with ecological aims and acuteness.⁴ The main challenge for ecomusicology, according to Rehding, is the bridging of this deconstructing nostalgic tendency of music with a sense of urgency as is prevalent in other arts.⁵ The deconstruction of the terminology of ‘nature’ both in a ‘nostalgic’ and ‘apocalyptic’ way can help navigate the discussion of glacier sounds in relation to the musical domain. This division serves overarching themes and topics. In Rehding’s definition, Kirsten Paiges’s research on nature-depictions in Wagnerian theater, David Kendall’s discussion of cosmic ecomusicology based on Greek philosophies, and Sabine Feist’s exploration of musical composition based on location and geographic memory —among others— all fit the ‘nostalgic’ category.⁶ An overarching theme of discussion within Rehding’s ‘nostalgic’ category centers around the temporal aspect of music. Music has the capacity to depict the sounds of natural phenomena that are (becoming) extinct, both by using these actual sounds and by using music inspired by these phenomena. These ecomusicological issues are tied up with complex questions of time and temporality. Disentangling these questions can help provide greater awareness of the current environmental crisis.⁷

This thesis incorporates Rehding’s ‘nostalgic’ category, arguing for its power to create awareness and address a feeling of urgency and need for cultural change. Rehding’s argument of deconstructing music in the ‘nostalgic’ way will be connected with the acuteness of climate change as notions of nostalgia will mainly be discussed in light of the disappearing landscape of the Arctic and the loss of biodiversity in the area. I will argue that the sounds of melting glaciers mediate notions of loss and nostalgia. As Lisa Coulthard has pointed out: “the sense of desolation for absent

³ Alexander Rehding, “Ecomusicology between Apocalypse and Nostalgia,” *Journal of the American Musicological Society* 64, no.2 (1 August 2011): 409–14.

⁴ *Ibid.*, 411.

⁵ *Ibid.*, 412.

⁶ Kirsten Paige, “‘Art and Climate’ and the Atmospheric Politics of Wagnerian Theater,” *The Opera Quarterly* 35, no. 3 (2019): 147–78; David Kendall, “‘All nature sings, and around me rings the music of the spheres’: Christianity and the Transmission of a Cosmic Ecomusicology,” in *Ecotheology in the Humanities : An Interdisciplinary Approach to Understanding the Divine and Nature*, ed. Melissa Brotton, (Lanham: Lexington Books, 2016), 119–139; Sabine Feisst, “Allô, ici la Terre: Agency in Ecological Music Composition, Performance, and Listening,” in *On Active Grounds : Agency and Time in the Environmental Humanities*, ed. Robert Boschman, and Mario Trono (Waterloo, Ontario: Wilfrid Laurier University Press, 2019), 102.

⁷ Feisst, “Allô, ici la Terre: Agency in Ecological Music Composition, Performance, and Listening,” 107.

or lost solace usually found through positive connections to landscape, environment, homeland, and space. More specifically [...] a sense of ‘environmentally induced distress,’ of which ecological catastrophe is a significant driver.”⁸

Taking a decisive impulse from Rehding’s ‘apocalyptic’ category, this thesis draws on political and geographical subjects. Scholarly works by Donna Potts about the political representation of Irish landscapes through music, Michael Silvers on politically charged songs about the droughts in Brazil, and Kyle Devine’s work on the ecological footprint of the music industry all exemplify this kind of inquiry.⁹ The commonality between these pieces of scholarship is their rootedness in more immediate environmental activism through musical practices. In addition to the ‘nostalgic’ dimension of eco-musicological inquiry, this thesis also draws on a more activist stance by grappling with music that includes the sounds of melting glaciers, symbolizing an immediate need for change and action to preserve biodiversity on the planet.

As my inquiry into melting glaciers draws out connections to both ‘nostalgic’ and ‘apocalyptic’ dimensions, as defined by Rehding, it bears mentioning that Rehding’s distinction might not be as clear-cut or rigid as it may seem at first glance because not all scholarly works fit the boundaries of these categories and transcend them. Yet, the difference in categories can help navigate the epistemology of my argument. In 2013, Aaron Allen created the first entry on ecomusicology in *Grove*. In it, he stated: “Ecomusicology, or ecocritical musicology, is the study of music, culture, and nature in all the complexities of those terms. Ecomusicology considers musical and sonic issues, both textual and performative, related to ecology and the natural environment.”¹⁰ Even though not very clear-cut, this broader definition better fits ecomusicological works that focus on interdisciplinary approaches. This broader definition fits this thesis because my analysis uses concepts from other disciplines. By building on Rehding’s distinction between ‘nostalgic’ and ‘apocalyptic’ ecomusicological approaches, this thesis tries to bridge the gap between these categories, committing to Rehding’s challenge of finding urgency and acuteness through ‘nostalgic’ notions. Fitting this definition, my thesis considers both the sonic and the musical issues regarding

⁸ Lisa Coulthard, “Haunted by Extinction: Sounding an Arctic Uncanny,” in *Haunted Soundtracks: Audiovisual Cultures of Memory, Landscape, and Sound*, ed. K. J. Donnelly and Aimee Mollaghan, (New York: Bloomsbury Academic, 2023), 108.

⁹ Donna L. Potts, “Music in Stone: Ecomusicology and the Burren,” in *Contemporary Irish Writing and Environmentalism: The Wearing of the Deep Green*, (Cham, Switzerland: Palgrave Macmillan Cham, 2018), 39–68; Michael B. Silvers, *Voices of Drought: The Politics of Music and Environment in Northeastern Brazil*, (Urbana: University of Illinois Press, 2018); Kyle Devine, “Decomposed: A Political Ecology of Music,” *Popular Music* 34, no. 3 (2015): 367–89.

¹⁰ Aaron S. Allen, “Ecomusicology,” *Grove Music Online*, 25 July 2013, accessed October 27, 2022.

glacier sounds related to their natural environment and our scientific and cultural explorations of these sounds.

This thesis will thus follow Allen’s plea that urges music scholars (and humanity scholars at large) to consider sustainability and ecological resilience.¹¹ He urges scholars to step away from the anxious feeling of Humanity scholars not being able to contribute to ongoing discussions of crises because Humanities research feels like a less ‘obvious’ fit.¹² By addressing both musical activism and “wasteful” standards of musicological research, he aims to rally scholars to at least think about sustainability within their field of study. He asks questions regarding the continuous habit of saving, storing, and containing music. Is sustaining always the way to go? However, he also addresses issues relating to aesthetics: how can listeners and music influence cultural actions and ethics?¹³ Allen highlights that contributing distinctively to the sustainability challenge can be abstract and distant for music scholars, but scholars might have to engage since so much is at stake.¹⁴ Building on Allen’s critical questions of aesthetics, much of my discussion is focused on the aesthetic dimension of glacier sounds: what is their sonic worth, and how can it help us understand and grapple with the complexity of the phenomenon that we call global warming? Can glacier sounds contribute to a cultural shift in engaging with glaciers and the Arctic or create a higher sense of urgency within the global population regarding climate change? In what way can the sound of melting glaciers—that is, their sonic representation— help overcome the geological distance between the Arctic and our day-to-day life?

I will unpack these issues by building and extending the scope of Jeff Todd Titon’s sound ecology.¹⁵ In his book *Toward a Sound Ecology*, he poses the question: “What would happen if we took music and sound, rather than text or material object, as the basis for our being in, understanding, and acting in the world?”¹⁶ Titon reviews his question from several vantage points, departing from a ‘nostalgic’ ecomusicological focus —describing his surrounding landscapes of birds and trees— to argue for a change in ontology; humanity should start to listen to surrounding

¹¹ Aaron S. Allen, “Sounding Sustainable; or, The Challenge of Sustainability,” in *Cultural Sustainabilities : Music, Media, Language, Advocacy*, ed. Timothy J. Cooley (Champaign: University of Illinois Press, 2019), 61–73.

¹² *Ibid.*

¹³ *Ibid.*, 63.

¹⁴ *Ibid.*, 69.

¹⁵ Jeff Todd Titon, *Toward a Sound Ecology: New and Selected Essays*, 255.

¹⁶ *Ibid.*, 3.

ecologies and realize a mutual dependence between these ecologies and humankind.¹⁷ Sound, he argues, cannot be detached from questions of ecology and the environment. As all entities vibrate to call attention to themselves, and all beings with membranes mimic these vibrations when coming in a closer radius of the vibrating entity, we are all in co-vibration. By attuning our listening to incorporate all sounding entities and ecologies actively, he contends that we can work toward an ‘ecological rationality’ —a rationality in which interrelation between all life and ecologies is deemed important and is incorporated in our decision-making and serves the “common good”—instead of, as Titon describes, our current economic rationality that is built on Western neo-liberal traditions.¹⁸ Our ecological rationality should extend our community to include other species. Intraspecies communities are all in cooperation with each other and thus are all one ecological community. Making rational ecological decisions should incorporate the well-being and support of all entities within these communities.

Ecological sounds are the main subject of my research. Thus, Titon’s philosophy of attuned listening and sound ecologies will be a common thread throughout this thesis and will be referred to in each chapter. Every chapter will show different ways of rethinking sound and music through the lens of sound ecology, attributed to the importance of hearing, understanding, and grappling with these sounds to create new modes of sustainability and resilience. However, Titon does not intensely engage with glaciers besides stating that they are vibrating entities.¹⁹ Therefore, I propose investigating philosophical concepts such as Lutz Koepnick’s concept of slowness, Timothy Morton’s concept of hyperobjects, and Avery Gordon’s conceptualization of specters, to extend Titon’s scope.²⁰ Each of these concepts will help critically disentangle the sounds and music in my case studies, showing the complexities and conundrums entangled in these sounds regarding questions of temporality, spatiality, and injustices. In so doing, I seek to show that the concept of sound ecology is complex and multilayered and has implications for our understanding of the role and modalities of listening, not only arguing for attuned listening but attuned listening for understanding the complexities of these sounds, better highlighting our relativity toward them and

¹⁷ Ibid., 274.

¹⁸ Ibid., 261–264.

¹⁹ Jeff Todd Titon, *Toward a Sound Ecology: New and Selected Essays*, 259.

²⁰ Lutz P. Koepnick, “Introduction,” in *On Slowness: Toward an Aesthetic of the Contemporary* (Columbia University Press, 2021), 9–24; Timothy Morton, “Ecology without the Present,” *Oxford Literary Review* 34, no. 2 (December 2012): 229–38; Avery Gordon, “Introduction to the New Edition,” in *Ghostly Matters: Haunting and the Sociological Imagination*, 2nd ed. (Minneapolis: University of Minnesota Press, 2008), xvi; Julie Cruikshank, “Are Glaciers ‘Good to Think With’? Recognising Indigenous Environmental Knowledge,” *Anthropological Forum* 22, no. 3 (2012): 239–250.

offering tools for reconceptualizing our relationships with these vibrating entities. Broadening this scope can help to highlight the aesthetic worth of these sounds and offer us tools for new modes of resilience and sustainability during the current ecological crisis.

This thesis will explore the aesthetic worth of melting glacier sounds through three independent yet interrelated chapters. The first chapter, *Glacial Intermission*, is a literature review that will serve as the theoretical framework throughout this thesis. This chapter will follow Mieke Bal's argument that research in the Humanities should be grounded in concepts rather than methods; this thesis' concepts (as method) are thus explored in this chapter.²¹ Critically engaging with the three main concepts of this thesis —slowness, hyperobjects, and specters— the first chapter provides the groundwork for the case studies discussed in the subsequent chapters. All these concepts work separately as interpretative and conceptual tools to explore issues relating to the sound of glaciers. Introducing Lutz Koepnick's understanding of slowness helps to grapple with questions of co-temporality and the aesthetic tools to understand slowed-down processes in current accelerating times.²² It is essential to acknowledge that the sounds of melting glaciers mediate some complex ideas of slowness and help to understand the melting of ice as a process. Timothy Morton's philosophical concept of hyperobjects provides perspectives on entities existing in vast temporal and spatial domains, offering an understanding of grappling with such complex structures as glaciers and climate change.²³ Considering glaciers as hyperobjects helps to explore the "object-ness" of glaciers and their temporal and spatial position. Avery Gordon's understanding of specters and haunting as ways to show patterns of social injustice and abusive systems that ask for recognition and acknowledgment will be combined with Julie Cruikshank's anthropological research on the Yukon Indigenous people and their relationship with glaciers.²⁴ Understanding air bubbles in the ice as stored memory contributes to yet another understanding of the glacier sounds. Therefore, by referencing the works of Koepnick, Morton, Gordon, and Cruikshank, this thesis expands Tilton's framework of sound ecology.

The second chapter, *Sounding Bubbles*, introduces the first case study: the sound of bubbles escaping from melting ice recorded, stored, and analyzed by Erin Pettit's team. Before closely interacting with the bubbles' sounds, this chapter draws parallels between Tilton's sound ecology and

²¹ Mieke Bal, "Introduction," in *Travelling Concepts in the Humanities: A Rough Guide* (University of Toronto Press, 2002), 3–21.

²² Lutz P. Koepnick, "Introduction," 9–24.

²³ Timothy Morton, "Ecology without the Present," 229–38.

²⁴ Avery Gordon, "Introduction to the New Edition," 239–250.

Pettit's work. These sounds will be analyzed through the conceptual lenses of slowness, hyperobjects, and specters. As I will argue, the sound of these bubbles can provide us with new ways of understanding and grappling with the immense entities we call glaciers. Understanding the potential cultural interpretations and effects of hearing these sounds can evoke a greater sense of urgency. The aesthetic worth of these sounds, then, is bridging the spatial and temporal distance between the day-to-day life of many and the melting of the Arctic, potentially creating new modes of resilience along the way.

Extending the discussion of glacier sounds to the musicological domain; the third chapter focuses on the soundtrack for the documentary *Songs of Earth* by Rebekka Karijord, a musical production that incorporates sounds recorded in the natural environment of the documentary into an orchestral composition.²⁵ The soundtrack will be analyzed using Denise Von Glahn's musical analytical approach to understand musical compositions with glacier sounds.²⁶ This analytical approach offers a musicological understanding of orchestral compositions incorporating glacier sounds by analyzing the composition in three categories —rhythm, pitch, and timbre. I will combine this analytical approach with the concepts developed in the first chapter—rhythm & slowness, pitch & hyperobjects, and timbre & specters. Because Rebekka Karijord has deliberately and notoriously transcribed the recorded natural sounds in Western musical notation, the interaction between the orchestra and the natural sounds are intertwined and provides an interesting case study for analyzing this soundtrack in musicological and conceptual terms. As such, this soundtrack is a pertinent case in point to study how glacier sounds 'become' musical materials. Combining these sounds and composition can be understood as mediating ideas of nostalgia and thus encompasses an inherently political dimension. These musical applications of these sounds can help listeners translate and interpret the sound of melting glaciers, understanding the problematic nature of hearing these sounds in this capacity, contributing to a greater sense of urgency and advocating for cultural change.

The conclusion will revisit the findings in chapters one, two, and three and highlight the interrelatedness of the three concepts. Analyzing sounds and music through these concepts separately allows zooming in on specific details and inner workings of the melting glacier sounds. Yet, all three concepts are connected and overlap. Combining the three concepts helps to create a general overview of the domains these sounds navigate, creating an overall understanding. Second,

²⁵ Rebekka Karijord, *Songs of Earth (Original Motion Picture Soundtrack)*. OONA Recordings AB, 2023, Spotify, <https://open.spotify.com/album/0o8KF0PGGNz60kmRvl60He?si=M-sk7EUkQxOTUkHzaFTL2A>.

²⁶ Denise Von Glahn, "Relational Capacities, Musical Ecologies, Judith Shatin's Ice becomes Water," in *Sounds, Ecologies, Musics*, ed. Aaron S. Allen and Jeff Todd Titon (Oxford University Press, 2023), 177–97.

by revising Titon's sound ecology, I argue that extending Titon's scope to include a conceptual analysis of natural sounds—both in a sonic and musical context—provides a deeper understanding of what a sound ecology entails and creates a more precise analytical grounding for musicologists to apply in ecomusicological analysis of sounds and music.

Hence, this thesis attributes to the emerging field of ecomusicology, building on and extending Titon's scope of sound ecology. Providing new conceptual understandings of natural sounds can contribute to a change in cultural behavior and a shift from economic rationality toward ecological rationality.²⁷ In addition, imageries of melting glaciers and the disappearing Arctic are familiar and omnipresent in presenting climate change; this thesis attributes familiarizing the sonic dimension of glacier sounds. Understanding the importance of this sonic dimension from a scientific and aesthetic standpoint is crucial in understanding how glaciers work, how they melt, and how humanity grapples with this phenomenon. Bridging the gap between musicology and glacier sound studies is not only a personal goal but also serves as a platform to answer Allen's plea for humanity scholars to engage with problems surrounding climate change. Images might speak louder than a thousand words, but sounds echo urgency. Listening to these glaciers will help build new modes of resilience and sustainability in the age of climate crisis.

²⁷ Jeff Todd Titon, *Toward a Sound Ecology: New and Selected Essays*, 261–264.

1. Glacial Intermission:

Temporal gaps and their co-temporality

“Audible or not, vibration and its media organize space and time, and in this way, they can not only provide abstract models of the social order but also actively create and sustain the rhythms and structures of banding and bonding, solidarity and resistance.”¹

We all know glaciers make sounds, vibrate, and are continuously moving. Especially the cacophonous cracking sound of significant calving events —the breaking off of an iceberg from a glacier and falling into the water— is portrayed in news coverages, documentaries, and YouTube videos. Calving events have become an allegory for climate change, embodying the warming of the planet and rising sea levels both in images and in sound. Unsurprisingly, these sounds are subject to exploration and interpretation in various ways. A simple internet search on “glacier sounds” offers a variety of applications, such as scientific warnings of what these sounds mean, writing songs with these sounds, using the sounds as sound effects in compositions, or other musical applications such as ASMR —autonomous sensory meridian response— functions. All these applications work with sounds that were recorded explicitly for the goal it was intended for. What would happen if we start seeing the various applications of these sounds more broadly, not merely understanding them in the light of what they can attribute to listeners in a specific context or function? Sound is a transgressive vehicle for (re)imagining what it would be like to overcome anthropocentrism. If we, for a second, stop listening from an anthropocentric vantage point, we might be surprised by what we closed our sensorium off of and find new ways of listening and interpreting the world around us.

This first chapter of the thesis is foundational to its theoretical framework. It delves into the concepts of slowness, hyperobjects, and specters that I consider while conceptualizing and understanding the liminal space in which glacier sounds operate. I have based my literature review on these concepts to create this framework. This aligns with Mieke Bal's recommendation to do Humanities research based on concepts rather than a methodology.² According to Bal, the rigidity of specific scholarly disciplines can be surpassed by using concepts because concepts are not limited

¹ Lutz Koepnick, “On Resonance.” In *Resonant Matter : Sound, Art, and the Promise of Hospitality*. New Approaches to Sound, Music, and Media (New York, NY: Bloomsbury Academic, 2021), 22.

² Mieke Bal, “Introduction,” in *Travelling Concepts in the Humanities: A Rough Guide* (University of Toronto Press, 2002), 3–21.

to the boundaries of a single specialty; these concepts are “traveling concepts.”³ Traveling concepts cross these boundaries, making interdisciplinary approaches more comprehensible and feasible. A theoretical framework built on concepts is best suited as my work situates itself with current discourses on Ecology, Media and Art Studies, Philosophy, Gender studies, and Musicology. By creating a framework on the concepts of slowness, hyperobjects, and specters and exploring their meaning concerning the sound of glaciers, I aim to understand the sound of glaciers better while contextualizing the abstract dimension in which this thesis operates. Combining these concepts creates new possibilities for exploration and offers a unique perspective on the sound of glaciers. “Concepts are not so much as firmly established univocal terms but as dynamic in themselves. While groping to define what a particular concept may mean, provisionally and partly, we gain insight into what it can *do*. It is in the groping that the valuable work lies.”⁴ Zuleika Sheik’s idea of liminagraphy aligns with this Bal’s plea. As liminagraphy is an approach to knowledge cultivation and is based on the principles of reciprocity, accountability, and relationality, as resisting traditional methods to research phenomena, it is a call to open up our sensorium and our minds to the land and the environment around us, a way of doing life-affirming research.⁵

This chapter provides the conceptual background for analyzing the glacier sound archive and score, arguing that using concepts such as slowness, hyperobjects, and specters makes it possible to investigate what the aesthetic domain of these glacier sounds entails. When glaciers make a sound, they give a signal. These signals are happening at a specific moment in time. Almost like a clock for geological time, the sounds of melting glaciers mark the passing of time. And since glaciers are always sounding, they can be understood as markers of time in general. These markers of time become more apparent when disentangling the sounding domain of glaciers through the concepts of slowness, hyperobjects, and specters. Ultimately, I argue that we need to adapt our way of listening to these sounds and understand them in the context of our applications and the entity as a whole. The aesthetic worth of these sounds lies in these markers of time.

The argument in this chapter is sixfold. First, the chapter will depart from Titon’s description of “the sound of climate change,” arguing that his description of bird and tree sounds is already well-found but misses a more vast temporal perspective and connections with ecologies that are not in our current surroundings. Current musicological research on glacier sounds in

³ Ibid., 5.

⁴ Ibid., 11.

⁵ Zuleika Bibi Sheik, “Liminagraphy: Lessons in Life-affirming Research Practices for Collective Liberation,” *Journal of Critical Southern Studies* 4 (2023): 7.

compositions also misses this dimension; thus, a new conceptual framework is needed to extend Titon's sound ecology to a temporal domain. Second, the chapter introduces the concept of slowness, engaging with questions of co-temporality and the idea of slowing down for better reflexive capabilities. In slowing down a liminal space, multiple temporalities and timeframes become detectable and possible to grapple with, including one of geological time. Third, the concept of slowness offers ways to rethink the process of melting ice. This paves the way for introducing hyperobjects as vast and massive structures. By describing these hyperobjects as impossible to contextualize, it will be argued that our current thought patterns and rational capabilities must be adapted to comprehend such massive entities. This helps to contextualize glaciers as objects in time and space. Fourth, looking at current philosophical contributions to sustainability, this adaptation of our rational capabilities is yet to be made possible. Bridging this divide with the conceptualization of irony, the argument moves to mediation and the auditive domain. Fifth, by grounding the argument in sound ecology, the added worth of using slowness and hyperobjects from an auditive perspective is attributed, arguing that listening and sound vibrations can tell much about our relationship with the natural world. This aligns with the concept of specters, which will be introduced next. It will be concluded that the aesthetic worth of glacier sounds can be found in looking at other temporal dimensions and changing our way of listening.

The Sound of Climate Change

In his chapter "The Sound of Climate Change," Titon attempts to describe what climate change sounds like.⁶ Basing his findings on a summer storm near his house, especially the sound of bird choruses (and their future absence) and the snapping of tree branches are on Titon's auditive radar. Notably, mainly the influence of changing bird populations due to climate change captured his attention. As migrating birds have thinner suitable climate strokes to migrate on, specific breeds of birds are forced to move elsewhere, crows become more ubiquitous, and other birds become extinct; the change in the auditive character of bird songs in local ecologies can be characterized as the sound of climate change.⁷ The changing animal population in their natural environments thus influences the environmental sound and how we perceive it. In addition, the increasing amount of storms pulling trees out of the ground and snapping branches in half are also sounds of climate change. These sounds of climate change can be understood as musical momentary consequences of

⁶ Jeff Todd Titon, *Toward a Sound Ecology: New and Selected Essays* (Bloomington: Indiana University Press, 2020), 248–253.

⁷ *Ibid.*, 250–51.

global warming that impact the environment because Titon has argued we should be moving away from poststructural textualization toward new interpretations: “The world is not like a text to be read but like a musical performance to be experienced.”⁸ From an ecomusicological perspective, these sounds are familiar to many people and fit sound descriptions applicable to many locations, experiences, and ecologies. Yet, thinking about the sound of climate change through animal sounds and snapping tree branches is not all-encompassing. How do we conceptualize those sounds in ecologies that we are unfamiliar with, far away, and exist in vast temporal and spatial dimensions? Understanding the sounds of glaciers in this context of ecomusicology is challenging and needs other critical inquiry than birds and trees. Thinking about the sound of glaciers in the context of climate change poses complex issues of time, vastness, perception, and interpretation.

Some musicologists have already engaged with the sounds of glaciers from an ecomusicological standpoint. Denise von Glahn has beautifully demonstrated in her analysis of the compositional piece “Ice Becomes Water” that music is very suitable for recontextualizing glacier sounds within the scope of Titon’s sound ecology.⁹ Because everything evolves around relationality, music as an aesthetic dimension has always been based on interrelationality, rhythms, tonal centers, compositional forms, quoting other pieces, and overtones.¹⁰ These are just a few examples of how music relates to its internal structures, external structures, and itself. Von Glahn argues that by using different rhythmic arcs, central pitches, and timbral textures, the composer Judith Shatin acknowledges the complexity of glaciers and their relationality to everything surrounding them.¹¹ By seeing glaciers as sentient beings and attributing the idea of perception to them, the piece actually thinks *with* the landscape rather than *about* it. It embodies the world’s intertwinement through rhythm, pitches, and timbre.¹² Terminology within the musical domain might not be able to describe or comprehend the complex sounds of glaciers immediately. Still, Von Glahn already developed an analytical approach regarding relationality toward these sounds. These tools are used not only on music inspired by glacier sounds but also on the sounds themselves.

Even though Von Glahn does an incredible job of reframing natural sounds in the Western classical music context, the analysis of the glacier sounds stays within the composition's

⁸ Jeff Todd Titon, “Knowing Fieldwork,” in *Shadows in the Field: New Perspectives for Fieldwork in Ethnomusicology*, ed. Gregory F. Barz and Timothy J. Cooley (Oxford: Oxford University Press, Incorporated, 2008), 29.

⁹ Denise Von Glahn, “Relational Capacities, Musical Ecologies, Judith Shatin’s Ice becomes Water,” in *Sounds, Ecologies, Musics*, ed. Aaron S. Allen and Jeff Todd Titon (Oxford University Press, 2023), 177–97.

¹⁰ *Ibid.*, 179.

¹¹ *Ibid.*

¹² *Ibid.*, 182–183.

boundaries, not engaging with complex issues of time and space intertwined with glacier sounds. We need to critically disentangle these issues and develop an understanding of these interrelated conceptions if we want to understand glacier sounds in the light of Titon's sound ecology. By investigating these glacier sounds through concepts of slowness, hyperobjects, and specters, we can build on and extend Titon's existing framework of sound ecology and provide a framework to engage with these glacier sounds in sound and musical context. However, before applying these concepts to the case studies in chapters two and three, they must be explored thoroughly, which will be done in the upcoming sections.

Slowing down aesthetically

The moving, growing, and melting of glaciers is an inherently slow process, raising questions of temporality. The concept of slowness has recently garnered a lot of scholarly attention, recontextualized mainly by Koepnick in the context of media studies. He investigates how current social structures influence how we perceive the world, both spatially and temporal. In his book *On Slowness*, Koepnick carefully builds the concept of slowness concerning industrialism, modernism, and consumerism, investigating what it means to experience the world through acceleration, speed, and slowness and how individual experiences of acceleration are interlocked with social meaning.¹³ Going fast and accelerating as a society in the current age is something both admired and critiqued and has affected how we perceive time.

“Time today is sensed as going forward, backward, and sidewise all in one; it might often be perceived as chronological and cosmic, geological and modern, local and global, evolutionary and ruptured in one and the same breath. Slowness [...] emerges as a special eagerness to account for and engage with a present marked by such a seemingly overwhelming and mind-numbing sense of simultaneity. It neither hopes to press history back into the singularity of a unified narrative, nor does it desire the end of history in order to challenge the pressures of acceleration. Rather, slowness actively reworks existing perceptions of cotemporality, of the copresence of disjunctive streams of development, in order to warrant the very possibility of experience.”¹⁴

At the heart of his work lies a concern about distinguishing between different types of slowness and modes of temporality. Drawing on photographic and cinematographic artworks, Koepnick mainly focuses on complexifying *aesthetic* slowness. Aesthetic slowness, he argues, can be understood as a medium through which we can experience the present, negotiating the senses

¹³ Lutz P. Koepnick, “Introduction,” in *On Slowness: Toward an Aesthetic of the Contemporary* (Columbia University Press, 20214), 9–24.

¹⁴ *Ibid.*, 12.

into actively and consciously experiencing everything that is happening simultaneously.¹⁵ Yet, there is more to it; rather than helping us to take a laid-back pace stepping into the romanticized rural lifestyle, it is a way of reflecting on ourselves, our conceptions of time, our visions of progress, and our notion of change.¹⁶ Current academic discourses within the media and art domain identify the concept of slowness as a way to slow down, using it as a nostalgic and escapist notion striving to get away from a technologically defined society. Koepnick, on the contrary, critiques this notion and argues that technology plays a vital part in exploring and understanding slowness; experiencing a world of speed and acceleration can only be understood by investigating these technological processes by zooming in temporally, decelerating its mechanisms and establishing “presentness” in the assortment of today’s cotemporality.¹⁷

Koepnick’s notion of cotemporality and “presentness” is further developed in the following chapters of his book, and he even brings this cotemporality to levels of geological time in his third chapter: “Glacial Visions, Geological Time.”¹⁸ By focusing on the work of several artists that encapsulate glaciers and mountain ranges through photography, Koepnick argues that through the use of technology (photography, editing, aviation), a liminal space is created for spectators to reflect on—their relation with— geological time, providing a gateway for spectators to investigate other perceptions of time than their own.¹⁹ By mediating a photographic representation of a glacier’s movements, the viewer is confronted with the slowness of a glacier’s progression and is suddenly inclined to identify the glacier as moving instead of a still object. The distinction between our understanding of how glaciers move and the stillness in which we actually perceive them plays an important part here. Glaciers are constantly moving, progressing their flow, and creating new ripples, crevices, and imprints, yet we see glaciers as stagnant.²⁰ These contrasting perspectives create this limited space in which spectators are confronted with more extensive temporal timelines outside their own temporal perspectives, creating an awareness of co-temporal structures.

For our purposes, as a particularly pertinent case in point, Koepnick grounds his study in the work of photographer Olafur Eliasson. His work unveils this perspective of a glacier’s temporal

¹⁵ Ibid., 15.

¹⁶ Ibid., 65–66.

¹⁷ Tiago de Luca, Review of *On Slowness: Toward an Aesthetic of the Contemporary*, by Lutz Koepnick. *Cinema Journal* 55, no. 2 (2016): 165.

¹⁸ Koepnick, *On Slowness: Toward an Aesthetic of the Contemporary*, 96–132.

¹⁹ Ibid., 131.

²⁰ Ibid., 103.

timeline by experimenting with the speed of perception viewpoints through aviation; the glaciers' continuous motion that is invisible to the naked eye is encapsulated in the images showing changes within the landscaping of the glaciers over time. His work —various photos of the same glaciers taken at different moments in time are presented in a raster of six by seven pictures— negotiates both scientific categorizations and aesthetic variations.²¹ By portraying seriality through his raster, Eliasson underlines the rhythm of scientific research, pursuing truths from a standstill, fixed observation, and comparisons.²² Through the seriality of the pictures, the raster of standstill images stimulates our cognitive abilities of systematic comparison and computation. Our observations of this changing landscape are similar to our current main research structures in which data collection is compared and poured into a mold or graph —we measure the difference in ice volume per photograph and compute these changes into a visual graph. Yet, when reading between the lines, that same raster highlights the gap between the pictures, underlining multiple timeframes that are not accounted for —it is unclear what time has passed between the images.²³ What happens in between the photographs is non-systematic and nonlinear. Koepnick conceptualizes these gaps as unidentified temporal spaces. Eliasson's raster of pictures is not just a schematic chart of how the glacier's motion progresses. Still, because of these specifically highlighted snapshots, the spectators experience their own development of perceptual time.²⁴ We slow down our perception to match the tempo of the glacier's temporal dimension, developing an understanding of how the glacier breathes, moves, and flows, playing with the relation between the subjective and the objective. These unidentified temporal spaces create non-linearity between the pictures and establish structures of representation that transform the photographs into a temporal realm of themselves.²⁵ “Time—the slow time of glacial movement, the accelerated time of aerial travel, the unpredictable time of a viewer's reception—thus emerges, not as a mere sequence of coordinates along a continuous arch, not as something that could be broken up into discrete units and then recomposed to produce seamless impressions of motion, but as a form of energy whose various flows and patterns resist a chart's objectifying fixity.”²⁶ Utilizing and highlighting these unidentified temporal spaces through the aesthetic concept of slowness makes it possible to comprise the scientific and

²¹ Ibid., 102.

²² Ibid., 105.

²³ Ibid., 102, 116–17.

²⁴ Ibid., 17

²⁵ Ibid., 117.

²⁶ Ibid.

aesthetic domains within the same work, which will be reconstructed with the archive of glacier sounds in the next chapter.

Drawing on Alexander Kluge's work, Koepnick visualizes this in-betweenness between stillness and movement —photography and cinematography— through a fire and ice metaphor to explain co-temporality.²⁷ The relation between fire and ice is not contradictory but dialectical. The rapid movement of fire melts away the stillness of the ice, but the melted ice extinguishes the flames of movement. Always inspired by the forces of the other phenomenon, ice resembles the spatiotemporal standstill represented through photography. In contrast, fire enlivens the dead pictures and timelessness by energizing the images in cinematography.²⁸ What emerges when the melted ice extinguishes the flames is an in-betweenness in which a broad range of speeds and temporalities are possible; slow-motion photography is just one example. We, as humans, perceive the glacier as frozen in time, not moving, and at a standstill. Conversely, through Eliasson's work, we are suddenly confronted with melted ice, a slowly moving force in another temporal domain. Thus, the aesthetic concept of slowness reveals this dimension of varying speeds and co-temporality, opening the door to new understandings and renegotiations of time.

Thus conceived, the fire and ice metaphor developed by Kluge is a productive focal point of how cotemporality functions. Slowness can help us access these various temporalities through mediated objects such as film and photography, but what happens if we skip the mediation through photography and go to the unmediated objects and sources themselves, arguing that “nature” in itself is capable of mediation, not just an object of remediation? “Nature is presented as a medium itself, capable of framing and producing views onto the world and onto itself, a site in which formal differences like those between water and ice matter and have the potential to produce both aesthetic pleasure and insight.”²⁹ Again, this aesthetic pleasure and insights highlight the multipurpose of mediating for both scientific and aesthetic goals, as nature has the potential to produce insights and aesthetic pleasure, just as Eliasson's work. If we, for the moment, surpass the philosophical questions that can be raised from this standpoint for the sake of argument and assume that “nature” can produce insights and that “nature speaks,” not just as a renegotiation of humans' sentiment, the claim that glaciers can mediate specific views and frame themselves in their own capacities is not so far-fetched. By slowing down our perception of glaciers, it becomes possible to recontextualize

²⁷ Nora Alter, Nora M., Lutz Koepnick, and Richard Langston, “Landscapes of Ice, Wind, and Snow: Alexander Kluge's Aesthetic of Coldness,” *Grey Room*, no. 53 (2013): 67.

²⁸ *Ibid.*

²⁹ *Ibid.*, 67.

how we understand and analyze glaciers. Slowing down our perception creates leeways in understanding and analyzing immense natural phenomena such as glaciers. By looking at a phenomenon from a different perspective, new points of view emerge. The same goes for looking at glaciers from another temporal perspective; seeing glaciers' movements through another feeling of time makes us understand the movements differently. It becomes possible to reposition our analysis in the glacier as a, as Timothy Morton calls it, hyperobject.

Petrifying Hyperobjects

Timothy Morton coined the concept of hyperobjects to describe massive and complex phenomena humans can never fully understand.³⁰ They are so vastly stretched spatially and temporally that their essence is out of our conceptual grasp. Examples of such hyperobjects are the concept of the never-ending universe, the effects of nuclear weapons, and climate change. We know from calculations and computations that the universe is still expanding. Our solar systems are so spread out that to even talk about it, we need the term lightyears to grasp the vastness of time within our universe. The term lightyear helps us to be able to model our findings and calculations, but really, being and feeling this temporal dimension slow down so immensely is outside our human capabilities. We will never be able to intrinsically grasp this timeframe, no matter how many simulations and calculations we make. The same goes for the temporal scale, in which the effects of climate change are still pertinent to Earth. Morton divided these effects into three different timescales to create a terminology to be able to talk about these different scales: the *horrifying* timescale that lasts about five hundred years, in which 75% of climate change effects are still present; the *terrifying* timescale of thirty thousand years in which 25% of these effects are still existent, and the *petrifying* timescale of hundred thousand years in which 7% of the impact remains.³¹ Especially the *terrifying* and *petrifying* timescales are so vast that we can never fully comprehend their totality and our current positionality towards this.

For our human world to be logical and understandable, we need terms like *here, there, past, future, now, and then*. Through these terms, we position ourselves toward hyperobjects and into our worldly experience without leaving space for other temporal dimensions.³² The concept and understanding of time have always been a human vantage point through which we render our

³⁰ Timothy Morton, "HYPEROBJECTS," *CSPA Quarterly*, no. 15 (2016): 7–9.

³¹ Timothy Morton, "Ecology without the Present," *Oxford Literary Review* 34, no. 2 (December 2012): 233.

³² Ibid.

stability and rationality within the vastness of time and space.³³ Yet, this stability is not as conceptually sound as we want. The concept of *now*, for example, has always been an ungraspable moment in time, an instant through which the future travels to the past and goes into *nowness*; of course, something is occurring at the moment, but we will never be able to create a boundary to catch something in the *now*, what is happening will already have been past.³⁴ It becomes even more complex when rendering these concepts through hyperobjects. As hyperobjects are so densely spread temporally and spatially, time in itself is just a vessel that exists separately from the actual physical universe for our brains to make sense of our experiences.³⁵ Our relation with hyperobjects is then always a question of relativity, consistently positioning the hyperobject's relativity towards ourselves and comprehending only the relative past and future of the hyperobjects concerning our current *nowness*. The *petrifying* timescale of climate change effects is so far away from our experience of *nowness* that even our concepts of *past* and *future* cannot encompass the vastness of a timeframe that spreads a hundred thousand years. We simply cannot relate to it. But what happens if we turn this thinking pattern around? Suppose we position ourselves relatively towards those hyperobjects instead of negotiating space and time only within the timeframe in our grasp—and we can understand from our *nowness* vantage point—we might accept our small timescale within the bigger whole. In that case, the account of the Anthropocene will probably cease to exist.

The Irony of Rational Thinking

The problem with hyperobjects in how Morton introduces the concept is that seeing everything, like climate change, on such a big scale can serve as an excuse for the continuous behavior of human self-interest because we cannot comprehend the consequences of our actions anyway.³⁶ The hyperobject is a borderless aesthetic phenomenon that disorients and creates vagueness; we lose concrete connection to the objects in their totality. This is why Mikkel Krause Frantzen and Jens Bjering—coming from a more activist standpoint—propose to adapt the term to *hyperabject*, using Julia Kristeva's concept of *abject* as a form of bodily waste.³⁷ By using the term *hyperabject*, Frantzen and Bjering argue that we can trace a waste cycle over more extensive time periods,

³³ Ibid.

³⁴ Ibid., 234.

³⁵ Ibid.

³⁶ M. K. Frantzen and J. Bjering, "Ecology, Capitalism and Waste: From Hyperobject to Hyperabject," *Theory, Culture & Society* 37 no. 6 (2020): 87–109.

³⁷ Ibid., 88.

making it easier for humans to relate to it as they can trace the consequences of their actions. Without a way to ground hyperobjects in our current conceptions of time, the concept can be utilized by current major polluters and conservative political parties. If we cannot understand horrifying and petrifying timescales, how can we be responsible for changes that will influence the development of these timescales? We cannot understand how our actions will change the future anyway.³⁸ The hyperobject, on the contrary, creates a physical understanding of our actions by moderating the timescales so that we can ground the consequences of our actions at least partially in our current understanding of time. “The hyperobject traces the temporality of a feedback loop. Having been discarded, junked and excreted in the everlasting process of capitalism, the concrete instantiations of the hyperobject at some point return with a vengeance: Humans consume fish that have consumed the plastic that the humans themselves once discarded. We emit stuff and stuff comes back to us in a process that we are both the subjects of and, to a certain extent, the objects of.”³⁹

Even though tracing a temporal feedback loop is insightful and can help compute data on human influence, actively adapting the concept to criticize Western capitalism is actually the root of the problem that Morton highlights. The hyperobject functions as the scientific understanding of phenomena but leaves little room for aesthetic explorations of the vastness of climate change. Morton argues against the instant need to analyze structures in a way that applies to our current reasoning patterns. The impossibility of understanding the vastness of these objects, a gap in our reasoning skills, makes the concept of hyperobjects so fascinating. Bringing it back to current-day activism completely eludes the concept's possibilities.

Yet, by zooming in on current philosophical discourse on the Anthropocene and climate change, changing this thinking pattern in the way Morton describes might be more complicated than it sounds when described as “simply rephrasing our relative positionality.” If we want to value natural processes in a non-anthropocentric way, humanity must change its ambitions for development, education, healthcare, and money.⁴⁰ We would have to reposition our role as a species in such a way that we don't perceive the world as utilizing resources, profit, and (personal) gain but understand that we have demanded too big of a role, demanded too much space, for the small temporal and spatial realm that we are fit to inhabit as a species —just as Titon's sound ecology. It is widely accepted that humanity has caused the climate to change rapidly. Thus, we as a species

³⁸ Ibid., 102.

³⁹ Ibid., 89–90.

⁴⁰ Ibid., 200.

might be unfit to safeguard the environment that helped our species flourish in the first place.⁴¹ On the other hand, others have argued that because we as humanity evolved in such a way that we developed reasoning, communication, and complex thinking patterns, it could be argued that our species is superior to others.⁴² Our brains are a unique evolutionary product and should be cherished and cared for. The question remains: Should this cherishing of our species continue even if we have to use other resources that result in the demise of different species to keep our capabilities present in the universe's development?

It is precisely this line of thinking that fits the current relational thinking patterns we use to position ourselves toward hyperobjects within our *nowness*. By identifying irony in these thinking patterns, however, we might find a way back to the abstract vastness of the hyperobject. Irony can only be used on something that exists, that is present, but we cannot always consciously grasp or understand. Morton uses irony to argue that hyperobjects have always existed within our realm of thoughts, just not always consciously.⁴³ Irony is always based on something, “[it] is the footprint of at least one other entity, an inner ripple, a vacuum fluctuation that indicates the distorting presence of other beings.”⁴⁴ Irony is used to fill the aesthetic gaps between us and entities near us that are not fully graspable. It is a way for our unique brain to be capable of reasoning and filling these gaps so that we don't lose our sanity and rationality by trying to grasp the totality of things we cannot understand. As the paragraph above pointed out, arguments on understanding how our reasoning and communication can benefit the flourishing of evolution are pertinent. The irony in these arguments is easily traceable: Our unfitness to safeguard our environment can be traced to our incompetence in understanding the more considerable processes of hyperobjects and our role in these processes. Suppose we are so unique in our capabilities that we should cherish our species' and brains' evolution. In that case, we might eventually —on a *petrifying* timescale— be able to comprehend hyperobjects in their vastness and complexity, finally seeing that our role as a species within these more prominent processes was not as crucial as assumed. The fact that we can already detect irony within this line of reasoning brings us back to hyperobjects. Arguing for a hyperobject relies on the irony of our lack of comprehension skills. By bringing everything back into the *now*, to

⁴¹ Darrel Moellendorf, “Hope for the Anthropocene,” in *Mobilizing Hope: Climate Change and Global Poverty*, (Oxford University Press, 2022), 181.

⁴² Hugo Mercier and Dan Sperber, “Introduction: A Double Enigma,” in *The Enigma of Reason* (Cambridge, MA and London, England: Harvard University Press, 2017), 2.

⁴³ Morton, “HYPEROBJECTS,” 8–9.

⁴⁴ *Ibid.*, 9.

a way in which we can grapple with such vast structures, we ironically highlight the existence of the hyperobjects as it is stated that the hyperobject is too complex to understand. Yet, the contextualization of the hyperobject rests upon the existence of hyperobjects in themselves.

Indeed, suppose we find ways to grapple with hyperobjects through irony to fill these gaps in our reasoning skills. In that case, the aesthetic domain is the most well-equipped to explore and comprehend hyperobjects in a way that can help renegotiate our positionality towards hyperobjects. This is precisely what Koepnick does with his conceptualization of aesthetic slowness. By envisioning the slowing down in time through artworks as a way of reflecting upon ourselves and the world, we inherently—even if it is unconsciously—reflect upon our relativity towards hyperobjects. This might well be how we come as close to grasping a hyperobject as we are currently able to, never fully encompassing or understanding, but at least trying to take a step outside our human domain of *nowness* and see the hyperobjects from their own temporal and spatial realm, leaving the *past* and the *future* behind. Ironically, these other ways of viewing a hyperobject can only be perceived through human artworks mediating something in themselves. The artwork becomes a balancing act of mediating the scientific and the aesthetic and the gaps in our understanding so that we as humans might be able to adapt our main reasoning patterns. Then, we can potentially reposition ourselves towards these hyperobjects if the artist does not accidentally re-establish our current thought processes in their own mediating capabilities. Suppose the artwork succeeds in grasping the core of a hyperobject without embedding too much hidden meaning within. In that case, the question remains: what do these hyperobjects themselves, or in this case, glaciers, actually mediate?

From Temporal Gaps to Intermissions

Answering this question from an aesthetic perspective is the most productive way of doing so. We can perceive glaciers as mediating upon geological time by utilizing aesthetic slowness. Within the liminal space of the melted ice, the slowing down and reflecting abilities on changing movements and seeing its continuous flow becomes possible. Slowing ourselves down creates other modes of reflection and analysis critical for understanding the exceptional geological slowness of glaciers.⁴⁵ This becomes especially apparent when looking at the sounds glaciers produce. Koepnick focuses mainly on the visual changes of glaciers over time, but analyzing glaciers' slowness through sound

⁴⁵ Koepnick, *On Slowness: Toward an Aesthetic of the Contemporary*, 23.

provides even more opportunities for broadening the temporal spectrum of analysis. Close-ups and snapshots in images create static; sounds, however, can never be frozen or still.⁴⁶

Once we move to audible sound, we need to rethink the idea of temporal gaps. Using a different aesthetic medium invites different ways of thinking about temporality and temporal gaps. Especially when thinking about Koepnick's argument with the fire and ice metaphor, a liminal slowed-down space is easier accessed through sound than images. Sound only exists in time; it can be slowed down, zoomed in/out on, or sped up, but it cannot be at a standstill. Sounds are constantly moving, never standing still, as photography can. Analyzing the sounds of glaciers creates new possibilities for understanding: The researched materials can only exist in time. Koepnick's examples hinge on *static* aesthetic remediations of the glaciers' temporal dimension, creating a frozen analysis of a continuously changing source. Investigating the aesthetic dimension through a *temporal* aesthetic conceptualization can provide other insights into the glaciers' slowness and the message it is trying to mediate. Sound only exists in this liminal space and is only perceivable in our experience of *nowness* when we listen to something. Whereas the pictures show ice decline in a melting glacier, the sounds these glaciers produce don't necessarily lessen in audibility. The passed time between the glacier sounds is not necessarily temporal gaps but a space for sensing echoes and vibrations; they are intermissions.

I propose contextualizing these gaps in the sonic domain not as a temporal gap, as this is particularly pertinent in the visual domain, but as intermissions. In a play or an opera, we know that the story on stage is not progressing in the intermission, and we do not get new information as spectators. Yet the foyer is filled with sounds reflecting, echoing, and digesting the information we have gotten thus far before diving back into the story world in the next act. The intermission is a temporal space in which we can reflect upon what we have heard. In the intermission of the perceived sounds, we can try to understand what we have listened to, interpret our findings, rethink our positionality, and re-adjust our approach and expectations before continuing. This is fundamentally different than the visual temporal gaps in Eliasson's work, as the temporal gaps are visible simultaneously with the pictures through the rasters. The raster and the images in Eliasson's work highlight a lack of utilizing these in-between moments, not providing as much time and space to reflect the changes over time. On the contrary, the intermission between the sounds creates a space of critical engagement and thinking through our experiences before hearing new sounds or other markers of time, as we can never experience all the sound recordings simultaneously.

⁴⁶ Nora Alter, Nora M., Lutz Koepnick, and Richard Langston, "Landscapes of Ice, Wind, and Snow: Alexander Kluge's Aesthetic of Coldness," 72.

To understand the value of sound in this temporal ecological domain, it is now necessary to turn to Titon's idea of sound ecology. He describes sound ecology as a sort of utopia, a suitable option to rethink humans' positionality towards each other and the nonhuman world.⁴⁷

As is well known, the dominant epistemology among modern Euro-Americans derives from the separation of self from object in which the thinking being contemplates the external world. The separation has enabled humans to engineer the world, but this instrumental rationality has come at the expense of our full sensory connection with it. And in the absence of feeling and knowing that humans are a part of nature, humans have done the planet and its beings, including ourselves, great harm.⁴⁸

Through reconnecting to our sensory experiences —specifically sound— Titon argues that ecological rationality can be reached. Sound travels in soundwaves that create vibrations; if we open our sensorium to these vibrations, we can become aware of the connection between the sender of the sound and the receiver (us). When the ice of a glacier makes a sound, we are immediately connected to it. When we perceive the crackling or booming sound, we are in co-presence, in mutual awareness, with the glacier.⁴⁹ Sound is an excellent way to position your presence in the world; by making sounds, any object can signal that it is part of this world, including glaciers.

Understanding sound as a way to make a connection can get us better attuned to our surroundings. It can be argued that through the co-presence and connection built through vibrations, we can get better attuned to our surroundings and move away from economic rationality —guided by self-interest and personal gain— towards an ecological rationality guided by communal living and interdependence.⁵⁰ “What happens in those moments of sound ontology when we feel our sensations, our being, and knowing centered in sounds? [...] Is it possible utilizing a thought experiment based on a sound connection to erect a just alternative to the alienated communities, neoliberal political economies, and behaviorist ecologies that drive humans toward injustice, and the planet toward extinction?”⁵¹ Connecting with glaciers through their sounds can provide new insights into their current presence and guide our co-occurring and co-living, visiting the auditive

⁴⁷ Jeff Todd Titon, *Toward a Sound Ecology: New and Selected Essays* (Bloomington: Indiana University Press, 2020), 255.

⁴⁸ Jeff Todd Titon, “Ecojustice, Religious Folklife and a Sound Ecology,” *Yale Journal of Music & Religion* 5, no. 2 (2019): 111–112.

⁴⁹ *Ibid.*, 112.

⁵⁰ Titon, “Sustainability and a Sound Ecology,” 261–263.

⁵¹ Jeff Todd Titon, “Sustainability and a Sound Ecology,” in *Toward a Sound Ecology: New and Selected Essays* (Bloomington: Indiana University Press, 2020), 255.

domain of glaciers from another perspective and attuning to their vibrations, as they might be telling us more than we perceive at first glance.

Bringing the hyperobject and slowness to the aural domain can help us reflect upon ourselves and everything around us. Musicologist Alexander Rehding grapples with music and slowness; he argues that our sense of self and our conceptualization of our existence is based on time.⁵² We depend on those concepts of *then* and *now*; we “unfold” over time. The *now* is forever fleeting, and it is impossible to set boundaries around it. The idea that we develop an understanding of our own temporality is closely related to music. Music evolves over time, just as our “selfhood” does, too.⁵³ Using an example of an algorithmic piece by Danny Hillis that lasts approximately ten thousand years, Rehding argues that confronted with long-lasting music that will unfold long after our demise, self-reflection is forced upon the subject.⁵⁴ “The sublime is typically figured as a mixed emotion in which initial displeasure, in the face of incomprehensible magnitude, which could — figuratively or literally— crush the individual, gives way to a sense of affirmation of the self, brought about by reason’s enduring ability to withstand this sensory overload.”⁵⁵ It might then be worth extending Koepnick’s scope of aesthetic slowness to the realm of musicology just as Rehding has already done, investigating this liminal space of temporality further and slowing down in such a way that the sounds of glaciers, separated by these intermissions, can be seen as continuous and flowing, mediating a message through their own temporal framework. Slowness can be seen as a way to create temporal length to create these moments of self-reflection. “Sound art [...] embraces the radiant qualities of sound waves to shape space beyond normative frameworks of focused attention, immobility, and disembodied appreciation, and we, therefore, do well to consider it, not as a self-contained medium or genre, but as a variable set of aesthetic strategies that produce and modulate objects, spaces, and practices of aesthetic experience.”⁵⁶ It is a way for the audience to imagine the unimaginable and becomes then an empirical symbol of the unimaginable, of the hyperobject.⁵⁷ “It is the concreteness of the material object, the ‘empirical symbol,’ that allows us to

⁵² Alexander Rehding, “The Discovery of Slowness in Music,” in *Thresholds of Listening: Sound, Technics, Space*, ed. Sander van Maas (New York: Fordham University Press, 2015), 28.

⁵³ *Ibid.*

⁵⁴ *Ibid.*, 30.

⁵⁵ *Ibid.*, 12.

⁵⁶ Koepnick, “On Resonance,” in *Resonant Matter : Sound, Art, and the Promise of Hospitality*, 26.

⁵⁷ *Ibid.*, 6.

begin to grapple with concepts that would otherwise lie beyond our comprehension.”⁵⁸ The long-lasting composition is liminal aurality.

A glacier in Titon’s sound ecology is then not “merely” a hyperobject but a *sounding* hyperobject, vibrating and co-occurring with its surroundings and perceivers within the same ecology. If we reconstruct Morton’s concept of the hyperobject to a *sounding* hyperobject, we open a pathway to rethink our aesthetic perception of glaciers. Using Koepnick’s notion of slowness to look at glaciers from an auditive perspective and connecting this to a *petrifying* timescale, the sounds of glaciers can be conceptualized as a composition but one that exists in a geological temporal dimension. A glacier’s complete composition can never be fully understood and perceived by humans, not even through a few generations. The glacier’s process is so extensive that the sounds only connect if the full context becomes apparent with time from a different temporal dimension. We need to start to actually listen to the glaciers to understand the aesthetic worth of these glaciers’ sounds and the intermissions between these sounds.

Specters in the ice

Actually, listening to glaciers is not new. As anthropologist Julie Cruikshank has described, the Yukon Indigenous peoples in the Saint Elias Mountains in Canada have always had an intrinsic relationship with the glaciers and ice fields near their territory.⁵⁹ This relationship between glaciers and the Yukon peoples is established, secured, and passed on to new generations through storytelling. Such stories contain warnings that glaciers *listen* to their surroundings, and the consequences of insults to glaciers can result in the growth or the breaking down of the ice sheet, among other things. Cooking meat on glaciers, for example, is a big insult and can result in growing crevices and the cook being “swallowed” by the ice. The stories posit glaciers as sentient beings, as larger-than-human entities that react to their surroundings and human activity.⁶⁰ These stories encompass a broader (sentient) understanding of glaciers but have always been discarded as superstition by Western sciences. Yet, such stories can provide us with insight into the social structures of these communities and their relations with their surroundings. The contribution of Indigenous oral tradition is precious; its contribution is threefold. First, scientific studies are trying to understand climate change and glaciers’ changing physicality, researching these phenomena

⁵⁸ Ibid.

⁵⁹ Julie Cruikshank, “Are Glaciers ‘Good to Think With’? Recognising Indigenous Environmental Knowledge,” *Anthropological Forum* 22, no. 3 (2012): 239–250.

⁶⁰ Ibid., 240

through anthropogenic causes. However, Indigenous storytellers' oral traditions combine social and local histories of the surroundings and landscape. Whereas the Western sciences only look at data-collection and research phenomena that fit their current hypothesis, Indigenous knowledges encompass a more coherent understanding of interlocking histories and societies. Second, scientific research focuses on the physical changes and external causes of melting glaciers. In contrast, in oral traditions, the focus lies not on materiality but on interpretations of interlocking entities such as humans and larger-than-human forces. By focussing on and interpreting these glaciers' sounds, Indigenous people perform ecological rationality, understanding these sounds as telling and being in co-vibration with them. Finally, through oral tradition, these storytellers created new knowledge of events like metamorphic glaciers by focusing on the transactions between humans and non-human persons.⁶¹ They explore the temporal gaps and intermissions by closely listening to the sounds of these glaciers.

Avery Gordon proposes the concept of haunting to suggest that injustices and events from the past leave residue that influences the social structures in the present. She argues that haunting is the way in which abusive power systems fixate attention upon themselves and the impact these systems have on everyday life, especially when these power systems are allegedly over with (for instance, slavery or apartheid).⁶² Haunting and specters represent the presence of systems of repression that are being ignored and in need of recognition and change.⁶³ Speaking through haunting and ghosts is Gordon's method to analyze social phenomena in their acuteness and how they advocate for change. According to Gordon, haunting does not fit our linear conception of time; it actively disrupts distinctions between past and present as it insists on recognition, understanding, and acceptance in ways that are not always immediately visible or acknowledged. The presence of specters through haunting is the residue of the initial trauma conflicted in the past and functions as a vessel of the temporality of trauma. Building on Foucault's conceptualization of subjugated knowledges —what formal knowledge represses in its own institutions and marginalized knowledges outside the official knowledge production of institutions such as universities— Gordon argues that it is challenging to find ways to get these knowledges heard and acknowledged in current institutions but these are the knowledges that can help specters being recognized and

⁶¹ Ibid., 243

⁶² Avery Gordon, "Introduction to the New Edition," In *Ghostly Matters: Haunting and the Sociological Imagination*, 2nd ed. (Minneapolis: University of Minnesota Press, 2008), xvi.

⁶³ Ibid.

acknowledged.⁶⁴ Telling stories and passing along knowledge about the behavior of glaciers based on experiences of sound, smell, and vision as the Yukon people do, serves as an example of these subjugated knowledges. These tactile ways of understanding geological phenomena are dismissed as superstition in mainstream academia and research. Yet, the Yukon Indigenous community has lived together with these glaciers for centuries and found ways to communicate and make sense of these entities before everything had to be explored according to data and specific measurements. Cruickshank posits in her book that this tactile knowledge can teach us an incredible amount of understanding outside our scope of numbers and graphs. As a medium, sound plays a crucial role in investigating these specters. Sound, existing only in time, actively alters the environment and atmosphere through vibration and always carries specters along with it. It has the power to activate and remember. Through sound, we cannot forget and revisit experiences and people. Sound, in essence, has the ability to remember and can help us revisit our knowledge and understanding of these glaciers from various perspectives, knowledges, and histories, recognizing specters in the ice.

At first glance, the connection between glaciers and specters of power systems and social structures may seem unconventional. However, as I will argue in the upcoming section, this connection, building on Lisa Coulthard's work, can be remarkably insightful. It allows us to understand the sounds of ice as an ecological critique, embodying a sense of the 'what will never be again' and melted ice sheets haunted by the destruction and distress caused by oppressive systems of colonialism and imperialism.⁶⁵

Coulthard starts her chapter with the concept of sonic nostalgia: the sonic remembering of sounds that will never be again, such as extinct species, historical objects, and disappearing sounds in our ubiquitous soundscape—such as specific traffic sounds, ringing cash registers, ringtones, Titon's birds, etc. In remembering, archiving, and saving these sounds, we hear the ghosts of the extinct species and the disappeared landscape.⁶⁶ Focussing on films and series, Coulthard argues that, especially in reconstructed landscapes of vanished sonic ecologies, historical films carry the ghosts of foregone landscapes.⁶⁷ By being remediated, "they haunt the present by sounding extinction."⁶⁸ Before she dives into her case studies, she conceptualizes the sonic category of ice

⁶⁴ Ibid., xix.

⁶⁵ Lisa Coulthard, "Haunted by Extinction: Sounding an Arctic Uncanny," in *Haunted Soundtracks: Audiovisual Cultures of Memory, Landscape, and Sound*, ed. K. J. Donnelly and Aimee Mollaghan, (New York: Bloomsbury Academic, 2023), 105–121.

⁶⁶ Ibid., 105.

⁶⁷ Ibid.

⁶⁸ Ibid.

and how this is interrelated with specters and haunting. Silence, whistling winds, animal noises, and the sounds of ice cracks characterize the sonic category of ice. I will demonstrate in the next chapter that this conceptualization can also be used outside a film case study and on the sounding ice itself. According to Coulthard, the sonic haunting of ice consists mainly of two temporally separated specters: one of the past and one of the future.⁶⁹ The immense loss of Arctic Ice in the polar landscapes is not only haunted by the factual disappearance of ice sheets and their complete disappearance in the future, but the Ice as an acoustic entity carries specters of historical documents on exploring the Arctic from a colonial departure as well.⁷⁰

The specters of the Arctic's past are grounded in the conception that colonizer-explorers saw the North as supernatural, otherworldly, out-of-reach, and uncanny. This has always been grounded in ideological, political, and aesthetic orientations.⁷¹ Not only do the ghosts of failed colonial expeditions live in the ice, but the cultural imagination of the spectral powers of the higher North reveals the dissociation and estranging from these landscapes and their peoples as valuable to exploit, hunt, and utilize its resources.⁷² On the contrary, the specters of the Arctic futures haunt us in the loss of possible futures and present us only with grim options: futures of destruction and extinction.⁷³ It is not a future of “not yet” or “no longer” but a future of “will never be again” that haunts the present melting of the ice sheets in the Arctic. This haunting intensifies, especially since the Arctic has become a symbol of the climate crisis. “The Arctic is not merely another landscape haunted by ‘erased histories and voices buried’ (although it is also this); it is a landscape of an absent future, a geography of extinction.”⁷⁴ All these sonic markers are endangered and will become extinct soon if they are not already. The haunting in these sounds is both from the past and the future: the past of oppressing nature and Indigenous people in the Arctic, the future of silence, and the disappearance of the landscape altogether.⁷⁵

Then, by not focusing on the external causes and materiality of the glaciers but revisiting glaciers through the oral tradition of these Indigenous elders and understanding these sounds as specters, it becomes possible to restructure our scientific research of climate change influences not

⁶⁹ Ibid.

⁷⁰ Ibid., 106.

⁷¹ Ibid., 107.

⁷² Ibid., 107–108.

⁷³ Ibid. 108,

⁷⁴ Ibid., 109,

⁷⁵ Coulthard, “Haunted by Extinction: Sounding an Arctic Uncanny,” 118,

from an anthropogenic point of view —one that is fueled by self-interest and self-preservation— but from a rational ecological perspective. It is precisely that which is left out when oral sources are pushed into models and teleological goals that fit environmental research, providing new vantage points and perspectives.⁷⁶ Visiting glaciers from a *perspectivism* point of view —an ontology in which all beings and entities (even glaciers) perceive the world from a distinct point of view— can be a new way of understanding glacier sounds and challenges the Western categories of nature and culture.⁷⁷ It is the “more-than-human” specter that binds everything together. Perhaps this specter is what Morton calls a hyperobject, especially if we see Morton’s definition of specters: “Ecological beings provide insights into the weird way in which entities are riven from within between what they are and how they appear. Another way of putting this is that beings, as a possibility condition for their existing at all, are specters.”⁷⁸ Going away from the object-subject thinking pattern, omitting materiality as a way of doing research, and understanding processes intrinsically and aesthetically connecting to the stories of these Indigenous storytellers might offer new vantage points for sustainability and ecological resilience. As these storytellers create new knowledges by highlighting the ties and transactions between humans and non-humans, they might have identified the glaciers’ intermissions so that we, as humans, with a change of vision and reasoning patterns, can at least conceptualize partially. This way of perceiving the world is the sound ecology that Titon describes.

Perceiving glaciers as sentient beings provides us with new tools to engage with their sound-making; it creates room to think about separate sounds as relational and connected. We just have to hear them from the proper perspective. In using aesthetic slowness to slow down to a glacier’s pace, the formerly separated sounds become intertwined and reactionary upon each other. As our current glacier recordings are too complex to describe in sound or music terms —as they never resemble a single pitch— this slowing down might provide new analytical possibilities.⁷⁹ This provides us with a great opportunity not to try and fit the sound of the glaciers in our current and existing theories of sound but to come up with new concepts and vantage points in which we can understand the sounds the glaciers produce. “As is well known, the dominant epistemology among modern Euro-

⁷⁶ Ibid., 244.

⁷⁷ E. Viveiros de Castro, “Cosmological deixis and Amerindian perspectivism,” *Journal of the Royal Anthropological Institute* 4 no. 3 (1998): 469–88.

⁷⁸ Timothy Morton, “Specters of Ecology,” in *General Ecology: The New Ecological Paradigm*, ed. Erich Hörl, and James Edward Burton (Theory. London: Bloomsbury Academic, 2017), 304.

⁷⁹ Denise Von Glahn, “Relational Capacities, Musical Ecologies, Judith Shatin’s Ice becomes Water,” in *Sounds, Ecologies, Musics*, ed. Aaron S. Allen and Jeff Todd Titon (Oxford University Press, 2023), 179.

Americans derives from the separation of self from object in which the thinking being contemplates the external world. The separation has enabled humans to engineer the world, but this instrumental rationality has come at the expense of our full sensory connection with it.”⁸⁰ Perhaps this new conceptualization should not be formed within our current methodological framework but through other conceptions of connecting with surroundings, such as Tilton’s sound ecology and the Indigenous storytellers that Cruikshank discussed.

Modes of Resilience

This chapter argues that adapting our way of listening and conceptualization of these glacier sounds by using a sound ecology perspective and the conceptualization of glacier sounds by the Indigenous peoples in Northern Canada to frame our understanding of the temporal gaps —or rather, intermissions— can provide new insights into how to understand these sounds. When using this mode of listening in the context of hyperobjects and slowness, we are provided with ways to engage with these hyperobjects actively. The aesthetic worth of these glacier sounds is their possibility for us to understand these vast and massive temporal structures, to slow down, and *listen* to the *sounding* hyperobject. It helps us renegotiate our positionality towards glaciers and the environment, allowing us to actively break the cycle of current economic rationality and our current rational thinking patterns. The next chapter provides a more analytical, hands-on case study in which the sounds of the glacier archive will be recontextualized within the domain of the concepts described here.

Even though slowing down is fruitful for discovering other modes of listening, this slowing down is used as an aesthetic category to rethink current thought patterns on sound. It is not meant as an excuse to slow down ecological and green developments; on the contrary, the aesthetic domain of slowness hopefully charges a speeding up of green developments and environmental structures within our current economies.

To close this chapter off and revisit the opening citation: “Audible or not, vibration and its media organize space and time, and in this way, they can not only provide abstract models of the social order but also actively create and sustain the rhythms and structures of banding and bonding, solidarity and resistance.”⁸¹ This is precisely what I have tried to underline in this chapter. By revisiting how vibrations or sounds persist in time as markers of time and temporal domains, we can open our senses to restructure our understanding of the rhythms of *sounding* hyperobjects and

⁸⁰ Tilton, “Ecojustice, Religious Folklife and a Sound Ecology,” 111–112.”

⁸¹ Koepnick, “On Resonance.” 22.

how these rhythms provide possibilities for living in sound ecology. We just have to be open to it. The aesthetic slowing down functions as a mode of resilience and resistance against the ongoing economic rationality and decisions fuelled by self-interest, hopefully creating solidarity and attributes to co-living societies and species. Let's utilize these concepts to reconnect to our senses and our environment.

2. Sounding Bubbles:

A Musical Ontology of Melting Ice

In my preliminary research, I came across the Sound of Ice project by Professor Erin Pettit, an American glaciologist at Oregon State University. At first glance, the database of sound recordings was helpful to my research question, I was primarily thinking about using this database to describe the sound glaciers make. But after some research into Pettit and her work, I discovered that her philosophy about these sounds and the construction of this database overlap with Titon's sound ecology; thinking about the perspective of sound, or rather a sound perspective, as a way to connect with and interpret the sounding world. This is striking in the opening of her Ted Talk, where she states: "These images [...] tell you the story through one perspective. A visually striking but silent one. What I want to do today is tell you the story through a completely different perspective; through sound."¹ She argues that even though the satellite image of glaciers can help us learn about the glacier's processes, there is much more to learn by listening to what happens below the water's surface. As glacial events are challenging to predict, satellite imagery does not provide enough data to anticipate and understand glacial events. The sounds in the database can be utilized to understand these underlying processes better and predict these rapid changes.

Similarly, in her National Geographic Live talk, she describes how she was inspired to start listening to the underwater sounds of glaciers in the first place.² Here, she shared her experience of camping near a calving glacier and the immense sounds it produced. During that night, when a calving event happened, a whale was continuously active, producing sounds reacting to the calving. The whale was echoing the glacier-calving events. Pettit describes that this echoing whale inspired her to think about what the whale was hearing and how a calving event would sound underwater. Starting to record and analyze the underwater sounds of glaciers, Pettit discovered a whole new realm of sound that is now encompassed in the "Sound of Ice" database.³ Pettit's work is more than "just" a sound database but a valuable case study fitting the philosophy of this thesis.

¹ TED Archive. The Warning Sounds of a Melting Glacier | Erin Pettit. 2016. YouTube, <https://www.youtube.com/watch?v=q12XrHi3-wY>.

² National Geographic. Erin Pettit: Glaciers on the Run | Nat Geo Live. 2013. YouTube, <https://www.youtube.com/watch?v=1hWp5Qaapi4>.

³ Ibid.

The sounds that this chapter is mainly focussing on, is the sound of bubbles and will be based on two databases provided by Professor Pettit and her team. The first database is a public data repository that contains their earliest recordings from Icy Bay, Alaska, recorded with a PAL Hydrophone while mooring.⁴ The second is a closed selection of other sound files from multiple glacier locations, such as LeConte, Lake Bonney, and Thwaites. The data is recorded to create a spectral analysis of the recorded sounds, researching which frequencies in the spectral acoustics are ubiquitous and which ones are uncommon. With a sensitivity of up to -160dB, the hydrophone can detect and record frequencies inaudible to the human ear and is impossible to project over regular consumer speakers. The only way to access these frequencies is then through spectral analysis. This dataset has been used mainly to investigate freshwater discharge, quantify the melting rate of the glacier, and trace the spatial and temporal acoustic energy.⁵ Pettit and her team argue that the main frequencies can be attributed to air bubbles enclosed in the glacier's ice escaping due to the progressive melting. Other frequency patterns at around 100Hz can be attributed to freshwater discharge navigating a way through subglacial pathways resonating in the cracks and cavities of the glacier.⁶ As the database has been designed to serve specific spectral analyses, it is harder to collect data from these files by purely listening, without having to use specific spectral analytical tools — the data seamlessly works together with the analytical tools, providing interpretive data for the researchers to investigate the glaciers influences and melting properties through specific frequencies and bandwidth. This leaves the “normal” listener with only a general auditive impression of the sound files and the sounds within the Icy Bay, as the recorded sounds leave little room for a less rigid tool-based analysis.⁷ Yet, this chapter seeks to explore what is hermeneutically possible when analyzing the general auditive impression of the sound files. The recorded sounds will be critically engaged with through the concepts introduced in the previous chapter —sound ecology, slowness, hyperobject, and specters— as a way to conceptualize these sounds differently. By using these concepts as tools to rethink the aesthetic worth, the importance of these sounds from a more sound ecological perspective is highlighted.

⁴ Erin Pettit, Shad O'Neel, and Jeff Nystuen, *underwater Acoustic Data from Yahtse Glacier, Icy Bay, Alaska*, Arctic Data Center (2016).

⁵ Erin C. Pettit, Jeffrey A. Nystuen, and Shad O'neel, “Listening to Glaciers: Passive Hydroacoustics Near Marine-Terminating Glaciers,” *Oceanography* 25, no. 3 (2012): 104–5.

⁶ *Ibid.*, 105.

⁷ A first personal impression of listening to the sound files created a general picture of the sound recordings that consists of a variety of trickling water sounds, some more quiet, some louder, some have more pertinent low frequencies, others higher frequencies. All similar in sound and overall impression with only small differences.

Therefore, this chapter will more closely engage not only the sound itself but also the phenomenon of bubbles escaping. In her Ted Talk, Pettit clearly describes how these bubbles come into existence, their progress over time, and what they can tell us when used as quantifiable data.⁸ She explains that the hissing sound at the terminus of a glacier consists of air pockets escaping the melting ice. These air pockets are created by air trapped under snow and compressed with the ice. These bubbles flow with the ice downward, being pressured by the ice until the bubbles are the size of a sesame seed. When the ice around the bubble melts, the bubble can escape, producing the hissing sound that Pettit talks about. As these bubbles are pressurized, the bubbles emit a close range of frequencies resembling a musical tone somewhere on the upper third of the keyboard. This hissing sound is much better audible and distinguishable underwater, as water carries sound much better than air. These bubbles are also used to study the history of ice, as these bubbles of air can tell much about the time in which they were trapped under the ice and, thus, the temporal framework of the moving glacier. In the example of the Ted Talk, the bubbles stem from about 1412, Joan D’Arc’s birth year.⁹ For Pettit, these sounds are valuable for understanding and listening to invisible processes that tell the causes of invisible changes of the glacier that lead to sea level rise from a more data-scientific perspective.¹⁰ I will argue for an added aesthetic worth to these sounds as they can help us to critically engage with glaciers from a more philosophical, aesthetic, and activist standpoint.

In this chapter, the sound of these bubbles will be investigated through the lens of Titon’s philosophy and the main concepts discussed in the previous chapter: slowness, hyperobjects, and specters. By contextualizing these bubbles of the glacier through these concepts separately, it becomes possible to zoom in on specific aspects of these bubbles individually. The bubbles have a different relation with slowness, hyperobjects, and specters. The main question in this chapter is: Why are these recorded sounds aesthetic, and what is the musicality of these bubbles? The answer to this question can be found in modes of listening. Pettit and her team are listening for data and quantifiable information to help map the melting of glacier ice. They have amazingly mapped the sounds of these bubbles for scientific usage and provided frequency spectrograms and figures

⁸ TED Archive. The Warning Sounds of a Melting Glacier | Erin Pettit. 2016. YouTube, <https://www.youtube.com/watch?v=q12XrHi3-wY>.

⁹ Ibid.

¹⁰ Ibid.

(Figure 2.1).¹¹ This spectrogram tells scientists much about these melting processes but not so much about the musicality of these bubble sounds and leaves wondering where the scientific approach regarding these sounds ends and where the musical dimension emerges. The scientific mode of listening creates quantifiable data, whereas the musicological mode of listening hears the aesthetic worth of these sounds—it is impossible to detect specters in a spectrogram analysis; this is only feasible through a hermeneutic approach. This chapter offers a hermeneutic approach; constructing a musicological relation and interpretation of these sounds. Developing a musicologically informed mode of listening to these bubbles clarifies these sounds' ecomusicological and aesthetic worth. Just as Titon's "sound of climate change" encompasses the sounds of birds and trees (as discussed in Chapter 1), these bubbles can also be understood as sounds of climate change and musical material. By critically engaging with these bubble sounds as musical material, the aesthetic worth of these sounds can be investigated.

Sound Ecology and Bubbles

As mentioned in the introduction, Titon introduces ecological rationality as a counter to economic rationality. He states that ecological rationality would lead to co-existing and universal living between humans and non-humans, such as animals and plants.¹² Instead of our current economic society, where all choices will be made for the best individual gain, society would thrive on shared communities, collaboration, and social relations with humans and non-humans. When making choices, we should not choose the path most suitable for our individual gain but what would benefit the community as a whole. The common goal and well-being should be deemed more important than one's personal gain, even if this means that, in some instances, the individual has to take a step back. According to Titon, we can reach this new social structure by focusing mainly on sounds. Since all living things vibrate and are susceptible to vibrations, they are all in contact with each other. "All beings are in the world of vibrations and sound experience."¹³ He argues that this connection signifies a relation, thus relational presence, knowing, and acting.¹⁴ If we indeed have relations with all living things, then we mutually depend on each other and should value all things equally. Right now, however, humans dominate over non-humans, following an economic rational

¹¹ Erin Pettit, et al. "Unusually Loud Ambient Noise in Tidewater Glacier Fjords: A Signal of Ice Melt," *Geophysical Research Letters* 42, no. 7 (2015): 2309–16.

¹² Jeff Todd Titon, "Sustainability and a Sound Ecology," in *Toward a Sound Ecology : New and Selected Essays* (Bloomington: Indiana University Press, 2020), 255–256.

¹³ *Ibid.*, 274.

¹⁴ *Ibid.*, 273.

thinking pattern. But if all living things co-exist and are related, we might acknowledge non-humans' importance to our existence. By conceptualizing our world through sound, we can realize this co-existence through vibrations and create ecological rationality. According to Titon, the key to a sound ecology might not be in sounding sustainable but in finding a sustainable sound. And where can you look for a sustainable sound other than natural environments? He wonders what would happen if humanity oriented the world mainly through sound and oriented our rational thinking in our sensations and being.¹⁵ According to Titon, this way of interacting with the world might be found in actively listening: "What happens in those moments of sound ontology when we feel our sensations, our being, and knowing centered in sounds? [...] Is it possible utilizing a thought experiment based on a sound connection to erect a just alternative to the alienated communities, neoliberal political economies, and behaviorist ecologies that drive humans toward injustice, and the planet toward extinction?"¹⁶ If new wisdom, truths, or insights exist in listening to nature, there might be ways to transcribe vibrations into sound to try and listen and communicate with nature. Through sound, a connection is made. If something vibrates and these vibrations are received, the sender of the vibrations announces its presence to the receivers and the presence of the receivers themselves.¹⁷ Following this argument, if the glacier makes sounds, it mediates attention to itself and the beings around it that hear them —such as a whale or a camping glaciologist. Even more so, since sounds are directional, the echoes of these sounds reveal all sorts of information, such as shape, extension, and intensity.¹⁸ The echoes of the glaciers' sounds can then reveal information about cracks, caves, and the solidity of the ice. By understanding the sound of the bubbles, we can interact with the glaciers' melting processes, predicting melting events and rising sea levels.

Titon uses ice as an example of all entities being able to call attention to themselves and other entities being in the "presence" of the ice.¹⁹ Pettit's instance of the whale responding to the calving events of the ice serves as an excellent example of this phenomenon, as well as Pettit's own experience of listening to these calving events from close by. Her description of the sound of the glacier when camping on top of a glacier, the feeling and hearing of the rumbling of the ice, thundering and cracking, as described in her National Geographic Talk, shows how you can be in

¹⁵ Ibid., 255.

¹⁶ Ibid.

¹⁷ Ibid., 257

¹⁸ Ibid., 258.

¹⁹ Ibid., 259.

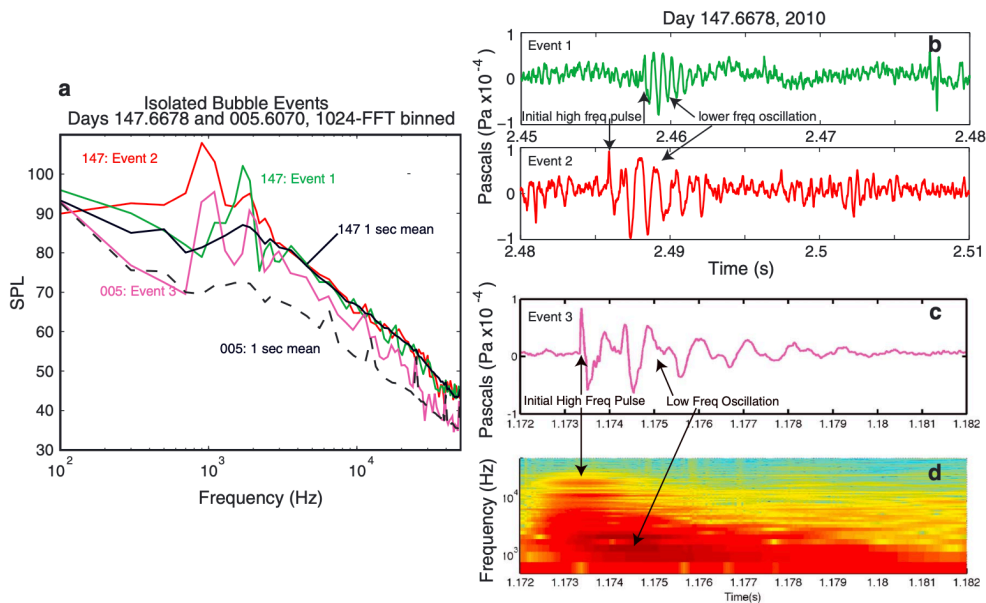


FIGURE 2.1: ANALYTICAL MODELS CREATED BY PETTIT ET AL. “UNUSUALLY LOUD AMBIENT NOISE IN TIDEWATER GLACIER FJORDS: A SIGNAL OF ICE MELT,” *GEOPHYSICAL RESEARCH LETTERS* 42, NO. 7 (2015): 2312.

copresence with glaciers.²⁰ The feeling and vibrating with the glacier, the glacier announcing its presence and movements, and its being as an entity all underline Pettit and her team being in copresence with the glacier in those moments. Titon uses copresence as a prerequisite for community and argues that communities take different forms and shapes; some are horizontal and egalitarian or vertical and hierarchical, varying per view and interpretation.²¹ The main characteristic of copresence and even communities is exchanging information, behavior, emotions, and interdependence, striving for cohesion.²² Pettit’s description of the ice as an emotional landscape, both visually and aurally, could be seen as an exchange of emotions, perhaps even as a community building with all entities surrounding the area: the glacier, the whales, the seals, and the researchers. Understanding natural entities in this way does find itself in the ongoing debates on “nature’s voice.”

The idea of stating that nature has a voice encompasses a deep exploration into the relationship between humanity and the non-human world. We must reconsider the agency, expression, and communicative capacities ascribed to nature and the natural world. Kate Soper provides an insightful introduction to the discourse on "What is Nature, Culture, Politics, and the Non-Human," highlighting the intricate relationship between nature, culture, and our understanding

²⁰ National Geographic. Erin Pettit: Glaciers on the Run | Nat Geo Live. 2013. YouTube, <https://www.youtube.com/watch?v=1hWp5Qaapi4>.

²¹ Titon, “Sustainability and a Sound Ecology,” 259.

²² Ibid.

of the non-human.²³ By recognizing the potential for nature to have a voice, we acknowledge the possibility that the non-human world engages in its own forms of expression, communication, and agency. Kate Soper's work delves into the multifaceted nature of this trope. She explores how our cultural and political frameworks shape our understanding of the non-human and influence how we perceive its voice. Soper challenges the boundaries traditionally drawn between nature and culture, highlighting the interconnectedness and how they mutually shape each other. She distinguishes nature-endorsing and nature-skeptical arguments.²⁴ Nature-skeptical arguments challenge the semiotics of nature and the mediating, political, and cultural conceptions of nature. Nature-endorsing arguments include ecological ethics and environmental activism, which are the conceptions of nature that have emerged in the eye of the environmental crisis.²⁵ Nature-endorsing arguments invite us to consider the impacts of our actions on the non-human world and to reevaluate our relationship with it. Understanding nature's voice in this light involves listening to its rhythms, observing its intricate patterns, and perceiving how it communicates in its own languages, such as vibrations and bubbles of glaciers. Embracing the notion that nature has a voice encourages us to challenge dominant power structures and narratives that marginalize and silence non-human entities. It prompts us to reevaluate our role on earth, emphasizing the need for responsible and sustainable interactions with the natural world.

By recognizing the voice of nature as nature-endorsing, we transcend the idea of nature as a passive backdrop or mere resource for human use. Instead, we acknowledge nature as an active participant with its own intrinsic value and agency. This perspective allows us to engage with nature more profoundly, listening to its expressions and understanding its presence as more than just an object of study or exploitation. It might humble our human positionality on questions of agency and power. The idea that humans cannot influence other forms of communication and are passed as actors in developing “nature’s voice” combines a post-human and nature-endorsing argument.

We must pay attention to the ideological implications of the idea of nature’s voice. As argued above, this trope offers a great window to argue for sustainability and against hegemonic structures; it is then inherently entangled with questions of power, ethics, and politics. In the face of activism against global warming, we should be wary of seeing this perspective of nature's voice as the place to look for solutions for climate change or as “the real truth.” The relation between nature

²³ Kate Soper, “Introduction,” in *What Is Nature? Culture, Politics, and the Non-Human* (Oxford: Cambridge, Mass: Blackwell, 1998).

²⁴ *Ibid.*, 4.

²⁵ *Ibid.*, 3.

and culture is dialectical; nature can only be understood through culture and vice versa. By recontextualizing nature into “having a voice,” the concept of nature is used for political opportunities and as a framework for solutions.

The trope of nature having a voice is currently widely used in ecological activism to listen to Mother Nature, how the Earth speaks to us, and how we should take better care of our environment through nature-endorsing arguments. Anthropomization of nature is something we have done for centuries —e.g., appointing gods to natural phenomena such as Thor or Zeus— and is a way to grasp phenomena as, according to Eric Katz, the term ‘natural’ is used to designate objects and processes that exist as far as possible from human manipulation and control.²⁶ By anthropomorphizing nature, humanity better understands ‘nature’ and gives it a voice. Instead, I propose that it is not nature’s voice in itself. Still, it is a way of *envoicing* nature to grapple with ecological stress and better understand the climate crisis processes. As the climate crisis is a hyperobject, humanity will never fully understand this phenomenon. Still, giving nature a voice in some sense helps contextualize and grapple with these forces. It becomes a question of listening. The agency lies with those who have envoiced nature but are in the service of the envoiced reason of sustainability and resilience. Nature in itself does not speak, but we provide natural elements with a voice to fit nature-endorsing arguments. A clear example of this process is attributing human rights to rivers now happening in Canada (the Magpie) and New Zealand (Whanganui River), envoicing these rivers to be granted the same legal rights as human beings. This thesis contributes to the envoicing of glaciers, not arguing for the trope of nature’s voice.²⁷

Titon’s sound ecology encourages creating other conceptions of our world and science by arguing the blurring of boundaries between humans and non-humans. What can we gain by transgressing our self-made barrier and self-acclaimed superiority over non-humans? We might achieve new truths and worldviews by actively listening to other sources, such as glaciers. It might not seem rationally fruitful to ask the glaciers if they have a solution for climate change, but if we listen closely, the sound of the glaciers can tell us more than we might think. We can learn much about resonance and vibrating signaling processes by closely studying melting systems and sonic communication below the water. These sounds represent another temporality, another time, and another timeframe. Sound can help us to comprehend other timeframes outside our human lifespan.

²⁶ Eric Katz, *Nature as Subject: Human Obligation and Natural Community* (Rowman & Littlefield Publishers, 1996), 104.

²⁷ I am aware that this boundary between envoicing and the voice of nature is not very clearly distinguished and leaves room for various interpretations and uses. Unfortunately, the thorough examination and critical assessment of environmental ethics on the subject of nature’s voice is outside the scope of this thesis.

If we listen more carefully to these different temporalities, we perhaps can alter our way of conceptualizing the world and let other forms of sound knowledge inspire our thinking. By conceding our ways of thinking to other communication systems, we can broaden our rationalist perspective and timeframe to include natural forces in other temporal spheres, leading to new ways of knowing and perceiving.

Slowness and Bubbles

The bubbles of melting ice that Pettit investigates are an attractive focal point for exploring and listening to other non-human entities, potentially broadening our perspectives and ways of knowledge production. This will be explored in this section by discussing Koepnick's understanding of slowness concerning the sound of these bubbles. As elaborated on in the first chapter, Koepnick's conceptualization of slowness, especially aesthetic slowness—a medium through which we can experience the present, negotiating the senses into actively and consciously experiencing everything that is happening simultaneously²⁸—critically engages with questions of temporality.²⁹ Melting ice, measured through the sounds of bubbles, is an inherently slow process. Yet, we know that the melting ice is currently in acceleration, which is audible through the intensifying of the bubbles. Suppose we want to understand this specific realm of acceleration. In that case, we need to understand these processes of acceleration by zooming in temporally, decelerating their mechanisms, and establishing “presentness” in the assortment of today's cotemporality.³⁰ Koepnick's understanding of slowness argues that slowness articulates a desire for both presentness and memory, allowing us to reflect on the “now.”³¹ Conceptualizing the sound of these bubbles through slowness can strengthen our sense of the coexistence of different temporalities and vectors of time, reflecting on our subjectivity and contemporary notion of speed.³²

This is precisely what Pettit did when recording the underwater noise in Icy Bay. The mechanisms of the melting glacier ice are decelerated, analyzed, and interpreted by actively engaging with sounds that are not necessarily on people's radars. Pettit's research takes the time to slow down and actively listen, deconstructing the varying frequencies in the bay. By listening to the

²⁸ Lutz P. Koepnick, “Introduction,” in *On Slowness: Toward an Aesthetic of the Contemporary* (Columbia University Press, 2021), 15.

²⁹ Erin Pettit, et al, “Unusually Loud Ambient Noise in Tidewater Glacier Fjords: A Signal of Ice Melt,” 2309–16.

³⁰ Koepnick, *On Slowness: Toward an Aesthetic of the Contemporary*, 65–66.

³¹ *Ibid.*, 13.

³² *Ibid.*, 12.

sizzling of the bubbles, we are listening to the deconstruction of the glacier—an ending point for both a long temporal and spatial journey of the trapped air. We hear the processes of the snow trapping air pockets in the ice, the air pockets compressing and taking a centuries-long journey, moving from the glaciers beginning toward the glacier terminus. Through the sound in the “now,” we hear the memory of this journey. Actively focusing on the hissing sounds of the bubbles creates a clear articulation of “nowness” and listening in the present while simultaneously providing an auditive footprint of the past, providing memories of now-gone ice.

Koepnick’s reference to Eliasson’s work is also precious in analyzing the sounds of these bubbles, as Eliasson’s work renders both the aesthetic and the scientific categorizations through using seriality in his artwork.³³ The pictures of Eliasson’s work provide a visual chart of the glacier’s decrease and development over time, slowing down our perception of time to the rhythm of the glacier; the rasters highlight the non-identified space between the photographs as unidentified temporal spaces. Mirroring scientific categorization in the structures of the rasters and charts and the aesthetic through the visuals of the photographs and the installation, the work provides engaging visuals but remains awfully quiet. While the pictures are at a standstill and silent, the dimension of sound can grapple with these scientific and aesthetic categorizations and questions of temporality from a different perspective.

The sounds of the bubbles are a perfect combination of the scientific and the aesthetic. First of all, from a scientific perspective, the recorded sound by Pettit’s team provides much fruitful material for varying spectral analyses, using the auditive dimension to get new data on retreating glacier movements that are otherwise only visible through pictures taken from above and only after melting events have taken place. This sonic dimension gives researchers and scientists new possibilities to predict and map the melting of the glaciers beforehand, contributing to monitoring sea-level rise and rising temperatures.³⁴ Secondly, fitting the aesthetic category as Pettit colorfully describes in her Ted Talk, the bubbles present a tone that can fit musical terminology and notation.³⁵ As the air in the bubbles decompresses and escapes, they send out a frequency that varies per glacier—in the case of the icy bay, a high C. The bubbling sounds are fit to render and understand through the lens of the musical analysis system. Thus, the bubbles provide sounds that can be understood as musical material. We can use these bubble sounds for sound mapping of the bay,

³³ Ibid., 102.

³⁴ TED Archive. The Warning Sounds of a Melting Glacier | Erin Pettit. 2016. YouTube, <https://www.youtube.com/watch?v=q12XrHi3-wY>.

³⁵ Ibid.

providing a sounding perspective of the retreating glaciers. It creates a sonic dimension to the otherwise static before and after pictures and makes the auditor listen to the melting event as it happens rather than “just” seeing the aftermath. By actively living through the melting processes and following the glacier's temporal structures by immersing in its sounds, it is an aesthetic mediation of the glacier's processes, providing opportunities to create awareness and resilience.

These quiet moments in between these bubbles are better understood as intermissions than as Koepnick's unidentified temporal gaps—as already contextualized in the previous chapter. In between sonic “markers of time,” moments of reflection are created in quiet moments. Showing temporal changes with pictures only accounts for specific moments in time. Yet, by tracing a glacier's movement through sound, a more continuous flow of time is present. Because we cannot listen to separate recordings of bubbles at the same time, we are forced to listen to these recordings separately, automatically creating intermissions in between recordings in which the listener reflects on what is heard. We know the glacier's movements through the sounds of the bubbles, even if no picture is taken or the picture shows no changes. We can identify traces that are not (yet) visible on the camera. Unfortunately, an unidentified gap remains because the sounds in the current database have not been recorded throughout and only at certain specific moments. This is partially camouflaged through the memories encapsulated in the bubbles, echoing their past changes in current recordings.

Another difference between a visual or auditive representation of the glacier's demise is the interpretative difference. Pictures only show a decline in ice, envisioning the ever-shrinking glacier. These images feed the nostalgic worth and sentiment of the landscape that once was present. The sound recordings, however, as “markers of time,” mark evolving events not only feeding feelings of sadness and nostalgia but offering new perspectives on the melting ice, embodying not only sadness but new possibilities. Another crucial difference between a visual temporal tracing of the movement of a glacier and an auditive dimension is that the visual dimension is relatively straightforward; we can all see that in the previous picture, there was more ice than in the next. Yet listening to these sounds requires a deeper understanding of the evolution of cracks and escaping bubbles over time. It requires a more expert ear to determine changing patterns. Of course, significant audible changes are more straightforward to identify as change. Still, the conceptualization of the sizzling sound through the dimension of the glacier needs training and requires an expert ear. Whereas the images show less and less ice over time, the recordings become louder and more intense, providing more data for scientific and hermeneutic analysis. The bubble sounds, therefore, do not (solely) function

as an enforcer of nostalgic worth and a visual figurehead of the climate catastrophe. To engage with these sounds, the listener has to actively listen and try the varying temporal scales and complex structures within the sound, activating a more critical approach to thinking about melting glaciers.

The sound of the bubbles can help better contextualize cotemporality, both regarding our own and the glacier's temporality. Pettit plays with these temporalities in her Ted Talk. She explains that the bubbles that we hear escaping the ice in the recording have been trapped in the ice around Joan D'arc's birth year, 1412.³⁶ It is an easy way to quickly highlight the great temporal length of the glacier's processes as something spanning centuries and lifetimes. However, underscoring this timescale is not solely for educating people on these processes. The glacier becomes a vessel through which we can bridge our "nowness" with past centuries. The bubbles become a liminal space in which the past becomes audible again. In the moment of perceiving the bubbles, many timescales come together. A timescale of centuries in which the air pockets have been trapped in the ice; a timescale of decades in which the topic of climate change and melting ice sheets have gained much more (scholarly) attention; a timescale of years in which Pettit's research on the auditive dimension of glaciers has grown; a timescale of months in which the sounds are recorded; a timescale of weeks and days in which the ability to record and get close to the glacier's terminus is dependent on weather and breaking of the ice; a timescale of (mili)seconds in which the bubbles leave the ice and produce the sound they are making. The glacier embodies all these different temporalities, processes, and developments. Slowness is, therefore, very suitable to investigate these temporalities as all these layers become visible by slowing down and taking the time to identify and understand the different processes.

Accessing these different temporalities through slowness can help us recontextualize how we actually understand and interpret glaciers scientifically and aesthetically. As has become clear, listening to these bubbles provides new insights into the movements of glaciers, creating new interpretative tools to predict and better understand the calving and melting processes. Aesthetically, the vastness and complexity of these glaciers can be heard and experienced by using the sounds of these bubbles. Especially if these bubbles all create a specific individual tone; the glaciers are not objects to study but individual phenomena with an individual sonic aura. In the same way that the harmony of spheres contextualizes the sounds of individual planets, glaciers can also be understood as individual-sounding entities. The melting glacier is not just a solid object that is melting somewhere far away but becomes a phenomenon that is audible through the recordings, portrays a

³⁶ Ibid.

co-occurrence of varying temporalities, and has the potential to create a more sound connection between glaciers and humans. It has the possibility of even representing a more mythical position and mediation.

Bubbles and Hyperobjects

In the previous chapter, it was established that glaciers are a hyperobject in Morton's definition. By closely engaging with the bubbles leaving the glaciers' ice, new ways of identifying and mapping the spatial and temporal spaces of the glacier become permeable. As Pettit describes in the National Geographic Talk, the glacier functions on multiple temporal and spatial scales: scales of millimeters, tens of kilometers, seconds, and a hundred thousand years simultaneously.³⁷ One cannot just focus on one scale and ignore the other; they are all interrelated. The bubbles are a traveling temporal vessel that more easily fits our capabilities to understand. When using bubbles to think about the spatiality of the glacier —both in millimeters and kilometers— the spatial domain gets a more precise mapping and visualization. By imagining the journey of the bubbles and the air being trapped under snow at the top of the glacier, the spatial domain becomes more clear. The length and depth of the slowly moving ice, carrying air pockets from the top of the ice sheet, being pressured further away in the ice, and sinking more deeply in the ice sheet before eventually escaping at the terminus, provide a visualization that we, as humans, can comprehend easier. It provides a roadmap showing the bubbles' route through the ice and landscape.

More importantly, the bubbles help us understand the *horrifying* timescale of about 500 years. As Pettit explained, the bubbles we are listening to were trapped in the ice around 1412. This date creates a timeframe and a constructive way of thinking about this time within the glacier's processes. We now know how long it takes for the air pockets to get compressed, pushed more profoundly in the ice, and travel spatially from the top of the ice sheet to the terminus. A timeline is created. A timeline that is more easily understood through the visualization and sounds of the bubbles. Understanding the slow pace at which the ice moves within glaciers would have been impossible without the bubbles. The bubbles function as a temporal and spatial road map. Without the bubbles, the glacier's movements stay more abstract. Using these sounds as spatial and temporal roadmaps creates an easier-to-understand conceptualization of the glacier's spatial and temporal vastness. Where pictures of glaciers can only show a decrease or increase in ice volume per glacier, the sound portrays the changing, moving, and generating new ice. Offering new ways of grappling

³⁷ National Geographic. Erin Pettit: Glaciers on the Run | Nat Geo Live. 2013. YouTube, <https://www.youtube.com/watch?v=1hWp5Qaapi4>.

with the *horrifying* timescale can help to engage more critically and actively with the melting ice sheet, especially for people not closely interacting with, thinking about, or researching glaciers on an everyday basis—which is most people on the planet.

However, the bubbles are not sufficient regarding Morton's *terrifying* and *petrifying* timescale. As the journey of the bubbles encompasses a few centuries as a maximum, they can not help provide more relative insight in timescales of thirty thousand and hundred thousand years. The bubbles are just not the correct vessels of time for humans to understand the even larger timescales. Yet, starting with identifying and grappling with the *horrifying* timescale creates ways to understand our timely relativity toward the glacier and perhaps vice versa as well.

Our relationship and comprehension of the hyperobject is always a question of relativity, consistently positioning the hyperobject's relativity towards ourselves and comprehending only the relative past and future of the hyperobjects concerning our current *nowness*.³⁸ We can only understand a hyperobject within what is understandable and graspable in our own feelings of time. The bubbles in the recordings prove to be an attractive focal point for this relativity. As described in the previous paragraphs, the sound of bubbles creates a visualization of the timescale encompassing several centuries. This relativity is accessed by mentioning historical figures and the visualization of the movement of the bubbles. It becomes something we can comprehend and posit concerning our understanding and feelings of time. Because the glacier moves in many varying temporalities simultaneously, it becomes possible to switch the relativity around. We might be able to understand the glacier's relativity towards human timescales. In a way, bubbles are an audible phenomenon that creates a glacier's relativity for us. The bubbles are compressed pockets of time that were formed in our past that are released in the current *nowness*. The bubbles are a point of convergence of these different temporalities relative to humans toward our understanding and grappling with time. It is as if the glacier's timescale is made relative to a human's vantage point. We must compress and squeeze the immense timeframes into a sound we can comprehend. It is an articulation of the glacier's processes within these sounds that are understandable and interpretable—both scientifically and aesthetically—by humans.

Frantzen and Bjering's understanding of the hyperobject, which functions as a temporal feedback loop over extended periods of time, is useful in understanding the bubbles.³⁹ Their conceptualization of the hyperobject traces a waste cycle over more extensive periods, making it

³⁸ Timothy Morton, "Ecology without the Present," *Oxford Literary Review* 34, no. 2 (December 2012): 234.

³⁹ M. K. Frantzen and J. Bjering, "Ecology, Capitalism and Waste: From Hyperobject to Hyperobject," *Theory, Culture & Society* 37 no. 6 (2020): 87–109.

easier for humans to relate to as they can trace the consequences of their actions. It creates a physical understanding of our actions by moderating the timescales so that we can ground the consequences of our actions at least partially in our current understanding of time. The air—not necessarily as a human waste—is trapped, transferred, and, in the end, audible through the bubbling sound, after which the air can get trapped in the ice again. Yet, as Frantzen and Bjering talk about a feedback loop of waste, tracing human influences over time in different ecosystems and objects, this feedback loop does not consist of waste, but it is influenced by it. The air pockets remain in the ice for a shorter period through rapid ocean warming and rising temperatures. Even though the bubbles function as a feedback loop, the air pockets are not necessarily a hyperobject—a waste cycle spanning *horrifying* timescales—rather than a hyperobject. The feedback loop provides the option of relativity and a feeling of urgency. The temporal structures of the glacier are affected by the increasing tempo of melting ice. Declining temporal structures can be articulated as the declining health of the glacier and the rapid rise of sea levels.

Conceptualizing the sounds of these bubbles through Morton's hyperobject shows how these bubbles can serve as a vantage point to grapple with the spatial and temporal vastness intrinsically connected to understanding the glacier itself. It gives us a starting point in grappling with the complex interrelatedness of these different domains.

Bubbles and Spectres

Linguistically, the words spectral and specter are etymologically very closely related. Both originate from the word spectrum used for describing things in scales: color scales, frequency scales, political scales, etc. On a conceptual level, these two are related as well. As haunting occurs in sounds, sound is an essential vessel for specters. The bubbles in the ice are vessels for the past and future specters that haunt the Arctic landscape. On a more scientific level, our focus on sounds can pick up on details missed by focusing only on visual cues. Pettit's spectral analysis of the sounds of these bubbles is potentially more than only describing the sounds on a frequency scale. The spectral analysis might pick up on the haunting that happens on a more emotional level; it is a way of connecting with the specters that are voicing themselves in the analyzed sounds. Specters are a great concept to broaden Titon's scope of sound ecology of co-occurrence, listening closely, and ecological rationality as it urges one to listen closely and understand other entities. Bubbles are an excellent tool for doing so.

Ice remembers. In its layers of ice frozen underneath centuries of newer ice, we can trace geographic history in the particles frozen that are within. It is possible to trace volcanic eruptions,

solar activity, local temperatures, and accumulation of greenhouse gas concentrations within thousands of years. This is investigated by drilling out ice cores and has become one of the leading research methods in understanding climate behavior in the ancient (and not so ancient) past to better understand the atmosphere's behavior and thus predict future climate changes. These ice cores are several-meter-long tubes archived in specific locations from which samples are sent to labs and research facilities. Yet, these ice cores consist of more than just “data trapped in ice.” These ice cores tell a part of the history of the ecology from which they originate. Leaving a gaping hole where the ice cores were extracted, the tubes tell the (environmental) stress and changes the ice has been under for centuries, highlighting impactful influences such as volcanic eruptions and greenhouse gas emissions. By taking ice samples, we mainly use our eyes and lab instruments to decompose the sample and its timeline. Yet, the ice can tell us more if we closely examine a broader picture. Ice has the capacity to keep objects relatively well preserved—shipwrecked boats, fossils, bones, tools, etc. This means that within the ice, traces of the past are conserved and stored. The ice is an archive of its own history.

The process of archiving human-made archives is always a judgemental process in which those in charge decide which is worthy enough to be stored.⁴⁰ These choices are often based on selection, authority, and patterns of discrimination.⁴¹ In their article on a seventeenth-century postmasters’ trunk, Rebekah Ahrendt and David van der Linden highlight that recent scholarship has urged away from the archive as a source of “universal truth,” as the process of archiving is always mediated through time, expectations, and political influences.⁴² They stress that many possible meanings emerge if we want to look past the singular meaning of traditional archived artifacts. We must learn to listen *differently*, for how we hear those voices and recount their stories will always be mediated through our own experiences and training.⁴³ The same applies to these ice cores. We understand these ice cores from a specific understanding and training in our education on how to read these histories of the ice. Even though the ice has archived its history without judgemental curatorship, we still interpret its history in a specific way. These scientific understandings and histories are situated knowledge based on Western worldviews and years of

⁴⁰ Achille Mbembe, “The Power of the Archive and its Limits,” In *Refiguring the Archive*, ed. Carolyn Hamilton *et al.* (Dordrecht and London: Kluwer, 2002), 20.

⁴¹ *Ibid.*

⁴² Rebekah Ahrendt, and David Van der Linden, “The Postmasters’ Piggy Bank: Experiencing the Accidental Archive,” *French Historical Studies* 40, no. 2 (2017): 190

⁴³ *Ibid.*

anthropogenic research where humans have had the urge to position themselves as superior to nature. Based on data, graphs, and numbers, the not non-quantifiable data is often not recognized as important enough to add value to the research.

Ahrendt and van der Linden provide a new archival methodology, one that relies not just on the formal archives consciously created by people interested in keeping a record of the past but also on what we call the ‘accidental archive’: a set of sources handed down to us not by an institution but by people who never dreamed of creating a formal record of the past.”⁴⁴ The ice might not be the same as people building a formal record of the past, but it is an entity not aiming for an archive and thus “accidentally” storing its own history and information in itself. By archiving its own history and not judging what information should be stored, the ice has its own unbiased collection of history, providing insight into its history in various ways and potentially providing us with a comprehensive and more complete conception of the past. However, how we grapple with all this information, mediate and judge the information in the ice, and decide to read and understand the archive of the ice brings back questions of power, situated knowledge, and judgment.

This is where the sound of the bubbles comes into play. As mentioned earlier, using the sound of these bubbles to map out the melting processes provides a different vantage point than investigating the ice through a more “traditional” visual analysis. These bubbles were encapsulated centuries ago, containing the sound of air in the atmosphere at that time. Grappling with the history of the ice through sound might prove helpful in comparison to the visually oriented ice cores. These sounds can not only be used as a tool to understand water flows. It is a sonic way of communicating not only the melting processes but also the histories of the ice.

The bubbles can be conceptualized as sonic specters of the past; the bubbles generate attention to the residue of trauma and repression. Avery Gordon’s conceptualization of specters and haunting as a way of analyzing trauma in social phenomena also applies to ice.⁴⁵ These specters are identifiable in three ways: the past of ecological trauma, the past trauma of power relations and repression, and the future of environmental demise. First, the sound of ecological trauma is more closely related to Pettit’s research project. We hear the ghosts of centuries ago dying out and disappearing in the water. Their sizzling sound attracts attention to the ecological stress the ice has been under. The quickly growing greenhouse emissions and rising temperatures make the ghosts audible. The specters are calling to attention a need for recognition of climate change and an urge

⁴⁴ Ibid., 191.

⁴⁵ Avery Gordon, “Introduction to the New Edition,” In *Ghostly Matters: Haunting and the Sociological Imagination*, 2nd ed. (Minneapolis: University of Minnesota Press, 2008), xv—xx.

for sustainable solutions. These specters are already acknowledged and heard in mainstream discourses. Unfortunately, a global change in human behavior toward emissions to rectify the past has to be provoked substantially.

The second, the past trauma of power relations and repression, is acknowledged less in our current mainstream situated knowledge. The melting ice carries specters of these injustices to the ice and the locals. Many Indigenous people living in the Arctic have been killed and oppressed by colonial explorers in the nineteenth century. Colonial explorers were violently disrupting the local ecosystems by exploiting whale hunting, looking for valuable minerals (still going on),⁴⁶ and enforcing Western ideas and structures upon these Indigenous cultures. This is visible in the history of ice due to a lessening of biodiversity. It is not audible in a quantifiable way but in a more sensory way. As Yukon people have elaborated, the glacier and the ice are sentient and react to improper behavior, telling the story of explorers falling into sudden new crevices as an example.⁴⁷ It takes attuned listening to understand and hear these ghosts to acknowledge the social injustices that happened against the ice and the Indigenous people.

The third, and maybe the most prominent one, is the specters of the future. As Coulthard points out, futures of extinction and destruction haunt the Arctic, the daunting “will never be again” that possesses the Arctic landscape.⁴⁸ The sizzling of the bubbles in the ice embodies solastalgia — “the sense of desolation for absent or lost solace usually found through positive connections to landscape, environment, homeland, and space. More specifically [...] a sense of ‘environmentally induced distress,’ of which ecological catastrophe is a significant driver.”⁴⁹ The sound of the melting bubbles embodies the horrifying sound of a disappearing landscape. It is a fear of not knowing and mourning the loss of the ice we will never see again. In a sense, the ending of a hyperobject haunts us. The ungraspable entity so far spread out in time and space is ending. Our tiny human timeframe interlocks with a critical moment in the timeline of the hyperobject. Since we cannot grasp the vastness of the temporal timeframe of hyperobjects in the first place, the ending of one feels even more surreal. Our tiny fragment of “nowness” overlaps with the ending of something incredibly vast. It is only logical that we want to look away and not dare to feel the immediate

⁴⁶Amanda Boetzkes and Jeff Diamanti, “At the Moraine,” *E-Flux Architecture* (September 2020).

⁴⁷ Julie Cruikshank, “Are Glaciers ‘Good to Think With’? Recognising Indigenous Environmental Knowledge,” *Anthropological Forum* 22, no. 3 (2012): 248,

⁴⁸ Lisa Coulthard, “Haunted by Extinction: Sounding an Arctic Uncanny,” in *Haunted Soundtracks: Audiovisual Cultures of Memory, Landscape, and Sound*, ed. K. J. Donnelly and Aimee Mollaghan, (New York: Bloomsbury Academic, 2023), 108.

⁴⁹ Ibid.

urgency of the demise of the ice; we cannot grasp the outcome, and we cannot fully understand in its complexity what it would be like when all the ice in the Arctic disappears. Scientists tell us about the earth's warming by two degrees and rising sea levels, but we do not know how it would feel and what would happen even if it is shown in simulations. We do not dare to overthink it because if we do, our moment of relatively peaceful “nowness” becomes too grim to handle. Yet, we might have to.

Conclusion

This chapter aimed to critically engage with Pettit’s described phenomenon of bubbles through the critical lens of sound ecology, slowness, hyperobject, and specters. Extending Titon’s “sound of climate change,” a new ontology to grapple with the temporality of glacier sounds is developed. All concepts have shown a different way of valuing the sound of bubbles in a way that is broader than quantification and data collection. Providing a more philosophical grounding for Pettit’s connection and experiences with these sounds offers new tools for understanding the sound of bubbles not only in a quantifiable way but also aesthetically and emotionally. The call for ecological rationality and attentive listening has been strengthened by considering Titon’s sound ecology in light of experiencing glacier sounds and envoicing nature. By understanding the sound of these bubbles in Koepnick’s conceptualization of slowness, I proposed to think about sounding intermissions rather than temporal gaps, arguing that by having room to reflect and assess the sounds we have heard, we can aesthetically encompass these sounds through eco-criticism. Thinking about bubbles in the conceptualization of hyperobjects, a more graspable roadmap for thinking of larger spatial and temporal domains is created. Seeing these bubbles as varying specters creates pathways outside the situated knowledge of Western science and offers room for other stories, conceptualizations, and emotions to weigh in on the complexity of the glacier.

All these assessments and engagements are interrelated and contribute to the glacier's complexity, ice melting, and our conceptualization of these sounds. The specters are very closely related to the vastness of the hyperobject, as it is only through the bubbles that such long timespans are accounted for. The specters are conserved, carried, and cared for in the longevity of the glacier’s processes, becoming audible when these processes are ending. The specters also help stabilize the hyperobject. By haunting both the past and the future, the hyperobject is held in place in its ungraspable feeling of everlasting and temporal frame—even if there is a feeling of the hyperobjects ending and demise. We can access all these critical engagements by slowing down.

Only in slowing down and reflecting upon the sounds in intermissions do we see the patterns of specters and hyperobjects emerge.

This ontology builds on and extends the scope of Tilton's sound ecology, providing tools to actively engage with phenomena that fit Tilton's utopian world. His notions of co-occurrence, co-vibration, and co-living get a more thorough grounding through utilizing these concepts on specific sounding phenomena. It provides a conceptual methodology to recognize patterns of sound ecologies in smaller environmental settings. Where Tilton mainly opts for ecological rationality and sound ecology, combining these concepts of slowness, hyperobjects, and specters provides a broader scope incorporating vaster temporal-sounding structures than Tilton's claim of rationality. We need to start incorporating emotions, feelings, and ghosts into our conceptualization of the world and our dealing with the environmental crisis, think outside the box, and develop new modes of resilience in this current crisis. Only then can we access and value our emotional connections to entities such as glaciers, and we might really find a way to create new sound ecologies. Using the concepts I have used, we can investigate how our feelings and emotions of time are closely interrelated with our rational thinking and choice-making processes. Using a sounding case study, such as the bubbles, has begun exploring this connection. Because music is an excellent vessel for emotions, the next chapter will work on the interlocus of glacier sounds and music, using the same concepts and conceptual tools to disentangle our physical and emotional connection in music that uses glacier sounds as musical material. The aestheticized sounds of the bubbles are incorporated into musical material, making these sounds musical in themselves.

3. Glacier Sounds in the Musical Imagination

The Sound Ecology of Margreth Olin's *Songs of Earth*

The documentary *Songs of Earth*, directed by Margreth Olin and composed by Rebekka Karijord, follows Olin's 85-year-old father for an entire year in the landscape of their birthplace, the glaciervalley Oldedalen, in Norway.¹ Showing majestic images of the mountainous landscape of Norway throughout the year, the documentary covers topics such as aging, life, death, being present in the world, and living alongside nature. The impact of immense forces of nature—significantly impacting the locals—becomes apparent when the documentary shows locals encountering snow, ice, and avalanches. Following Olin's father on his hikes in the glacier valley throughout the year, the spectator is invited to walk alongside him, seeing the seasonal changes and rhythms of the environment. *Songs of Earth* has been nominated for several cinematographical and compositional prizes and received many praising reviews in a.o.: *Modern Times*, *Cineuropa*, and *Screen Daily*.² The music consists of locally recorded nature sounds such as cracking or melting ice, wind, flowing creeks, and animal sounds. Combined with an original score of Karijord, played by the London Contemporary Orchestra, the score continuously negotiates the relationship between the natural and musical realms, intertwining their sounds and outputs and musically mimicking the visual backdrop of the impressive landscape.

When watching the documentary at the art movie theater Louis Hartlooper Complex in Utrecht, I was completely immersed in Rebekka Karijord's sounding universe. The intertwinement between natural sounds and composed music seamlessly combined and embodied Tilton's sound ecology. The emotional soundtrack clearly resonates with the rhythm of the glacier valley's environment and its changing parameters and appearances throughout the year. The central musical theme appears in varying moments throughout the soundtrack in different orchestral compositions, registers, and volumes, following the arc of the documentary's storyline. The soundtrack is divided

¹ *Songs of Earth*, directed by Margreth Olin (2023; Denmark: Norsk Film distribusjon, 2024) Movie theater Louis Hartlooper Complex.

² Carmen Gray, review of *Songs of Earth: Memories of a Retreating Glacier*, *Modern Times* (18 March 2023), accessed June 10, 2024. <https://www.moderntimes.review/songs-of-the-earth/>; Vladan Petkovic, review of *Songs of Earth: Revis: Songs of Earth*, *Cineuropa* (20 March 2023), accessed June 10, 2024. <https://cineuropa.org/en/newsdetail/440112/>; Wendy Ide, review of *Songs of Earth: Songs of Earth? : CPH:DOX Review* *Screen Daily* (20 March 2023), accessed June 10, 2024. <https://www.screendaily.com/reviews/songs-of-earth-cphdox-review/5180335.article>.

into four seasons, with four tracks per season (except for the summer, which has three). Some of these tracks only recorded environmental sounds, others only composed music, but most combine the two.

In this chapter, the score of *Songs of Earth* will be analyzed as it is presented on Spotify, not incorporating the documentary's visuals.³ Even though the interaction between the images and the sounds is valuable in analysis and interpretation, the analysis in this chapter will mainly focus on the auditive domain with only some references to the visuals. As this thesis focuses on the auditive domain of the glacier sounds, the auditive domain of the documentary in itself is already extremely well suited for analysis and interpretation. A multimedia analysis would fit an analysis of a complete documentary and its story arc. By primarily focusing on the music this chapter explores the musical part of glacier sounds, not necessarily the visible, even though they influence each other and are inextricably intertwined. Unfortunately, this means that some of the sound design and recording of natural sounds present in the documentary but not in the soundtrack will not be incorporated into the analysis.

The separate tracks on the Spotify album all have a similar buildup; they almost always start with environmental sounds —such as glacier, wind, and ice sounds. Hereafter, the orchestra mimics the same sounds and drones before a musical theme comes in. By introducing environmental sounds in the score, the glaciers are introduced in the musical realm as sounding entities and musical material. The sounds are not necessarily used as instruments in orchestration or follow a specific harmonic or rhythmic structure; they serve as separate sounding entities and musical inspirations. At the beginning of the tracks, only the natural sounds are audible, portraying low thunderous sounds of cracking ice, winds howling, and water droplets. After a while, musical instrumentation starts recreating these sounds; contrabasses, cello, and timpani take over the low drones of the ice, and high strings and flutes take over the water droplets. The field recordings fade away, and the recreated musical drone continues. After a while, a musical theme emerges, bringing a more conventional emotive layer to the soundtrack, whereafter, the musical instruments fade and make room for natural sounds again before fading away completely. By alternating between natural and musical sounds, the musicality of the glacier sounds is highlighted. If natural sounds have the same sounding frequencies as our musical instruments, then —as I will argue in this chapter— they are musical in themselves and should be considered within the aesthetic realm of musicality.

³ Rebekka Karijord, *Songs of Earth (Original Motion Picture Soundtrack)*. OONA Recordings AB, 2023, Spotify, <https://open.spotify.com/album/0o8KF0PGGNz60kmRvl60He?si=M-sk7EUkQxOTUkHZAfTL2A>.

The musicality of natural sounds is thus highlighted by mimicking the glaciers' sounds in the orchestra. The ontological meaning of these sounds—as discussed in Chapter 2— is being aestheticized by being part of the musical compositional process. The glacier sounds are musical material. I will investigate the interconnectedness of glacier sounds and the orchestra through slowness, hyperobjects, and specters, arguing for the glaciers' sounding aesthetic dimension. As these nature sounds are not “traditional” musical material, a straightforward methodological toolbox on how to musically analyze these sounds has yet to be developed. Traditionally, musical transcriptions were the backbone of musicology, objectifying music by writing it down in Western notation.⁴ Yet, the emergence of ethnomusicology argued away from transcriptions for observations, listening, and a hermeneutic approach.⁵ The Western classical musical notation system does not offer methodological tools for microtonality or very complex rhythmical structures, and knowledge-based systems do not always encompass other knowledges or interpretations. But how can we then encompass these glacier sounds in the musical realm and provide a helpful analysis of their meaning, especially if there are no suitable tools to engage with the musical analysis of glacier sounds?

Denise Von Glahn has already paved the analytical way to musically understanding glacier sounds by developing musical ecological categories (pitch, rhythm, and timbre).⁶ She used these categories as entry points when investigating Judith Shatin's composition *Ice Becomes Water*, which combines orchestral music, a technological installation, and glacier sounds.⁷ I will build on and extend these categories beyond compositional analysis, integrating the ontological understanding of glacier sounds as a whole to analyze the *Songs of Earth's* full score and main theme. This will be done by linking Von Glahn's categories with the conceptual categories developed in the previous chapters: rhythm with slowness, pitch with hyperobjects, and timbre with specters. By combining the conceptual understanding and analysis of the central concepts in this thesis with the categories of musical analysis, this chapter bridges the understanding of sound ecologies into the musicological domain.

First, a bridge between the documentary and Titon's Sound Ecology will be discussed. Secondly, a small generic musical analysis of *Songs of Earth's* main theme and Denise Von Glahn's

⁴ Jeff Todd Titon, “Knowing Fieldwork,” in *Shadows in the Field: New Perspectives for Fieldwork in Ethnomusicology*, ed. Gregory F. Barz and Timothy J. Cooley (Oxford: Oxford University Press, Incorporated, 2008), 25.

⁵ *Ibid.*, 26–29.

⁶ Denise Von Glahn, “Relational Capacities, Musical Ecologies, Judith Shatin's Ice becomes Water,” in *Sounds, Ecologies, Musics*, ed. Aaron S. Allen and Jeff Todd Titon (Oxford University Press, 2023).

⁷ *Ibid.*

analysis structure will be discussed. Hereafter, all conceptual categories will be addressed separately with their musical analytical buddy —slowness and rhythm, hyperobjects with pitch, and specters with timbre. Finally, it will be argued that the sounds of glaciers are well suited to be understood within the musicological domain as we can analyze and comprehend them with traditional analytical tools and understandings. This can support ecological activism, sound ecologies, and new modes of resilience.

Songs of Earth as a Sound Ecology

First, I want to start by illuminating the connections between the documentary and Titon's sound ecology. The documentary follows Olin's father perceiving and interacting with his environment. As becomes clear throughout the movie, he has a clear, rational understanding of his surroundings, the way natural processes work, and the role of humans in this environment. Yet, he, too —just like Pettit— marks the environment as emotional. The landscape is filled with life cycles and vibrant connections, grieving the loss of ice in the glacier, the tumultuous growth of the connected waterfall, and celebrating the new life of neighboring trees and plants in spring. The gigantic pine tree on the hill near his house carries many of these emotions as his grandfather planted the tree to overlook the valley and show support for the upcoming generations. The environment also clearly carries specters of the past: floods, landslides, and growing ice have taken a toll on human and non-human populations, wiping out entire families and households. Memories, traces, and spirits are apparent throughout the landscape, just as in the pine tree of his grandfather. According to Olin's father, these scars and memories are remembered in the landscape and can always be felt and traced in the environment. Perceiving through a more expressive lens and connection provides gateways to connecting with these memories and emotions. Through sensing, the environment speaks and connects. This is where Titon's sound ecology comes in.

The documentary actively invites the spectator into the perceived world of Olin's father. This is achieved by focusing on the sensory stimuli Olin's father receives when walking. The main visual and auditive focus is on his sensory input. His hands, eyes, and ears are often the main objects in the camera lens, zooming in, slowing down, and standing still. By showing a shot of his ear, the viewer is signaled to pay attention to his auditive experiences; we hear a rare bird call, the hooves of a grazer, water creeks, or nearby insects. Similarly, the camera shows shots of his hands, reminding us of the tactile experiences and sensations when walking in nature. We see a butterfly landing on his hand, the rustling of leaves, a soft breeze, and long grass. Cinematographically, parallels between Olin's father and non-human entities are drawn: The lines on his aging hands

visually resemble the grains of a nearby leaf and the linear pattern in the bark of a nearby tree. All these connections show how Olin's father pays attention to his environment, always watching, listening, and feeling. He listens to everything that vibrates, pays attention to it, and co-occurs with these vibrating entities. We start to understand his way of perceiving the world and his surroundings. He notices patterns of continuity and change and immerses himself in a world of natural sounds.

Olin's father's connection with the specters of the surroundings becomes clear throughout the documentary. He understands and grapples with the complexity, bruteness, and forces of his environment, which is an essential attribute in sound ecology. As Titon argues, many eco-justice movements romanticize nature as an uncorrupted force of wisdom and peace, seeing Indigenous lifestyles as a romantic way of life. Yet, it is easy to underestimate the practical parts of living together with nature in these ways.⁸ The downsides and sacrifices are disregarded. By paying attention to the specters of the past in the landscape and its forces, Olin's father steers away from romanticizing (living alongside) nature. He shows a deep-rooted awareness of the risks of living in this area. He does not separate himself from the "external world," as is the current dominant epistemology in the Western world, but stays connected with the emotional aspect of this external world.⁹ What we have named "nature" has been a way to limit our view to "blind and deafen oneself" to the complexity and complete understanding of natural phenomena.¹⁰ As it becomes clear, the local population is not forcing their surroundings to behave in a specific way; they do not try to "rule over" nature but live alongside it. Olin's father embodies both the rational and the emotional connection with his natural surroundings, mediating between the two in co-occurring with his environment, creating a sound ecology.

The viewer is immersed in this worldview through sound and visuals. This is done with utmost care and eye and ear for detail, focussing on the panoramas of the vast plains of ice, the frozen highlands, and the mountains with their valleys in disappearing sunlight. The tiniest details in the smallest natural components are apparent as well; we see details of a leaf, zooming in on the cracks in an ice cave, hearing the rustling of grass in the wind, his footsteps in the crackling snow, and drops of melting ice on the water surface. Unsurprisingly, the credits show seven names on photography alone and a specific crew for recording environmental sounds. By focusing so strongly

⁸ Jeff Todd Titon, "Ecojustice, Religious Folklife and a Sound Ecology," *Yale Journal of Music & Religion* 5, no. 2 (2019): 106.

⁹ *Ibid.*, 111–112.

¹⁰ Timothy Morton, "Specters of Ecology," in *General Ecology: The New Ecological Paradigm*, ed. Erich Hörl, and James Edward Burton (Theory. London: Bloomsbury Academic, 2017), 318.

on the sensory details, the spectators get a feeling of being immersed in the same surroundings as well, experiencing the natural environment just like Olin's father, following his footsteps and his understanding of the world, not in the way dominant Western epistemology has invented it, or suitable to be engineered, but in a sounding and more harmonious understanding of his surroundings. The documentary inspires the viewer to re-investigate their own surroundings through their senses, to start seeing, to start listening, and to start feeling their surroundings, to understand better and connect with their environment.

A Short Musical Analysis

In the documentary, the local field recordings play an important part in creating an inspirational atmosphere. By paying close attention to the sonic environment and focusing on sounding details, the composed score seems not to play a critical role in the sound universe, navigating more in the background of the auditive domain. However, the composed layer fulfills an entirely different function navigating a more general emotive layer. Whereas the field recordings help the spectator to get a better grip on experiencing surroundings through the senses, the composed music contributes on a more relational level, underscoring not only the emotions within the landscape but offering musical guidance through the story arc and contributing to understanding the natural sounds more aesthetically. Because Karijord transcribed the field recordings for musical instruments to mimic, the score has a sounding connection with the landscape.¹¹ Creating similarity and overlap between the timbres of the instruments and the field recordings, the score underlines the musicality of the landscape. The field recordings not only function as a way of apt listening to the environment, but when used in a musical context —such as cracking ice and howling winds in this score— it contributes to understanding environmental sounds through an aesthetic lens and, in extension, sound ecology.

Denise Von Glahn's analysis of Judith Shatner's piece *Ice Becomes Water* is an inspiration on how to analyze musical pieces with natural sounds such as glacier and ice sounds.¹² Von Glahn starts her analysis by arguing that music can help us understand the relational capacities between nature and humans.¹³ In a composition, the melodies of the different instruments are interrelated and work best in harmony. Individual listeners have the capacity to hear and understand these

¹¹ OONA Recordings, "Rebekka Karijord - Scoring 'Songs of Earth' With London Contemporary Orchestra," November 24, 2023, <https://www.youtube.com/watch?v=rQV9Amb4uV8>.

¹² Von Glahn, "Relational Capacities, Musical Ecologies, Judith Shatin's *Ice becomes Water*."

¹³ *Ibid.*, 177–78.

counterparts in relation to each other. According to Von Glahn, this is applicable to varying natural sounds as well.¹⁴ She posits that all natural sounds exist in the same sounding universe and are thus interrelated. This idea clearly resonates with Titon's sound ecology, co-presence, and co-vibrations. Von Glahn argues that all these sonic elements have the potential to highlight their relationality and are embodied in musical works in various ways, such as rhythm, pitch, tempo, and timbre. Understanding this relationality can result in a more complex understanding of the sounding universe of the musical work.¹⁵ Suppose a musical piece uses ecological processes as its source of inspiration and potentially uses ecological sounds. In that case, it can help listeners better understand the musical piece's separate elements in broader ecological terms. As Von Glahn shows this process of understanding a musical piece in broader ecological terms in her analysis of *Ice Becomes Water*, she focuses on the pitches, timbres, and rhythms (and time).¹⁶ I will roughly use the same categories in analyzing the score's central theme, but since the main theme of *Songs of Earth* rhythm plays a less important role, I will mainly focus on the tempi and general framing of time instead. I will use rhythms and time in the context of slowness, pitches in the context of hyperobjects, and timbres in the context of specters, but I will first give a small general overview and musical analysis of the main theme.

The main theme of the score is apparent in several tracks, including *Spring IV: The Mountain*, *Winter III: Glacier & The Moose*, and *Winter IV: The Glacier*.¹⁷ It is a simple melody in a minor key with sustaining notes and a forward-moving accompaniment. It is an emotional lament, slowly progressing its movements and reoccurring patterns. If we take a closer look at the main theme (see Figure 3.1), the first thing that stands out is the reoccurrence of the F#.¹⁸ Since the key in this fragment is G#minor, the constant jumping to the F# creates friction. The continuous reminder of the seventh tone in every measure reminds us of the incompleteness and not resolving of the melody. The listener feels the urgency to resolve the F# into the G# but does not get this satisfaction. Similarly, in the final measure, the melody ends on the A, the second tone in the scale. The listener does not get the resolving satisfaction or peace and is continuously reminded of the friction, abrasing the grounding accompaniment with the unsettling tones. Only in measure eleven

¹⁴ Ibid.

¹⁵ Ibid.

¹⁶ Ibid., 183–93.

¹⁷ Karijord, *Songs of Earth (Original Motion Picture Soundtrack)*. Spotify, <https://open.spotify.com/album/0o8KF0PGGNz60kmRvl60He?si=M-sk7EUkQxOTUkHZAfTL2A>.

¹⁸ This transcription is very schematic, encompassing only the lead melody and the chord progression, as this best serves my analysis. I am aware that not all musical information is embedded in this transcription.

does it seem that the melody rests on the G#. Yet this quick moment of release only lasts for one-and-a-half measures before jumping again to the F#.

It is easy to argue that this theme symbolizes the demise of the ice—a lament that does not fit in the current grounding of our anthropocentric worldview and day-to-day life. The theme's minor key is used to position the listener in feelings of sadness, melancholy, and grief. Yet, the chord progression is very straightforward—alternating mainly between i-VI-VII-v-III—and, therefore, predictable. Most listeners are accustomed to these chord progressions, which are apparent in most recent music in all varying genres. Following more “mainstream” chord progressions creates a feeling of familiarity and ease: we know this musical arc and how it progresses. The melody, however, fights this feeling of comfort and familiarity. By continuously abrading the familiar chord progression, the melody fights for a place to be heard and recognized: the listener cannot relax in the ease of the minor melody and its melancholic abilities but needs to pay attention to the tones that do not fit in this familiar auditive world. The chord progression embodies the mainstream understanding and perception of global warming: an acceptance and grief of it happening but not feeling the urgency of this phenomenon in everyday life. This feeling gets breached with the final chord resting on the VII, not resolving and leaving the listener feeling uneasy. The melody of the main theme, on the other hand, supports the urgency of the melting ice. The current state of the melted ice in the Arctic and the glaciers does not accord with the easy day-to-day present in the mainstream perception: the melody does not fit in the slowly progressing lament. It is a continuous friction and a phenomenon that asks for a more intense feeling of urgency.

Tempo and Slowness

In this section, the score's sense of time and tempo will first be analyzed through the music analytical lens of Von Glahn and the conceptual lens of Koepnick's slowness. As the main theme embodies a tempo of roughly forty-five beats per minute, the progression of the melody is slow. Only one of the tracks, *Fall IV: Decay and Love*, has a quicker perceived tempo, with more swift changes in the melody and the accompaniment. The overall slow tempo can be attributed to the use of field recordings. As Karijord first starts the tracks with a display of specific natural sounds before the orchestra blends in, the music adapts to the tempo of the natural sounds. It follows the pulse and organic changes within the recording, adapting to the temporal frame of the recorded entity. The tracks, therefore, embody different types of slowness and temporality.

Von Glahn analyzes the rhythm and tempo of Shatins piece as “chains of temporal relationships expos[ing] the interdependent environment in which both the music and we

FIGURE 3.1: MAIN THEME, TRANSCRIBED BY RONNEKE NIEUWENHUIS

participate.”¹⁹ She investigates the temporal scheme of the *Ice Becomes Water*, which is embodied in rhythmic and metric patterns that symbolize the varying temporal patterns in the world. As many of these patterns and structures are not audible to the untrained ear, she draws a parallel between the importance and workings of natural systems and how these are not dependent upon humans and their awareness of these systems and functions.²⁰ In Shatin’s piece, there are over thirty meter changes and palindromic structures; a parallel between multiple temporalities —only audible when slowing down and listening critically— can be made quickly. In many of the tracks of *Songs of Earth*, meter changes are more difficult to trace. Because the orchestra mainly works with the swelling of chords and tones, the pulse is more challenging to trace, has no attack, and is not very rhythmic. Instead, it becomes a sound bath, continuously flowing from one chord to the other, not hearing the beginning nor the ending of a specific tone. It could be argued that the multiple temporalities —of both the orchestra and the natural sounds— are not clearly audible to the untrained ear as they do not provide a clear-cut pulse or rhythmic structure. Yet, the different layers

¹⁹ Von Glahn, “Relational Capacities, Musical Ecologies, Judith Shatin’s *Ice becomes Water*,” 186.

²⁰ *Ibid.*, 187.

are all functioning, even without the listener's knowledge, fitting Von Glahn's comparison with the workings of natural systems. However, by providing more temporal context by using natural sounds, the variety of layers and temporal structures within the music becomes more accessible to navigate.

Koepnick's concept of aesthetic slowness proves particularly fruitful in this musical conceptualization. Slowing down makes it possible to pay attention to music from a different angle. The multi-layeredness of compositions becomes apparent, both rhythmically and harmonically. Slowing down can help us to comprehend our relationality with the piece and the temporal structures it comprehends.²¹ Slowing down helps us to surpass the teleological order of the musical piece from start to finish, understanding the composition as an energy source that resists fixity and objectification.²² Slowness can be a tremendous conceptual tool in discussing music and composition. The connection between slowness and music has been made several times before. Alexander Rehding analyzed musical pieces in the context of slowness.²³ Rehding's case studies focus on extremely long musical compositions lasting hundreds of years. He cleverly draws connections between slowing down and our worldly perception, arguing that by slowing down immensely, the music functions as an empirical symbol as the listener is invited to imagine the unimaginable —or, as conceptualized in this research, hyperobjects.²⁴ His work does not discuss musical slowness within the realm of compositions in comprehensible time regarding topics that exist in vast temporal spaces.

Rehding argues, similarly to Morton, that the conceptualization of "now" is impossible to comprehend; it is a forever fleeting point that is impossible to capture.²⁵ He argues that only through temporal structures, such as rhythm, can one position oneself in time. Rehding argues that it only becomes possible to grapple with the temporal dimension of long musical pieces by translating it into the spatial domain. Any type of music that has a pulse is spatial. This means that

²¹ Lutz Koepnick, "On Resonance." In *Resonant Matter : Sound, Art, and the Promise of Hospitality*. New Approaches to Sound, Music, and Media (New York, NY: Bloomsbury Academic, 2021), 22.

²² Music notation is also only a vessel to best capture the ideas of composers. A clear example of this is non-Western music that simply does not fit in this frame as its microtones and complex rhythmic structures cannot be translated into the format of Western classical art music. This point can be developed further by arguing that none of the music played is actually completely encapsulated in the sheet music, as is shown not only through different interpretations but also by changing instruments and temperaments.

²³ Alexander Rehding, "The Discovery of Slowness in Music," in *Thresholds of Listening: Sound, Technics, Space*, ed. Sander van Maas (New York: Fordham University Press, 2015).

²⁴ *Ibid.*, 3.

²⁵ *Ibid.*, 7.

unchanging sound would be the metaphorical equivalent of silence, as no sonic events would capture our attention.²⁶

Even though I agree that sonic events are needed to announce presence, just as Titon argues, this does not mean that these vibrations, if they are already sounding, are the equivalent of silence. On the contrary, if something can vibrate a singular frequency for so long, it feels deafening. This sound signals something we must pay attention to over a more extended temporal framework. In the current society, where the sounding universe is overly saturated, a “survival of the loudest” among sounds is created. It is logical to need new inputs to focus your attention on the “silence” of a sustained tone, but it is not silence—the continuous drone of an Airco or fridge is not a sound we would describe as “silence” either. Rehding’s metaphor feels misplaced. If one cannot hear a sustained sound anymore, you should reattune your listening in such a way that it does become audible again. It is, then, not necessary to have “spatial” changes and progression in your music for it to make sound. Rehding’s spatial explanation of sustained tones is a way to be able to grasp the temporal vastness of the tone. According to Rehding, we cannot comprehend how the sounds move and progress over such vast temporal time; thus, it needs a spatial structure to comprehend. Because their vastness is unable to comprehend, these tones are then hyperobjects. Perhaps we should attune our listening to the unchanging tone and accept that we cannot conceptualize what we hear.

When listening to *Winter IV: The Glacier*, the layering of temporalities in the track becomes clear. The track opens with a distanced whale call that slowly becomes more audible. After the first whale call, we hear the low rumbles of moving ice, sounding like far-away thunder. Softly, we hear waterdrops falling in a cave and some underwater sound layering on top of the whale calls and the ice cracks. The orchestra subtly comes in with a glass harmonica and strings, first leaving the listener wondering if they hear natural or orchestral sounds. Only at 0.59 does the orchestra take over with the main theme's chords. The glass harmonica creates a continuity mimicking the higher frequencies of the ice cracks. The layering of the natural sounds displays a variety of temporality: the temporality of the whale, the progress of the glacier, and the melting ice. By auditively zooming in and slowing down, we can start to establish our “presentness” in these temporalities.²⁷ It feels easier to navigate. The orchestra assists in this process. The listener stays in a slowed-down perspective by slowly changing chords and allowing the melody to resonate and vibrate before moving on. A pulse only comes in when the strings start playing and progress relatively

²⁶ Ibid., 12–13.

²⁷ Tiago de Luca, Review of *On Slowness: Toward an Aesthetic of the Contemporary*, by Lutz Koepnick. *Cinema Journal* 55, no. 2 (2016): 165.

straightforwardly. This tempo resonates primarily with the temporality of Olin's father and his perception of the glacier. They are sounding his grief over the loss of ice over the decades. Furthermore, a continuous high string throughout the track does not change or move, yet it is very audible. The more "cold" sound of the high strings fit a feeling of chill and ice and can be seen as embodying the temporality of the ice. In the middle of the track, the whale sounds are mimicked by an instrument from the flute family.²⁸ Because almost all song buildups consist of natural sounds, followed by orchestral sounds, before closing off with natural sounds again, the orchestral sounds can be interpreted as the intermission between the field recordings. As contextualized in Chapter One, the intermission between natural sounds is a moment of reflection. The intermission of the natural sound recordings creates a space of critical engagement and thinking through our experiences before being presented with new recordings. The musical translation of the recorded sounds contemplates and echoes what we have heard before.

The soundtrack thus embodies different temporalities of the natural sounds, primarily since the orchestral sounds are based on the transcription of the field recordings. The listener is guided through the coexistence of these temporalities within the composition, hearing their harmonies, interrelatedness, and friction. By slowing down and hearing the composition through a temporal lens, the listener is made aware of the varying temporalities that are all interrelated with the glacier and happening alongside each other. It allows an understanding of the relationality between the varying temporal components and creates an awareness of our influences on them. It helps us feel these temporal structures.

Pitches and Hyperobjects

In the following section, a connection between Von Glahn's analysis of pitches and Morton's hyperobjects will be made concerning *Winter IV: The Glacier* from the score of *Songs of Earth*. Combining pitches and hyperobjects will create an enriched way of analyzing and listening to this case study. I will argue that recognizing the sound of hyperobjects in music can help create a more encompassing relativity toward the hyperobjects. I will do this by first diving into Von Glahn's analysis of pitches and comparing this to the case study, whereafter, the relation between hyperobjects and the case study will be discussed in light of Von Glahn's analysis.

In her analysis of pitches and intervals in *Ice Becomes Water*, Von Glahn focuses mainly on the centrality of the E in the piece as a symbol for the Earth, environment, and ecology.²⁹ The

²⁸ It is difficult to determine the exact instrument, but my guess would be a Fajara.

²⁹ Von Glahn, "Relational Capacities, Musical Ecologies, Judith Shatin's *Ice becomes Water*," 183.

glacier sounds Shatin uses are too complex to ascribe a single tone. The E is the closest to the microtonal pitches of these glacier sounds and thus serves as a mediator between the glacier recordings and the instruments. The E serves as an essential anchor through which the listeners can ground themselves in otherwise harder-to-place chords and melodies of minor seconds, minor thirds, and tritones. The E thus functions as a resolution in the piece's progress, especially with a lack of resolving chords and melodies. This uncertainty plays an essential role in the conceptualization of the music; as the listeners do not know what is happening or where and how the piece will end, *Ice Becomes Water* “materializes, [and] reifies, the inescapable unknown consequences of human actions against the environment.”³⁰ In the analysis, a continuous arc can be traced throughout the uses of the “tonal center” of the E that is continuously contested through friction-creating intervals. These moments of friction are accompanied by the increasing loudness of booming and crashing sounds of melting ice.

In *Winter IV: The Glacier*, a similar thing happens less rigidly —and does not have a fulfilling poetic connection between the tonal center and words like Earth or environment. The track opens with the whale call that comes in on a D and switches to an A. The low rumbles of the cracking ice of the glacier make it harder to give a tonal center but circle around a G#. The orchestra slowly swells in the background and establishes this G# before continuing (see Figure 3.1). The D of the whale call is not represented in the orchestral part of the track but signals its ominous relation with the melting ice through the tritone. The whale's A, however, is clearly represented musically as the A is played in measure five and at the end of the melody, never resolving and continuing on the A until the end of the piece. The continuous jumps to the F# combined with the highlighting of the A create an urge for resolution toward the piece's tonal center, G#, yet this never happens. Karijord's composition creates a feeling of uncertainty for the listeners; the never-resolving music reiterates the conceptualization of unknown consequences and futures of the environmental catastrophe. According to Pettit's anecdote, whales can react to glaciers' calving events.³¹ The whale's A can then be interpreted as its stressful or sad reaction to ice melting, especially when realizing that, In addition, since the sound recordings used in the score have all been recorded on location, it is plausible that the whale was actually reacting to specific sounds. The continuous A at the end of the track highlights the unknown consequences and futures of the recorded environment, just as the friction in *Ice Becomes Water*.

³⁰ Ibid., 186.

³¹ National Geographic. Erin Pettit: Glaciers on the Run | Nat Geo Live. 2013. YouTube, <https://www.youtube.com/watch?v=1hWp5Qaapi4>.

This is where Morton's conceptualization of the hyperobject comes in. As described above, the pitches of minor intervals and tritones orchestrate the friction of the piece. As these frictions resemble unknown futures and unknown consequences, they also resemble hyperobjects. Morton uses a musical example to argue the vastness of frequencies that guide us into a "realm of soothing contemplation."³² As music functions around having a "tune" and how attunement between different musical instruments and players is essential for harmonies, "a nowness of harmonic frequencies, vibration within vibration, the infinite in matter, on this side of things; an immanent beyond. A sonic ecology without presence, without the present" is created.³³ Thus the frequencies in attunement with each other are hyperobject themselves. For example, Morton points to an algorithmic structure that holds a specific chord for as long as possible—fitting to Rehding's analysis of slowness as well. Suppose the correlation between different frequencies at particular moments in time reflects our current "nowness" and contemplation. In that case, primary entities that co-vibrate each other in specific moments attune themselves to hyperobjectivity. Especially considering that humans can only hear a particular spectrum of sounds and only hear a limited amount of the sounds non-human entities make, the realm of frequencies is not only a hyperobject in itself but functions as a temporal checkpoint in the sounding universe. Sound can thus be seen as an aesthetic transcendence of the normative human limits.³⁴

In *Winter IV: The Glacier*, we can trace this hyperobjectivity in several ways. First, as is apparent in Von Glahn's analysis, the unresolved tension and friction of the A in the G#minor scale highlight the unknown consequences and futures of environmental catastrophe. The A underlines the hyperobjectivity of climate change. We can never grasp, know, or understand climate change's full implications and effects on a larger temporal scale. Thus, we cannot know the ending or resolution in this temporal framework. The track embodies this feeling of not knowing or being unable to understand, leaving the listener uneasy. Secondly, the orchestra's harmonies with the glacier and the whale create this "nowness of harmonic frequencies" Morton talks about. The layering of the various pitches originating from different sources creates a feeling of "nowness." In this exact moment, we hear these sources resonate together; it calls attention to the entities making these sounds, yet it is ever fleeting. The moment we hear the co-vibration, their harmonies are already in the past. It is impossible to ground ourselves as listeners in the vastness of the sounding entities, and our conceptualizations of "past," "present," and "future" cannot help us to stabilize the

³² Timothy Morton, "HYPEROBJECTS," *CSPA Quarterly*, no. 15 (2016): 8.

³³ *Ibid.*

³⁴ *Ibid.*

ever-fleeting temporality of hyperobjects. Combining whale, glacier, and orchestral sounds in one track contests this feeling of “nowness” even more. We are aware of the different timespans these sounding entities live in, and we are aware that the recordings of nature sounds have been made before the recording of the orchestra and that we are listening to a recording of something that happened in the past in general. The different sounds and their frequencies thus highlight the variety of temporal frameworks within one recording and the impossibility of fully understanding all these sounds individually as combined. Finally, on a more abstract note, as Morton pointed out, we can only hear a specific spectrum of frequencies within our human limits. Therefore, we can never know what we miss out on, both the orchestral instruments and the natural sounds. This point can be elaborated on further when considering the loss of sound through recording and editing devices, which are currently technological possibilities.

Tracing hyperobjects in specific musical pieces allows us to reflect on these vast spatial and temporal objects from a more aesthetic perspective. As we must find ways to grapple with these impossible-to-understand hyperobjects, the aesthetic domain can offer new resonating tools. Because we cannot grasp hyperobjects with our rational capabilities, we might access some relationality through aestheticization and emotions. The landscapes portrayed musically in the score of *Songs of Earth* are emotional and encompass various timescales. By analyzing the presentness of the hyperobjects’ soundings in a musical composition, we can connect our emotional responses to the composition with the relationality toward these hyperobjects. Even though the musical output is mediated in several ways, it still connects with these sounding elements. Understanding the proximity of a hyperobject's sounding dimension in compositions can help build new modes of resilience, offering tools to investigate our emotional connection with these entities.

Timbres and Specters

Moving to an analysis of timbres and specters, the following section dives into Von Glahn’s understanding of timbres and analysis of specters by first touching upon the work of Von Glahn, whereafter I will discuss Coulthart’s understanding of the sounding Arctic specters in relation to the soundtrack of *Songs of Earth*. I will argue that hearing and recognizing the sound of specters in musical works can help one become aware of things that require acknowledgment and change. We all know that the ice sheets are melting, but actively hearing these specters in our surroundings, mediated through soundtracks, creates a new sense of urgency and resilience.

Von Glahn’s analysis of the timbre of *Ice Becomes Water* starts by referring to Cruickshank’s work and her connection with the Indigenous people of the Yukon Territory, stating

that by acknowledging the mutualism between different organisms (including glaciers), they all can benefit from each other and is a way of connecting and understanding.³⁵ According to Von Glahn, Shatin's piece comments on this relation by embodying the result of ignoring these mutualistic relations by creating a compositional timbre in which natural, technical, and orchestral sounds all benefit from each other and are interrelated.³⁶ She argues that by instructing the string players to play with different techniques, the timbral domain shifts to create tension and control. The impossibility of distinguishing the source of the sounds at several moments in the piece and matching timbral calibers of the sounding groups (nature sounds, technical devices, orchestra) show this interrelatedness and mutualism.³⁷ Von Glahn interprets this phenomenon as a connection to agency and choices of humanity concerning the environment. As the instrumentalists have many varying approaches and techniques for playing their instruments in this piece, it symbolizes humans' choices to change their behavior and approaches toward the environment.³⁸ As the continuity of timbre throughout the piece and the different sounding groups is pertinent in *Ice Becomes Water*, the piece symbolizes the connectedness of nature, humans, and technical advancement. In addition, as the piece builds on the E as a grounding tone, it relies on the aural memory of the listener to create another form of connection; "this is the way things were. This is how they should be. This is the way they will be."³⁹

The overall timbral connections of the *Songs of Earth* soundtrack and the timbral relation between the natural sounds and the orchestra are undeniably interrelated and highlight this mutualistic approach. Because all the recorded natural sounds are transcribed and transferred to the domain of Western musical language, the timbral overlap between the orchestra and these sounds is almost perfect at certain moments, not being able to distinguish between the two. If we again take *Winter IV: The Glacier* as an example, this timbral overlap is evident. For example, from 2.45-3.05, we hear a very soft wind blowing in the background, yet at 2.55, this sound shifts slightly, exposing the sound's originator: a cymbal. The timbres of sounding sources are so closely related that it is almost impossible to distinguish them. This shift of sound sources also happens at the beginning of the track. A musical drone is introduced between the song's start and 0.59. This is done so subtly that, in the beginning, it is unclear what sound originates from the recordings and what sounds are

³⁵ Von Glahn, "Relational Capacities, Musical Ecologies, Judith Shatin's *Ice becomes Water*," 189.

³⁶ Ibid.

³⁷ Ibid., 190.

³⁸ Ibid.

³⁹ Ibid., 191.

played by instruments. This drone is maintained throughout the score, serving as a timbral bridge and anchor point for the aural memory of the listener; the continuity of nature is highlighted. Fitting Von Glahn's analysis, this continuity in *Winter IV* is contested by the "unlogical" pitches in the melody, as discussed previously, highlighting the agency of humans to change their behavior and challenge the aural memory; this is what it was, but not what it will be in the future.

These timbral connections are very suitable for portraying specters. As conceptualized in the first chapter, the sounds of ice carry specters. Silence, whistling winds, animal noises, and the sounds of ice cracks characterize the sonic ice category. All these sonic markers are endangered and will become extinct soon if they are not already. The haunting in these sounds is both from the past and the future: the past of oppressing nature and Indigenous people in the Arctic, the future of silence, and the disappearance of the landscape altogether.⁴⁰ As specters are omnipresent in the sounds of ice, they are also present in the soundtrack of *Songs of Earth*. Highlighting these specters showcases the endangered sounds and the extinction of some of the recorded sounds of the glacier valley in Norway, haunting us in varying ways. The concept of "solastalgia" as lost solace through connecting with the environment is also beneficial in analyzing the soundtrack of *Songs of Earth*, as it fits our aural memory of the sounding glaciers before their exhilarating melting and breaking down, carrying specters of the past.⁴¹

Specters are present in the soundtrack in several ways. First, by using field recordings, the specters encapsulated in those sounds are mediated through the soundtrack. We actively hear the sounds of the glacier's distress. Secondly, because the field recordings are transcribed to orchestral sounds, the specters are *remediated* through the orchestral sounds. As the initially recorded sounds emit sounding specters and these are transcribed as perfectly as possible into the orchestral sounding domain, the sound of these specters will have been transcribed and thus are present in the orchestra. Thirdly, if the timbre reflects on the relationship and mutualism of humans and nature, then the score carries this relationship's past, present, and future connections. The listener is made aware of the current environmental stress by evoking the aural memory of the listener, creating a feeling of solastalgia. The score carries specters of the past, sounding a desire for the past, portraying feelings of loss and desolation. Fourthly, this timbre and interrelatedness also sound the relationships between humans and the environment. The extractivist and imperialist outlook on the globe that resulted in the current environmental stress is carried in this timbre as well. As human

⁴⁰ Lisa Coulthard, "Haunted by Extinction: Sounding an Arctic Uncanny," in *Haunted Soundtracks: Audiovisual Cultures of Memory, Landscape, and Sound*, ed. K. J. Donnelly and Aimee Mollaghan, (New York: Bloomsbury Academic, 2023), 118.

⁴¹ *Ibid.*, 108.

agency is reflected in the instrumental timbre, it shows possibilities for connection, as well as points of tension and friction. Finally, the score also carries the glacier's specters of the future; the sounds of the glacier's demise carry the specters of the landscape's disappearance and its geography of extinction.

By being aware of the presence of specters in compositions, soundtracks, songs, and other musical material, we need different modes of listening to pay attention to these specters, acknowledge them, and try to resolve current sounding issues. As timbre changes are kept to a minimum and are only very deliberately apparent when showcasing friction and tension, the continuity of the timbre symbolizes the interconnectedness of nature and humans, thus highlighting the importance of a sound ecology. The fact that so many varying specters are (re)mediated in the timbre of the soundtrack argues for change. As Gordon states, specters are showing the residue of past traces and a demand for behavior change. We must become aware of these specters and start listening to the effects and environmental changes we have caused.⁴² Karijoord welcomed these specters in her composition and created a sounding world through which these specters resonated. Tracing these specters through musical analysis—or listening in general—can help develop new modes of resilience and a higher sense of urgency.

Conclusion

As explored in this chapter, the field recordings are intertwined with the musical composition and are part of the musical imagination. As the sounds are deliberately transcribed to Western music notation, their sound is acknowledged as musical material by Karijoord. Their sounding dimensions interconnect on pitch, tempo, and timbre levels, providing interesting compositional connections and musical output. This interconnectedness highlights, once again, Titon's conceptualization of a sound ecology of co-occurrence, co-vibration, and a world through the aural dimension. Other patterns, connections, and relations become apparent by perceiving the world mainly through sound. It also advocates for different modes of listening within Titon's sound ecology. If we start hearing from an aural dimension, focussing on the auditive force of other sounding entities apart from musical instruments, new ways of conceptualizing music, or even the world, emerge. A more in-depth musical analysis and understanding of the soundtrack supporting this notion can be achieved by highlighting this interconnectedness through slowness, hyperobjects, and specters. As demonstrated above, the concepts are valuable to understanding musical pieces. Opening our

⁴² Avery Gordon, "Introduction to the New Edition," In *Ghostly Matters: Haunting and the Sociological Imagination*, 2nd ed. (Minneapolis: University of Minnesota Press, 2008), xvi.

auditive gaze can prove fruitful in creating new modes of environmental activism, environmental critique, and modes of resilience. Attributing an aesthetic character to the sounds of these glaciers can help us reimagine their sounds, their beings as entities, and their role in the environmental crisis—or rather, the role of humanity in relation to glaciers.

Conclusion:

Musically Informed Modes of Listening

This thesis has aimed to answer the question of what the aesthetic worth of glacier sounds entails and how the sonic dimension of melting glaciers contributes to sustainability and ecological resilience. As the field of ecomusicology examines the relationship between music, culture, nature, and sound, grounding this thesis in ecomusicology provided a rich context for this topic. Combining ecological and environmental issues with musicological analysis, the field of ecomusicology offered new ways to grapple with the environmental and cultural importance of natural sounds, such as glacier sounds. I aimed to build on and extend Titon's scope of sound ecology.¹ By introducing three concepts in Chapter 1—slowness, hyperobjects, and specters—a deeper philosophical understanding of sounding glaciers has been investigated, exploring how the conceptual framework of these concepts can enhance our understanding of glacier sounds and their musical representation. Two case studies have been examined to investigate these concepts concerning Titon's sound ecology and the aesthetic worth of glacier sounds. First, in Chapter 2, the bubble sounds recorded by Erin Pettit are investigated. These recordings encompass the sound of bubbles escaping from melting ice and have been analyzed in a scientific context by Pettit and her team.² These recordings give a unique sonic perspective of melting glaciers and can be interpreted as aesthetic and scientific data. In Chapter 3, the second case study was explored. The score of *Songs of Earth*, composed by Rebekka Karijord, incorporates natural sounds recorded in glacial environments with orchestral music.³ By transcribing the recorded natural sounds, Karijord has created a connection between the musical and natural sounding domains, showcasing the musicality of these natural recordings. The analysis of these two case studies, based on the three main concepts of slowness, hyperobjects, and specters, has showcased the aesthetic worth of the sounds of glaciers.

Chapter 1, "Glacial Intermission," served as the theoretical foundation for this thesis. Building on Mieke Bal's argument that research in the humanities should be based on concepts rather than specific methodologies, the three main concepts were introduced and explored through a

¹ Jeff Todd Titon, *Toward a Sound Ecology: New and Selected Essays* (Bloomington: Indiana University Press, 2020).

² Erin C. Pettit, Jeffrey A. Nystuen, and Shad O'neel, "Listening to Glaciers: Passive Hydroacoustics Near Marine-Terminating Glaciers," *Oceanography* 25, no. 3 (2012): 104–5.

³ Rebekka Karijord, *Songs of Earth (Original Motion Picture Soundtrack)*. OONA Recordings AB, 2023, Spotify, <https://open.spotify.com/album/0o8KF0PGGNz60kmRv160He?si=M-sk7EUkQxOTUkHZAfTL2A>.

literature review.⁴ Titon has described in “Sound of Climate Change” what the sound of climate change can entail in local environments.⁵ Yet, the implications of the sound of climate change on more extensive temporal and spatial frameworks have not been explored. In addition, introducing Von Glahn’s musical analysis of an orchestral piece with glacier sounds shows the possibilities of musically understanding glacier sounds within the musical domain.⁶ Yet, the absence of tools to grapple with these sounds in broader contexts that are missed outside the specific orchestral scope is evident. Therefore, the concepts of slowness, hyperobjects, and specters are introduced and examined to understand their relevance in understanding the aesthetic worth of glacier sound and their cultural applications.

First, Lutz Koepnick’s conceptualization of slowness is explored. He addresses the co-temporality of ecological processes, for which he uses photography of melting glaciers as an essential example.⁷ His conceptualization of slowness showcases why we should slow down our perception and engagement with environmental entities to understand ecological processes better. Second, Timothy Morton’s concept of hyperobjects—referring to entities distributed in time and space on massive scales— is introduced.⁸ Because glaciers are hyperobjects, they embody ecological phenomena’ complexity, interconnectedness, and extensive impact. The sound of these glaciers can help to grapple with understanding this complex construction by translating the hyperobject into an aesthetic realm. Finally, Avery Godon’s conceptualization of specters is introduced.⁹ The concept of specters explores how memories and histories are carried in the sound of glaciers, often portraying power imbalances, forgotten histories, and haunting futures. These glacier sounds are contextualized as embodying the environmental and cultural narratives embedded in the ice, both past and future. Recognizing specters can help contribute to fighting ecological injustices. By connecting the concepts of slowness, hyperobjects, and specters, an enriched understanding of natural sounds, their aesthetic worth, and their cultural applications are explored. This chapter served as the groundwork for a hermeneutic exploration of the case studies,

⁴ Mieke Bal, “Introduction,” in *Travelling Concepts in the Humanities: A Rough Guide* (University of Toronto Press, 2002), 3–21.

⁵ Titon, *Toward a Sound Ecology: New and Selected Essays*, 248–253.

⁶ Denise Von Glahn, “Relational Capacities, Musical Ecologies, Judith Shatin’s Ice becomes Water,” in *Sounds, Ecologies, Musics*, ed. Aaron S. Allen and Jeff Todd Titon (Oxford University Press, 2023), 177–97.

⁷ Lutz P. Koepnick, *On Slowness: Toward an Aesthetic of the Contemporary* (Columbia University Press, 20214).

⁸ Timothy Morton, “Ecology without the Present,” *Oxford Literary Review* 34, no. 2 (December 2012): 229–238.

⁹ Avery Gordon, “Introduction to the New Edition,” In *Ghostly Matters: Haunting and the Sociological Imagination*, 2nd ed. (Minneapolis: University of Minnesota Press, 2008), xv–xx.

investigating how glacier sounds can be understood and interpreted within an ecomusicological framework.

Chapter 2, “Sounding Bubbles,” presents the first case study: bubbles escaping from melting glacier ice, recorded by Pettit.¹⁰ This chapter investigated these bubble sounds through the lenses of the concepts developed in Chapter 1. As these recordings are made with a specific scientific goal, the scientists listen to these sounds in a “scientific listening mode.” I argue that with different modes of listening, other understandings of these recordings are possible. Glacier sounds need a different ontological framework than Titon’s description of natural sounds, such as birds and trees, because glacier sounds are intrinsically connected with questions of time and space.¹¹ Applying a “musicological informed listening mode,” these sounds are explored through an aesthetic lens, highlighting the possibilities of understanding these sounds as musical material.

The recorded bubbles highlight the temporal dimensions of melting glaciers. By listening to these sounds and slowing down our perception, we can better understand the varying temporal structures interwoven in ecological change. Koepnick’s concept of slowness invites the listener to engage with these slow processes, reflecting upon questions of temporality and relationality. Only by slowing down can we hear the changing processes of the glacier’s ice over time. The sound of these bubbles helps to create an understanding and a context to grapple with the vastness in both time and space, navigating a possible relationality toward the hyperobject. The sonic connection to the past becomes audible because the air that escapes has been frozen in the ice for thousands of years. Creating an auditory connection to the temporal vastness of the glacier offers a framework for understanding the implications of the melting ice. The concept of specters is applied to the sound of the bubbles to investigate the historical and cultural significance of these sounds, showcasing the remains of the glaciers’ past and evoking the presence of lost ecosystems. These specters remind us of the changing environment and the need to address climate change. They highlight the possible loss of landscapes and environments if we do not act on these specters. The sound of these bubbles can thus evoke a greater sense of urgency and cultural change by bridging the spatial and temporal gaps between daily life and the melting Arctic. New perspectives on the significance of glacier sounds are offered, demonstrating how these bubbles can be understood in an ecomusicological framework.

Chapter 3, “Glacier Sounds in the Musical Imagination,” explores glacier sounds within a musicological context, focusing on the soundtrack for the documentary *Songs of Earth* by Rebekka

¹⁰ Pettit, et al., “Listening to Glaciers: Passive Hydroacoustics Near Marine-Terminating Glaciers,” 104–5.

¹¹ Titon, *Toward a Sound Ecology: New and Selected Essays*, 248–253.

Karijord.¹² The ontological meaning of these glacier sounds is that they are aestheticized by becoming part of the compositional process, and the sounds are musical material. This chapter aimed to expand the theoretical framework established in the first chapter into the musicological domain by analyzing musical compositions that integrate natural glacier sounds. Traditional Western musical analytical tools do not discuss the connection between sounds and composition, so this must be developed. Building on and extending Von Glahn's analytical approach—which considers rhythm, pitch, and timbre—the concepts of slowness, hyperobjects, and specters are connected with Von Glahn's analytical categories to offer an ecomusicological analysis.¹³

Von Glahn's category of rhythm is connected to Koepnick's understanding of Slowness, showcasing how Karijord's composition illustrates the continuous melting of glaciers, advocating for attuning to slower temporalities of environmental entities. Morton's hyperobjects are connected with Von Glahn's category of pitch, arguing how pitch can evoke the massive entities of glaciers. The pitch ranges and harmonic structures of Karijord's composition are interpreted as musical representations of the vastness and complexity they embody. Specters are connected to the timbre category, arguing that the unique timbral qualities of the glacier sound in the compositions are sonic characteristics of the environmental specters, sounding disappearing ecologies. By integrating field recordings of glacial environments in the composition, Karijord creates an immersive sonic experience, sounding the urgency of the melting glaciers. The sounds are not only musical, but the music serves as a medium through which listeners can engage with these sounds of ecologies and environments outside their daily spatial and temporal scope.

An Extended Sound Ecology

The interrelatedness of the three main concepts is crucial to answering the questions of what the aesthetic worth of glacier sounds entails and how the sonic dimension of melting glaciers contributes to sustainability and ecological resilience. As the three chapters have shown, all three concepts negotiate temporality and specific relativity between the spectators and the glaciers. By understanding our positionality, relationship, and relativity toward glaciers in a way that connects us to these entities, we become more in touch with co-vibration and sound ecologies. This relativity is easier accessed through the aesthetic realm of these sounds. The world of scientific data presents us with lots of frightening data, yet within the data itself, no emotions are visible. Only through

¹² Rebekka Karijord, *Songs of Earth*, <https://open.spotify.com/album/0o8KF0PGGNz60kmRvl60He?si=M-sk7EUkQxOTUkHZAfTL2A>.

¹³ Von Glahn, "Relational Capacities, Musical Ecologies, Judith Shatin's Ice becomes Water," 177–97.

aesthetic and cultural processes —documentaries, poetry, speeches, music— does the emotive connection with these disappearing ecologies become clear. The aesthetic worth of these sounds, then, is the ability to awaken an emotive response to the current environmental crisis. The visuals of melting icebergs have become an allegory for climate change and are ubiquitous in news coverages and documentaries on climate change. However, their sound offers new interpretations and ways to grapple with this melting phenomenon. Images provide a more static connection with melting glaciers, but the sounding domain uniquely offers a relational temporality. Being able to grapple with melting glaciers through time, even if it is only relatively, can create a new level of critical awareness and feelings of urgency. The glacier sonic dimension then contributes to sustainability and ecological resilience by offering temporal connections to create this feeling of urgency.

To conclude, this temporal framework contributes to Titon’s sound ecology. Integrating the concepts of slowness, hyperobjects, and specters into Titon’s framework offers room to highlight the temporality of natural sounds and their cultural significance. Titon’s conceptualization of co-vibration already provides an understanding of being in connection with nature and sounding entities. Yet, as I have argued, this connection is broader than “just” co-occurrence; it highlights questions of temporality, relativity, and positionality toward sounding entities, strengthening this feeling of connection and co-occurrence. Titon’s sound ecology is more than connecting with sounding entities; it also encompasses mediating natural sounds into sounding data and musical works to grasp these entities’ emotional and temporal dimensions. We can qualify these glacier sounds as musical material, showcasing that we start to see value in different sounds by listening to the world not from a textual but a sounding perspective. Titon’s plea to listen to the world with “musically-informed ears” offers understanding and added value to hearing the aesthetic worth of glacier sounds.¹⁴

This thesis opens several avenues for further research in ecomusicology and sound ecology: First, Pettit and her team recorded sounds in the water near the glacier terminus. Expanding the sounding domain of glaciers to encompass more areas of the glacier can provide different sounds that negotiate different temporal scales, potentially contributing to temporal connections with the glacier that are now beyond reach. The same argument applies to glacier sounds from glaciers in other parts of the world. Do these glaciers sound different? What does that entail for their temporal dimensions and aesthetic worth? Second, the sounding overlap between field recordings and

¹⁴ Jeff Todd Titon, “Knowing Fieldwork,” in *Shadows in the Field: New Perspectives for Fieldwork in Ethnomusicology*, ed. Gregory F. Barz and Timothy J. Cooley (Oxford: Oxford University Press, Incorporated, 2008), 29.

musical instruments has been briefly touched upon, expanding this notion and researching the sonic identities of glacier sounds concerning musical instruments potentially argues for natural entities to be seen as musical instruments or composing entities. This would be attributed to the aesthetic worth of these glacier sounds. Third, the notion of agency has not been discussed in this thesis. Research into the agency of natural sounds over aesthetic mediations offers new interpretations of sounding entities. Fourth, the boundary between envoicing and the “voice of nature” is only briefly touched upon in chapter two. This notion of *envoicing* nature is something that could be explored further. Fifth, this thesis has not explored the avenue of technological innovations and explorations. Investigating how emerging technologies, such as sound mapping and bioacoustics, can contribute to studying and interpreting natural sounds in aesthetic contexts. Sixth, the interpretation and reception of musical pieces with glacier sounds by spectators and what responses these compositions, and these sounds at large, evoke. Investigating how to start listening to nature collectively and this sonic dimension of the ecological crisis creates a more hands-on approach to creating musical modes of resilience. Seventh, the conceptual framework of investigating these sounding phenomena can be extended. These three concepts already provide many valuable insights if other concepts introduced by different scholars are explored in this context as well —such as sound conservation, Annea Lockwood’s sound mapping, Koepnick’s resonance, Steve Goodman’s sonic warfare, Noah Heringman’s deep time, and Pauline Oliveros’ deep listening.¹⁵ Finally, this thesis has only focussed on the sounds of glaciers. Yet, climate change sounds apply to many natural phenomena and entities. A more complete sonic identity of climate change can be explored by investigating other natural phenomena and entities such as —biodiversity loss, acidification of the ocean, dying coral reefs, the effects of forest fires, floods, tornadoes, or extreme heat on the sounds of local ecologies. By continuing to develop and apply these conceptual frameworks, ecomusicology can play a crucial role in addressing our time's cultural and ecological challenges, promoting a shift from economic rationality towards ecological rationality and sustainability.

This thesis has bridged my personal gap between musicology and glacier studies. Finding a way to navigate environmental anxiety as a musicologist is an ongoing process. Including my fascination with the sonic domain of glaciers in this thesis has broadened my understanding of this sonic domain and enriched my understanding of how I perceive sound in general. Developing a

¹⁵ Annea Lockwood, *A Sound Map of the Hudson River*. Lovely Music, Ltd., LCD 2081, 1989; Lutz Koepnick, “On Resonance.” In *Resonant Matter : Sound, Art, and the Promise of Hospitality*. New Approaches to Sound, Music, and Media (New York, NY: Bloomsbury Academic, 2021), 3–29; Steve Goodman, *Sonic Warfare: Sound, Affect, and the Ecology of Fear* (Cambridge, Mass.: MIT Press, 2010); Noah Heringman, *Deep Time: A Literary History* (Princeton, New Jersey: Princeton University Press, 2023); Pauline Oliveros, *Deep Listening: A Composer’s Sound Practice* (Bloomington, IN: iUniverse, Inc., 2005).

“musically informed ear” has helped me navigate my perception of the sounding world and motivated me to investigate our (disappearing) sounding environments and argue for their intrinsic value. Saving a piece of ice from a calving glacier might not be the way to execute environmental consciousness. Still, almost twenty years after my first encounter with glacier ice, I now know that musicologists can contribute to sustainability and ecological resilience.

Bibliography

Ahrendt, Rebekah, and David Van der Linden. "The Postmasters' Piggy Bank: Experiencing the Accidental Archive." *French Historical Studies* 40, no. 2 (2017): 189–213.

Allen, Aaron S. "Ecomusicology." *Grove Music Online*. 25 Jul. 2013; Accessed 27 Oct. 2022.

Allen, Aaron S. "Sounding Sustainable; or, The Challenge of Sustainability." In *Cultural Sustainabilities: Music, Media, Language, Advocacy*, edited by Timothy J. Cooley, 61–73. Champaign: University of Illinois Press, 2019.

Alter, Nora M., Lutz Koepnick, and Richard Langston. "Landscapes of Ice, Wind, and Snow: Alexander Kluge's Aesthetic of Coldness." *Grey Room*, no. 53 (2013): 60–87.

Bal, Mieke. "Introduction." In *Travelling Concepts in the Humanities: A Rough Guide*, 3–21. University of Toronto Press, 2002.

Boetzkes, Amanda, and Jeff Diamanti. "At the Moraine." *E-Flux Architecture* (September 2020).

Bowers, Katherine. "Haunted Ice, Fearful Sounds, and the Arctic Sublime: Exploring Nineteenth-Century Polar Gothic Space." *Gothic Studies* 19 no.2 (2017): 71–84.

Coulthard, Lisa. "Haunted by Extinction: Sounding an Arctic Uncanny." In *Haunted Soundtracks: Audiovisual Cultures of Memory, Landscape, and Sound*. Edited by K. J. Donnelly and Aimee Mollaghan, 105–121. New York: Bloomsbury Academic, 2023.

Cruikshank Julie. "Are Glaciers 'Good to Think With'? Recognising Indigenous Environmental Knowledge." *Anthropological Forum* 22, no. 3 (2012): 239–250. 10.1080/00664677.2012.707972

Devine, Kyle. "Decomposed: A Political Ecology of Music." *Popular Music* 34, no. 3 (2015): 367–89. <https://doi.org/10.1017/S026114301500032X>.

Feisst, Sabine. "Allô, ici la Terre: Agency in Ecological Music Composition, Performance, and Listening." In *On Active Grounds : Agency and Time in the Environmental Humanities*, edited by Robert Boschman and Mario Trono, 87–106. Waterloo, Ontario: Wilfrid Laurier University Press, 2019.

Frantzen, M. K., & Bjering, J. "Ecology, Capitalism and Waste: From Hyperobject to Hyperobject." *Theory, Culture & Society* 37 no. 6 (2020): 87–109. <https://doi.org/10.1177/0263276420925541>

Goodman, Steve. *Sonic Warfare: Sound, Affect, and the Ecology of Fear*. Cambridge, Mass.: MIT Press, 2010.

Gordon, Avery. "Introduction to the New Edition." In *Ghostly Matters: Haunting and the Sociological Imagination*, 2nd edition, xv–xx. Minneapolis: University of Minnesota Press, 2008.

Heringman, Noah. *Deep Time: A Literary History*. Princeton, New Jersey: Princeton University Press, 2023. <https://doi.org/10.1515/9780691235806>.

Katz, Eric. *Nature as Subject: Human Obligation and Natural Community*. Rowman & Littlefield Publishers, 1996.

Kendall, David. "'All nature sings, and around me rings the music of the spheres': Christianity and the Transmission of a Cosmic Ecomusicology." In *Ecotheology in the Humanities: An Interdisciplinary Approach to Understanding the Divine and Nature*, edited by Melissa Brotton, 119–139. Lanham: Lexington Books, 2016.

Koepnick, Lutz P. *On Slowness: Toward an Aesthetic of the Contemporary*. Columbia Themes in Philosophy, Social Criticism, and the Arts. New York: Columbia University Press, 2014. <https://doi.org/10.7312/koep16832>.

Koepnick, Lutz. "On Resonance." In *Resonant Matter: Sound, Art, and the Promise of Hospitality. New Approaches to Sound, Music, and Media*, 3–29. New York, NY: Bloomsbury Academic, 2021.

Lockwood, Annea. 1989. A Sound Map of the Hudson River. Lovely Music, Ltd., LCD 2081.

Luca, Tiago de. Review of *On Slowness: Toward an Aesthetic of the Contemporary*, by Lutz Koepnick. *Cinema Journal* 55, no. 2 (2016): 164–68.

Mbembe, Achille. "The Power of the Archive and its Limits." In *Refiguring the Archive*, edited by Carolyn Hamilton *et al.*, 19–26. Dordrecht and London: Kluwer, 2002.

Mercier, Hugo and Sperber, Dan. "Introduction: A Double Enigma." In *The Enigma of Reason*, 1–12. Cambridge, MA and London, England: Harvard University Press, 2017.

Moellendorf, Darrel. "Hope for the Anthropocene." In *Mobilizing Hope: Climate Change and Global Poverty*, 177–203. Oxford University Press, 2022.

Morton, Timothy. "HYPEROBJECTS," *CSPA Quarterly*, no. 15 (2016): 7–9. <http://www.jstor.org/stable/90000650>.

Morton, Timothy. "Ecology without the Present." *Oxford Literary Review* 34, no. 2 (December 2012): 229–38. <https://doi.org/10.3366/olr.2012.0043>.

Morton, Timothy. "Specters of Ecology." In *General Ecology: The New Ecological Paradigm*, edited by Erich Hörl, and James Edward Burton, 303–321. Theory. London: Bloomsbury Academic, 2017.

Oliveros, Pauline. *Deep Listening: A Composer's Sound Practice*. Bloomington, IN: iUniverse, Inc., 2005.

- Paige, Kirsten. “‘Art and Climate’ and the Atmospheric Politics of Wagnerian Theater.” *The Opera Quarterly* 35, no. 3 (2019): 147–78.
- Pettit, Erin C. “Passive underwater acoustic evolution of a calving event.” *Annals of Glaciology*, 53 no. 60 (2012): 113–122.
- Pettit, Erin, Shad O’Neel, and Jeff Nystuen. *Underwater Acoustic Data from Yahtse Glacier, Icy Bay, Alaska*. Arctic Data Center (2016). doi:10.5065/D66Q1VB7.
- Pettit, Erin C., Jeffrey A. Nystuen, and Shad O’neel. “Listening to Glaciers: Passive Hydroacoustics Near Marine-Terminating Glaciers.” *Oceanography* 25, no. 3 (2012): 104–5. <http://www.jstor.org/stable/24861400>.
- Pettit, Erin Christine, Kevin Michael Lee, Joel Palmer Brann, Jeffrey Aaron Nystuen, Preston Scot Wilson, and Shad O’Neel. “Unusually Loud Ambient Noise in Tidewater Glacier Fjords: A Signal of Ice Melt.” *Geophysical Research Letters* 42, no. 7 (2015): 2309–16.
- Potts, Donna L. “Music in Stone: Ecomusicology and the Burren.” In *Contemporary Irish Writing and Environmentalism: The Wearing of the Deep Green*, 39–68. Cham, Switzerland: Palgrave Macmillan Cham, 2018.
- Rehding, Alexander. “Ecomusicology between Apocalypse and Nostalgia.” *Journal of the American Musicological Society* 64, no. 2 (1 August 2011): 409–14. <https://doi.org/10.1525/jams.2011.64.2.409>.
- Rehding, Alexander. “The Discovery of Slowness in Music.” In *Thresholds of Listening: Sound, Technics, Space*. Edited by Sander van Maas. New York: Fordham University Press, 2015.
- Sheik, Zuleika Bibi. “Liminagraphy: Lessons in Life-affirming Research Practices for Collective Liberation.” *Journal of Critical Southern Studies* 4 (2023): 7, 1–18.
- Silvers, B. Michael. *Voices of Drought : The Politics of Music and Environment in Northeastern Brazil*. Urbana: University of Illinois Press, 2018.
- Soper, Kate. “Introduction.” In *What Is Nature? Culture, Politics, and the Non-Human*. 1–14. Oxford: Cambridge, Mass: Blackwell, 1998.
- Titon, Jeff Todd. “Sustainability and a Sound Ecology.” In *Toward a Sound Ecology: New and Selected Essays*, 254–275. Bloomington: Indiana University Press, 2020.
- Titon, Jeff Todd. “Ecojustice, Religious Folklife and a Sound Ecology.” *Yale Journal of Music & Religion* 5, no. 2 (2019): 103–116.
- Titon, Jeff Todd. “Knowing Fieldwork.” In *Shadows in the Field: New Perspectives for Fieldwork in Ethnomusicology*, edited by Gregory F. Barz, and Timothy J. Cooley, 25–41. Oxford: Oxford University Press, Incorporated, 2008.

Viveiros de Castro, E.. “Cosmological deixis and Amerindian perspectivism.” *Journal of the Royal Anthropological Institute* 4 no. 3 (1998): 469–88.

Von Glahn, Denise. “Relational Capacities, Musical Ecologies, Judith Shatin’s Ice Becomes Water.” In *Sounds, Ecologies, Musics*, edited by Aaron S. Allen and Jeff Todd Titon, 177–197. Oxford University Press, 2023. 10.1093/oso/9780197546642.003.0009

Primary sources

Karijord, Rebekka. *Songs of Earth* (Original Motion Picture Soundtrack). OONA Recordings AB, 2023, Spotify, <https://open.spotify.com/album/0o8KF0PGGNz60kmRvl60He?si=M-sk7EUKQxOTUkHZAfTL2A>.

National Geographic. Erin Pettit: Glaciers on the Run | Nat Geo Live. 2013. YouTube, <https://www.youtube.com/watch?v=1hWp5Qaapi4>.

Olin, Margreth, dir. *Songs of Earth*. 2023; Denmark: Norsk Film distribusjon, 2024. Movie theater Louis Hartlooper Complex.

OONA Recordings. “Rebekka Karijord - Scoring ‘Songs of Earth’ With London Contemporary Orchestra,” November 24, 2023. <https://www.youtube.com/watch?v=rQV9Amb4uV8>.

TED Archive. The Warning Sounds of a Melting Glacier | Erin Pettit. 2016. YouTube, <https://www.youtube.com/watch?v=q12XrHi3-wY>.