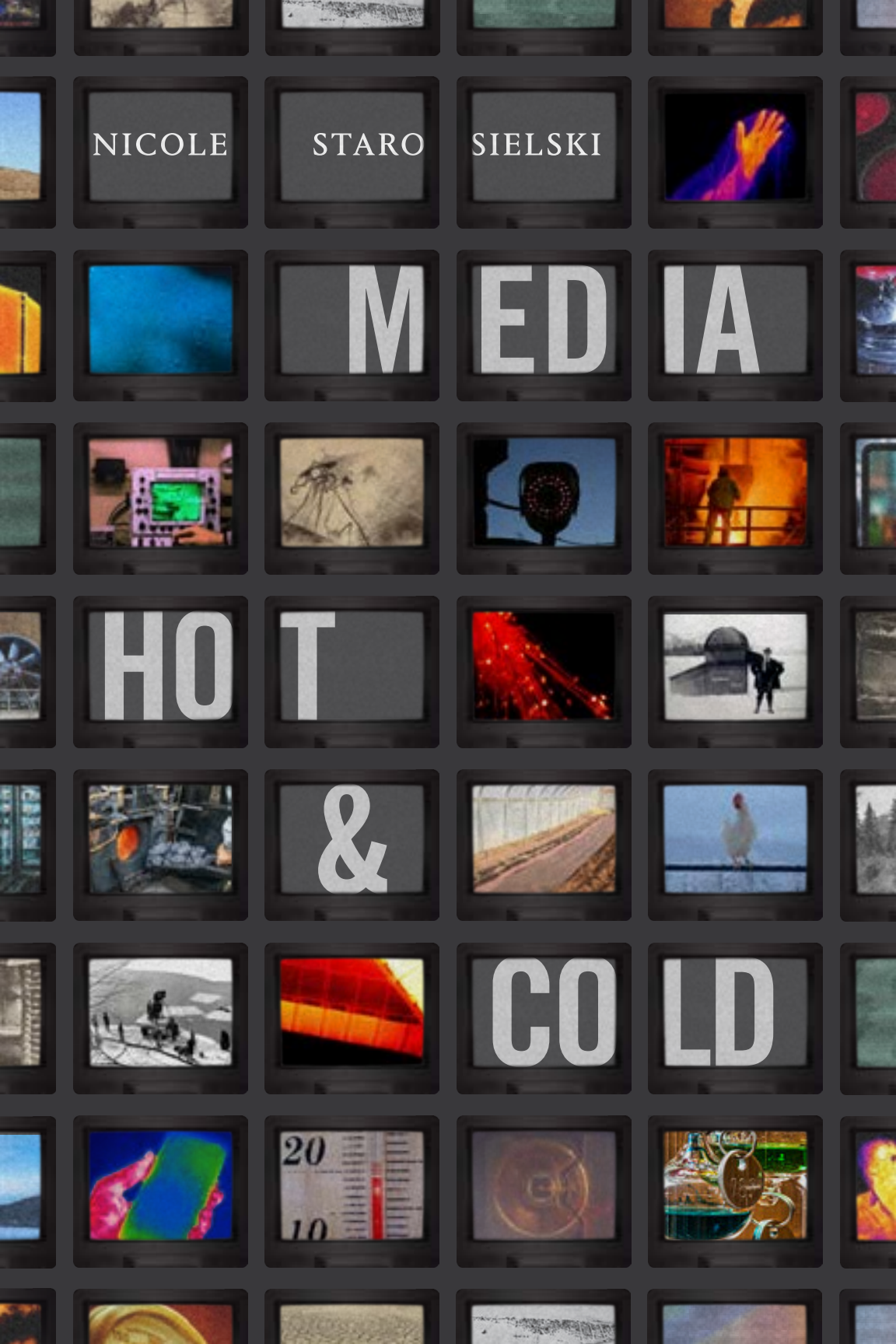
NICOLE STARO SIELSKI
MEDIA
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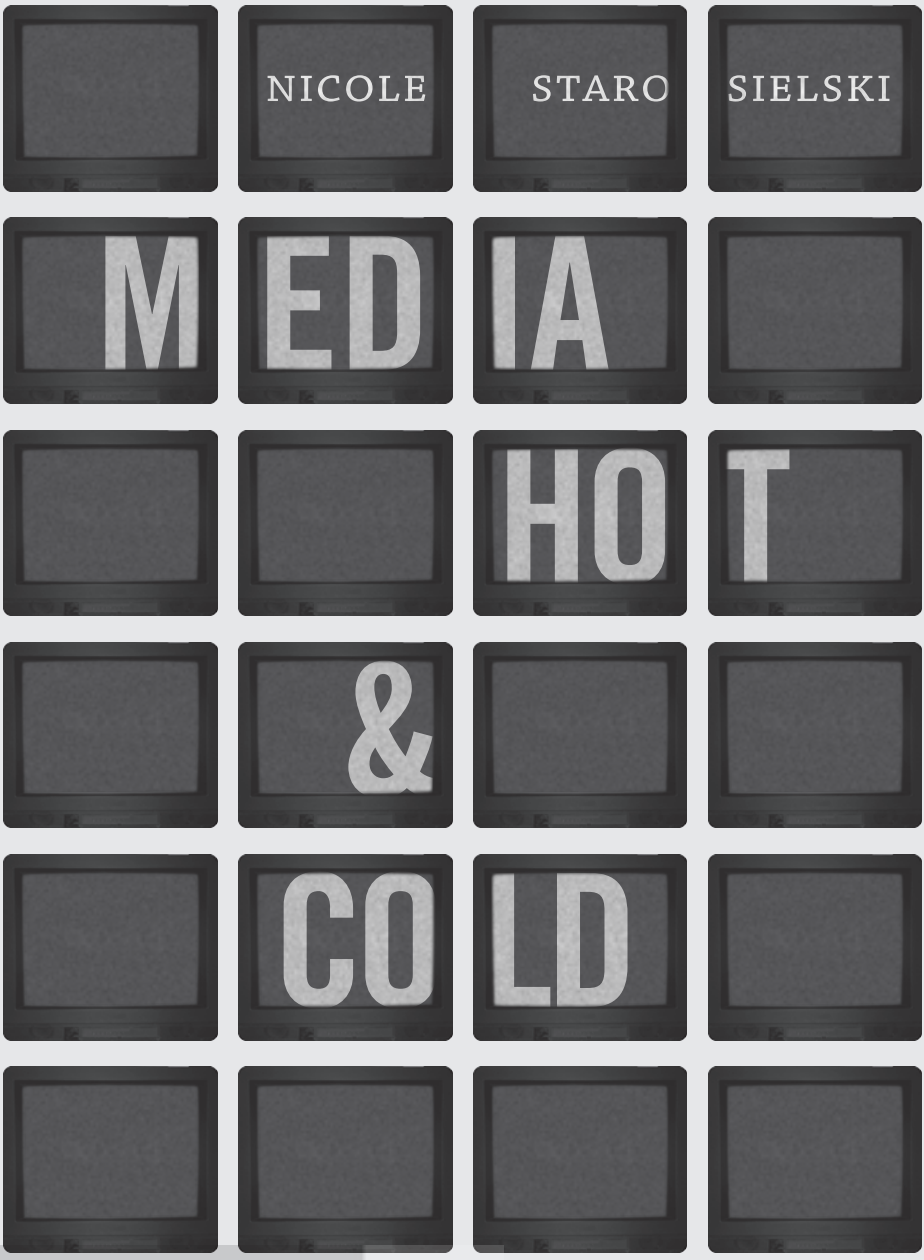
MEDIA HOT AND COLD

ELEMENTS *A series edited by Stacy Alaimo and Nicole Starosielski*



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for and with Jamie

Writing this book has been an absorptive process. Everyone I speak with has something to share about temperature: observations, sensations, memories, chance encounters, and objects. These exchanges have found their way into the following pages, and this book has benefited enormously from them. I want to thank Shannon Mattern for being the most generous reader I could imagine; Stefan Helmreich for attuning me to waves; Fernando Domínguez Rubio for the joint investigations into thermal ecologies; Kyle Devine and Jacob Smith for sound feedback; Regina Longo for archival wisdom; Natasha Schüll for helping me to track heat with a borrowed Embr Wave; Jeff Scheible for laying everything on ice; Susan Zieger for thinking outside the box; Tracy for the phase state changes; Rahul Mukherjee for radiant awareness; Erica Robles-Anderson for ambient and architectural awareness; Julia Velkova and Yarden Katz for meditations on ecological computing; Daniel Barber for broadening my sense of climate; John Durham Peters for asking, among many other things, "What about warm?"; and Alex Galloway for carefully reading the manuscript in its final iteration. I would like to thank the many colleagues who directed me to cases of heat and cold, read pieces of the manuscript in progress, and shepherded sections of *Media Hot and Cold* into publication—especially Brooke Belisle, Elena Beregow, Nathan Ensmenger, Ilana Gershon, Anna McCarthy, Dylan Mulvin, Jussi Parikka, Rachel Plotnick, James Schwoch, and Jonathan Sterne.

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earth, salt, air, oil, and plastic. I have been incredibly fortunate to have the insight and support of Courtney Berger, whose capacious editorial work and expansive vision paved the way for the series and this book, and Stacy Alaimo, whose questions over the past several years reverberate through the following pages. The editoral team at Duke University Press has been wonderful, and I would like to thank Aimee C. Harrison and Lisl Hampton.

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no. 3 (2016): 293–309; "Thermal Violence: Heat Rays, Sweatboxes and the Politics of Exposure," *Culture Machine* 17 (2019): 1–27; and "Thermal Vision," *Journal of Visual Culture* 18, no. 2 (2019): 1–23.

Media Hot and Cold was written for and with Jamie Skye Bianco, who built the fires, checked the thermometers, and composed a thermal landscape for all of us to inhabit.

I wrote this book in the heat and the cold, in fields and under plastic hoops, in barns and chicken coops, as I built a farm in the interstices of another life. Farming is a practice of temperature. It is the long, slow waiting for the last night that dips below freezing. It is the rush that happens when the heat arrives and everyone runs out to the fields. It is a constant, ever-present attention to slight changes in heat. It is the sensation of standing in frigid water. It is the blast of cold air in walk-in refrigerators. It is watching produce wilt because of radiant pavement. It is moments of thermal recognition: Seedlings baked under too much plastic. An entire crop wiped out by an unexpected frost. It is the warmth of mammals born on winter nights. It is the heat that lingers in an animal's body after it dies. It is the blanket, the hutch, the straw, the hay, the tarp, the paper, the plastic, and a million other things overlaid and removed in order to maintain radiant life.

I wrote these words in short bursts between these practices of temperature, often when it was too cold or too hot to be outside. Some were written on a cell phone in the field, others scrawled on paper encrusted with dirt, shit, and blood. Theory always bears the traces of the author's environment, as Melody Jue so eloquently explains in *Wild Blue Media*. The theory of heat and cold in the following pages does not carry the sensory residue of an air-conditioned office. It emerges from a radically variable thermal world, with exposures ranging from –34°C/–30°F to over 37°C/100°F. Although this book is not about farming, it brings with it the traces of agricultural labor.

Media Hot and Cold is an experiment in writing and inhabitation.[1] In the field I wondered: Can words actually transform thermoception, the sense of temperature? If so, what can they evoke and elicit? How is temperature patterned not only for people insulated in air-conditioned offices but also for those who remain immersed and vulnerable in their environments? Can thermal media, whether films or fans, offer other ways of being in temperature? While these questions crystallized for me in the field, I found the answers in the thermal accounts of others. The following pages are an

archive of thermal experiences: women subjected to chilly workplaces; cinema exhibitors exploiting the cold; people punished in sweatboxes; doctors producing artificial fevers; and conservationists using thermal imaging to manage wildlife, among many others. Looking for heat and cold, I quickly found that temperature is neither a neutral nor a natural environmental register; instead, it's thoroughly entangled with cultural practices and media technologies.

On the farm, I found an analogue for book writing while watching chicks gather around a heat lamp. After years of using digital thermometers to manage the birds, we have come to rely simply on sight. When the birds are clustered at the edge of the brooder, it is too hot. When the birds are evenly distributed, the temperature is just right. I would only later discover that the first application of electrical thermostats was to standardize incubation temperatures on chicken farms.[2] Farming attunes one's body to differentiated thermal zones. It cultivates synesthesia, ways to thermosense through hearing and vision. At its core, this is also the project of *Media Hot and Cold*. I hope that this book will cultivate a synesthetic attunement, make social activity reveal its invisible thermal contexts, and orient readers to thermal fields. In short, this is an experiment in temperature manipulation, intended to work as farming does: on and through the body.

The most influential messages of the twenty-first century will be sent not through words and images but through heat and cold. People will be turned around at borders not only by signs but also by air conditioners that withdraw feeling from their fingertips. Thermal cameras will scan bodies for fever and sickness. Militaries will shoot heat rays at target populations. Overheated prisons will tell some people that they are less than human. Other people will learn that climate change is their own problem to deal with, an individual discomfort to be overcome with a digital app. Temperature differences, read by satellites, will indicate sites for mineral extraction more effectively than they predict the coming weather. The internet's content will be transcoded into infrared waves and sent through fiber-optic cables. As temperature volatility increases, thermal media—thermostats, heating and cooling systems, architectures, and infrared cameras—will carry the promise of stabilization and social control. But their deployment and effects will be uneven. They will mitigate the impact of climate change for some and intensify its harm for others.

The most powerful media organizations of the twenty-first century will be thermal. The circulation of images, sounds, videos, and texts will depend on a massive regime of heating and cooling. Data and networks, like the people they connect, will be ever more fragile. Too hot or too cold, and the platforms will collapse. Digital infrastructures—data centers, network exchanges, and fiber-optic cables—will drain the planet's energy in order to create a stable thermal environment—not for people but for information. Meanwhile, designers and operators of thermal media will make decisions about how information will travel, how quickly the planet will warm, and who will survive. They will establish standards for acceptable temperatures. They will modulate and regulate bodily exposures. Their products will cultivate thermal expectations. In the process, they will expand zones of thermal privilege and thermal harm. Bodies will be subjugated and populations will be organized not only through imprisonment and torture, surveillance

systems and databases, but also through a vast regime of temperature management. Technologies from wearable air conditioners to water cannons will be the instruments of thermopower.

Heat and cold are everywhere a means of communication, manipulation, and subjugation, but they often appear simply as natural phenomena. There is widespread faith in thermal objectivity, the sense that temperature is independent of both culture and perception. Even though heat is used to differentiate people and places, it is often described as universal and democratizing. After all, heat travels in and through everything. It affects the metabolisms of all bodies and influences the operations of all matter. Everything is, fundamentally, entangled with temperature. Thermodynamics, the science of energetic conversion and thermal transformation, has been powerful in part because of this generality. One textbook boasts that thermodynamics "can be applied to any discipline, technology, application, or process."[1] Thanks to thermal objectivity, heat is not only a subject of scientific study but also a metric. Temperature offers a universal language—degrees Celsius and Fahrenheit (and Kelvin)—that can describe engines, people, and climate change alike. In turn, temperature's meanings can be taken for granted by scientists, architects, meteorologists, environmentalists, and the public. Thermal objectivity has immense political potential. A global anticipation of a 2°C/3.6°F increase in temperature sparks political action on climate change. Governments define thermal rights—the right to heat and, in some instances, the right to air-conditioning.

Although thermal objectivity grounds climate science and the everyday politics of thermal exposure, it often masks the operations of thermopower. Descriptions of heat waves bind people in a shared perception of their surroundings, but they often obscure how thermal media redistribute heat effects.[2] The common sense of "hot" and "cold" obscures vernacular thermal perceptions. A focus on the thermometer obscures how body temperature is managed through color, screens, and tactile interfaces. *Media Hot and Cold* investigates the many meanings and messages of heat and cold, the ways that people manipulate heat signals, and, in particular, the technologies that relay thermal communications. Instead of situating temperature as a neutral backdrop for social life, this book tracks how heat and cold are mediated by expansive thermal regimes.

Attuning to heat has never been more critical than in the current moment, which is marked by the intensification of climate change as well as atmospheric communication, control, and contagion. The argument of this book is that these forces are catalyzing a shift in the operation of thermo-

power. They elevate thermopower—the enactment of social and political power through thermal manipulation—to a pervasive means of biological, social, and environmental control. At the same time, temperature is being tethered to digital systems. Heat and cold are now experienced in ways that mirror shifts across the media landscape: they are increasingly personalized, marketed as a means of networked affective consumption, and digitally modulated as part of weaponized sensory environments. Tracking the history of this transition—from the mass thermal communications of the twentieth century to the digital thermal technologies of the twenty-first century—*Media Hot and Cold* traces how media set baselines for our thermal futures. Its conclusion runs counter to arguments that locate digital and networked technologies as a means of stabilization in the midst of climate change. Instead, I argue that local and autonomous forms of thermal communication are essential to truly mitigate climate effects.

ATTUNING TO HEAT

To attune readers to temperature's political operations, *Media Hot and Cold* begins with a premise radically different from thermal objectivity. In this book, temperature is not a property of bounded entities—the measure of a place, a body, or a building. Rather, temperature is one way of describing the exchange of heat, a process in which everything participates. All matter emits heat: the skin of a human body, the asphalt of a road, the hard plastic of a container. Plant leaves emit heat even as they stretch up toward the sun. A sweatshirt radiates heat even as it also traps it. All media emit heat. Phones transfer heat to hands. Broadcast towers, cellular antennae, and satellites emit thermal radiation alongside radio waves. Heat moves through these pages, through bodies, clothes, architecture, and atmospheres. We (and this "we" extends to the nonhuman, the animal and the geophysical) are constantly communicating by generating heat signals. These are often affective emissions, relayed without intentionality and registered without cognition.

At the same time, we—bodies, objects, and infrastructures—are also heat receivers, affected by heat and cold. We are caught in the midst of emissions, both waves and electrons, generated by all of the promiscuous heat producers around us. One goat huddles with others on a cold night, receiving their warmth and, in turn, contributing its own body heat. The herd is created in the exchange of heat, not solely through vision or sound. Observing humans rather than ruminants, some argue that the drive toward heat is a drive

toward the mother, a drive to return to the womb and to a state of shared bodily warmth. Others point out that thermal exchanges can reinforce species, familial, and sexual connections. Warmth, as Lauren Berlant writes, "is an atmosphere that allows life and death to be in the same place as what's potentially unbearable in love every minute."[3] Feeling the heat of others can also be a queer process. Packed together on a subway car, in an auditorium, on a dance floor, or in the streets, people receive heat signals from other bodies. They slide in warm sweat and brush up against clammy skin. This heat might be sensed as a crowd, a community, or a collective.[4] Or it might be perceived as a threat, oppression, or a means of controlling their bodies from afar. Social distancing mutes thermal transmissions, extracting some people from interpersonal heat networks. People use heat and its absence to navigate the world. Mosquitoes gravitate toward warm blood, pit vipers sense prey from a distance, and drone operators view the landscape through thermal cameras. Bodies are oriented by thermoception.

Temperature also stimulates responses without any perception at all. A building does not perceive the fluctuation between hot and cold, but it is sensitive to changes in the weather. On a hot day, its large windows heat up. The glass expands, first in the center of the window and later next to the frame. As night falls, the temperature drops quickly. The difference between hot and cold is stressful. The glass cracks—this is called a thermal fracture. Fluctuating temperatures have generated fragility, and the window breaks. Bodies inside the building, now subject to a draft, lose heat at their edges; fingers and toes are the first to cool. Changes in temperature alter a building's potential to shelter people. They also alter how long a virus remains viable. And they shape a body's capacity to survive. Even in the absence of the sense of thermoception, thermosensitivities cascade. Temperature catalyzes waves of transmission. Heat signals come to matter in a multitude of ways that escape conscious perception.

In other words, the transmission of heat and cold is a form of communication, even if in many instances what they relay—any "message" sent, received, interpreted, and reacted to—is diffuse and distributed. But despite their ubiquity, thermal communications have rarely been a part of understanding media.[5] Instead, media studies has historically focused on texts and images, turning only more recently to sonic and haptic technologies. Thermoception is marginal even in the environmental humanities and social sciences, research areas committed to understanding the cultural dimensions of environmental phenomena. In the expansive and dynamic field of scholarship documenting environmental news, literature, and media, heat

and cold are rarely described as communicative forms, even though they have been used to enact violence, sell products, and send information. In order to understand images, scholars analyze practices of light and visual culture. Sound studies has emerged in order to conceptualize aural transmissions. In *Media Hot and Cold*, I argue that in order to understand temperature, scholars must attend to practices of heat and to thermal cultures. This book offers a sensory paradigm that can make practices of heat and cold thermoceptible.[6]

Encounters with the field of heat exchanges, this book shows, are not neutral interactions with an external environment. They are always shaped by thermocultures, or thermal cultures: the cultural processes of thermal modulation and exposure that pattern sensitivities to heat and cold, construct normative ways of making sense of thermal stimuli, and set expectations for temperature. One aim of this book is to evoke a multitude of thermocultures. It might not be surprising that many thermocultures mirror other cultural formations. For example, just as the visual blankness of an Arctic landscape is deployed as part of colonial projects, its temperature—which to bodies of white settlers might feel "foreign"—is enrolled in projects of dispossession. This is thermal colonization: the use of a sense of temperature to justify colonial expansion and inhabitation. Or consider how the central cooling of an office building, set to standards for cisgender men, signifies a failure to accommodate women.[7] Corporations then deploy personalized systems that enable people to regulate their own temperature. This is thermal neoliberalism, which off-loads thermal responsibility onto the individual.

As is true for visual, aural, and textual cultures, there are dominant and marginalized thermocultures. In many Western contexts, hot and cold are sensed as antithetical, as oppositional extremes. For Hawaiians, as Hi'ilei Julia Kawehipuaakahaopulani Hobart documents in a groundbreaking study of ice, the sensation of heat is historically closer to the sense of cold than either is to a "neutral" temperature.[8] And although global weather reporting assumes its viewers share a common understanding of what temperature feels hot or cold, Mary Douglas's anthropological account of people in the Congo testifies to the local specificity of thermoception: although they experience the same weather, two tribes locate their hot and cold seasons at opposite points of the calendar.[9] The emission and transmission of thermal affect is not only a physical or physiological process. Like cultures of viewing and listening, thermocultures emerge out of existing practices and take shape in existing structures of meaning.

Thermocultures, like visual and sonic cultures, are deeply technological. A vast infrastructure of heating and cooling conditions bodies, objects, and materials. The air-conditioning of a retail store during a hot summer is engineered to draw people in and produce a space for consumption. The air-conditioning of concrete rooms where data is housed facilitates the circulation of digital media. Networked and intelligent thermostats learn personal preferences, producing an ever more controlled, sensitive, and seemingly safe environment for subjects. Infrared cameras target bodies at international airports, looking for signs of fever and threat to domestic populations. Thermometers produce "objective" and "standardized" bodies for medical practice.[10] Thermal media are the material and socially realized forms that communicate temperature, enabling heat and cold to be transmitted and received.[11] Thermal media relay thermal affects, craft thermal subjectivities, and calibrate thermoception. They communicate to people and modulate the thermal experiences of nonhumans. *Media Hot and Cold* describes the operations of thermal media, ranging from infrared cameras and air-conditioning units to heat ray guns and coldsploitation cinema. These forms of communication function as many other media do: They standardize and scale transmissions. They establish pathways for social interaction. They reorganize the mediating capacities of bodies, materials, and environments. They facilitate the encoding and decoding of meaning. They instill modes of sensation. In the process, they also emerge in relation to the landscape of existing media: as broadcast, narrowcast, or personalized forms.

Despite the apparent universality of heat, its effects and affects are not evenly distributed. *Media Hot and Cold* tracks these inequities. It shows how, through specific thermal media, thermoceptive regimes—the dominant material and ideological formations that set normative responses to heat and cold—are embedded into architectures and pierce through the skin. Take the case of a public housing complex in Chicago where residents for decades had been accustomed to the extraordinary heating of their buildings, colloquially referred to as "Project Heat." As Catherine Fennell documents in a sensory ethnography of the building, when the projects were sold, residents were newly able to control the heat and would regularly set it at a high temperature.[12] Yet they still had to wear several layers of clothing to keep warm. Project Heat had been programmed into their bodies. Their sense of environment had been calibrated to an unsustainable norm, both in relation to the economic realities of the newly privatized infrastructure and the extractive energy regimes it depended on. Communication by heat and the technologies that reconfigure it are always political. Thermoceptive regimes

enact racialized, colonial, gendered, and sexualized forms of power, and they instill these forms of power as embodied sensation.

This book is not about how nature seeks to undo gradients (a core principle of thermodynamics) but rather dwells in the many forms of thermal difference. It describes how heating and cooling infrastructures—and forms of thermal privilege—are made available for some people and not for others. Architectures subject some inhabitants, and not others, to thermal violence. The freeze is sold as an attraction to some viewers, and not others. Heat maps illuminate some bodies, and not others. Smelters produce industrial materials for customers while generating harsh thermal conditions for their operators. Even the thermometer, as Deanna Day demonstrates, did not always appear to be a neutral carrier of thermal objectivity: it threatened physicians' authority, evoked female sexual desire, and was taken up as a gendered tool for reproductive labor.[13] Because it differentially activates (and thus sorts) bodies, thermal mediation helps to produce gender, race, class, ethnicity, and other forms of social difference. Although heat exchanges may be universal, they are certainly not uniform. This book is a story of thermal media's role in their uneven distribution, a study of the thermal fractures that structure contemporary life.

The word *thermopower* describes the mechanisms of this uneven distribution—the ways that temperature management defines subjects, produces objects, and locates both in grids of social and political organization. As thermocultures expose people to particular thermal worlds and normalize thermoceptive regimes in which heat and cold make sense, thermopower operates as a form of biopower, a means of administering and regulating life. In the process, thermopolitics also operates as a form of necropolitics, what Achille Mbembe describes as the capacity to expose to death.[14] But thermopower's subjects are not only people. Thermal media construct and dismantle environments. They are integral to the creation of almost all industrial and postindustrial technologies. Their communicative forms extend far beyond the human. Indeed, thermal media are often used to distinguish between life and nonlife, operating as vectors of what Elizabeth Povinelli calls geontopower. In short, thermopower extends through these many other forms of political power. It is defined neither by its subjects nor by its particular operations. Like energopower, the operation of political power through fuel and electricity, thermopower is defined by its media: heat and cold.[15] It is the enactment of power across all of these domains—the biological, the geological, and the energetic—through the mediation of temperature.

Media Hot and Cold attunes readers to thermocultures, documents the work of thermal media, and tracks their imbrication with regimes of thermopower in order to congeal an emerging field of inquiry. What I call critical temperature studies approaches thermal objectivity as a historically specific system of knowledge based in Western science. Counter to thermodynamics and other universalizing lineages, critical temperature studies foregrounds the investigation of the material, political, cultural, and representational dimensions of heat, warmth, and cold. It is committed to addressing how temperature materializes in divergent ways across geographies and history, and to documenting forms of thermal violence and colonization. It locates thermoception alongside sight and hearing.

Critical temperature studies is already well developed in anthropology, energy studies, geography, architecture, and studies of affect and the senses, among other fields.[16] Architecture, as Boon Lay Ong defines it, "is the orchestration of heat through energy, climate, and habitation."[17] Buildings function as "climate mediators," Daniel Barber shows, not only through their mechanical systems but in the design of their facades.[18] Historians have chronicled the cultural dynamics of heating, cooling, and thermometric technologies, as well as the "invention" of temperature itself.[19] Media scholars have documented the communicative work of fire and matter's shifting phase states, and the difficulty of representing heat waves in journalism.[20] The critical study of cryopolitics reveals how life is managed through refrigerating technologies, and the "cold humanities" investigates the experience of cold on a warming planet.[21] Temperature, Fernando Domínguez Rubio points out, is a crucial part of the ecologies through which "'social' and 'cultural' worlds become possible."[22] And as geographer Mike Hulme describes, the very idea of climate functions to stabilize cultural relationships between people and their weather.[23] Ethnographers have observed cultures of thermoception and the "temperature work" that scaffolds them.[24] In radically different contexts, Eva Horn and Bharat Jayram Venkat have called for an anthropology of climate and of heat that can account for the many connections between thermal environments and culture.[25]

These studies are the foundation of *Media Hot and Cold*. Such works often remain within disciplinary confines, heat or cold specific, tied to geographic areas or historical periods, oriented toward the natural or built environment, and anchored in particular forms of human sensation or nonhuman agency. *Media Hot and Cold* locates these as part of a shared inquiry into temperature's social and cultural dimensions. Like visual culture and sound studies, work in critical temperature studies melds research across disci-

plines, geographies, and historical periods. As recent works in the environmental humanities, new materialisms, and sensory studies suggest, such research extends beyond the human sensation of temperature to its nonanthropomorphic possibilities.[26] To this field of inquiry, *Media Hot and Cold* offers a capacious framework for understanding the complexity of temperature's social operation and cultural entanglements: thermal mediation.

FROM METAPHOR TO MATERIALITY

Even though media and cultural studies rarely account for the materiality of temperature, heat and cold are pervasive metaphors in these fields. This is in part because the language of heat and cold evokes density, movement, sensation, and temporality, all of which are fundamental aspects of media ecologies. One of the best-known examples, from which I draw the title of this book, is media theorist Marshall McLuhan's distinction between hot and cool media. Hot media, including photography, radio, and cinema, extend a single sense in high definition. They are filled with data and require little participation from their viewers. Cool media, such as television, cartoons, and the telephone, supply a "meager" amount of information and elicit completion from their users.[27] Inspired by McLuhan but inverting the modes of participation, Phillip Vannini and Jonathan Taggart distinguish between hot energies (such as the heat of a wood stove), which require intense participation and maintenance, and cool energies (such as home heating generated from an electrical grid), which require less bodily involvement.[28] In these pairings, hot and cool are metaphors. Just as hot or cool environments reposition subjects, elicit responses, and affect bodies, so do media and technology reposition, elicit, and affect. Temperature—a mode of environmental description attuned to the rhythm of movement, the composition of substances, and their sensory effects—captures media's capacity to shape time and space. It evokes a sense of media and technology not as stable objects but as dynamic ecologies.

While for McLuhan and others, *hot* and *cold* describe the relationship between a technical system and its users, another lineage of thermal language is more directly influenced by thermodynamics and its "daughter," information theory.[29] Media and culture with high levels of content transmission are often described as conductive: they generate heat and intensity. Concentrated sites of signal exchange are "hot spots." Cold describes the inability to transmit. One photography project, *Screens, Cold*, simply depicts blank, nonfunctioning screens: to be cold is to be off.[30] In these thermal

metaphors, mediation itself is always hot; the failure to mediate is cold. The photograph is not hot but, rather, cold and icy as it freezes time and enacts a "spatiotemporal standstill."[31] The cinematograph, with its perpetual movement, is a fiery medium.[32] A foundational author in this vein is Claude Lévi-Strauss, who famously characterizes hot societies as those whose institutions and cultures are designed to accelerate change. Cold societies are those that reduce the effects of historical factors. Heat is aligned with speed, capitalism, repetition, technology, and modernization. Coolness is slowness. The idea that signal exchange is equivalent to heat exchange can be traced back directly to Claude Shannon's theory of information, which advances thermodynamics-inspired concepts such as entropy in the description of communications systems. Today, thermodynamic description often characterizes the extensive transformations of a technological modernity, one that is heating up, increasing in entropy, and ultimately moving toward a heat death.[33]

Along with their frequent use of thermal metaphors, theorists of technology and culture often ground their claims in both the physical transfer of heat and cold as well as experiences of climate. Many argue that the capacity to emit and process heat is a barometer for life itself. "When one gets to the bottom of an animism," Gaston Bachelard claims, "one always finds a calorism. What I recognize to be living—living in the immediate sense—is what I recognize as being hot."[34] Aristotle observes that all living things have a "natural source of heat."[35] And as Thomas Mann puts it, life itself is warmth, "a fever of matter."[36] Whereas, in conceptualizing the human, heat is seen as an essential property of life, in understanding technology, the mastery of heat is what makes humans more than just warm-blooded animals. In *Technics and Civilization*, Lewis Mumford links civilization to the emergence of thermal technologies: wood relieves man of his "servitude" to a cold earth; coal lifts industry beyond seasonal influences; glass hothouses free agriculture from the uncertainty of weather.[37] And for Lévi-Strauss, cooking marks the transition from nature to culture, the process by means of which "the human state can be defined with all its attributes."[38]

Alongside humoral medical theories (which posit temperatures' effects on the body), environmental determinism has permeated Western theories of culture from Hippocrates and Aristotle to the twentieth-century writings of Ellsworth Huntington to contemporary studies of climate change. Environmental determinists posit temperature as a crucial influence in the development of civilization. Montesquieu, for example, writes that

people from cold climates are more vigorous, have more courage, and have a sense of superiority, and that people from warm climates commit more crimes, indulge inordinate desires, and are almost "entirely removed from the verge of morality."[39] Exposed to any climate, environmental determinists argue, people adapt. Climatic differences therefore translate directly into social and physical differences. In these writings, heat and cold get linked not only to civilization but also to intelligence, political forms, and race. These discourses are grounded in what Jen Rose Smith describes as "temperate-normativity," the assumption that "proper" civilizations arise in temperate climates and anyone who lingers outside of this zone is aberrant.[40]

Temperature—the measurement of heat—offers a relational system, a means of sorting, separating, and orienting. Whether it is a metaphoric language for media studies or evidence for cultural theory, temperature is harnessed to articulate distinctions: between media, between old and new, between life and nonlife, between humans and nonhumans, between cultures, and between civilized and uncivilized people. In each of these cases, describing things as hot or cold naturalizes a set of social and cultural differences. It marks entities as naturally faster or slower, affective or not, dynamic or static. In turn, these function to naturalize racial, sexual, gendered, and geographic distinctions. The fact that many people believe temperature is an objective measurement system makes these descriptions even more powerful metaphors.

These thermal theories and languages matter. They ground actual practices in the world. As many scholars have pointed out, thermal knowledge actively reproduces racist, colonial, and patriarchal social structures. In a study of French spas and thermal tourism, Eric Jennings highlights how thermal knowledge has been critical in "delineating the non-European 'other' since ancient times" and as a means of legitimizing European dominance.[41] Theories of acclimatization in the eighteenth century, which posited that Westerners could acclimate to the tropics, served as a science of colonization. In the nineteenth century, enslavers used antiacclimation as an antiabolition rationale: white men, they argued, simply couldn't work in the heat. The institutional management of temperature is underscored by these theories and in turn scaffolds hierarchies of race, gender, sexuality, ethnicity, and empire. Labor laws include thermal specifications, and as a result, thermal knowledge permeates work practices. Medical institutions define some bodies as more susceptible to the heat, and as a result, thermal knowledge differentially structures systems of care. Architectural modernity, scaffolded by climate

determinism, "inserted a certain type of thermal environment—one that was seen to derive from and to be amenable to inhabitants from Euro-American metropolitan centers—into almost any climatic, social, or political condition."[42] Thermopower materializes in these thermal descriptions—as they shape people's thermal exposures, they become powerful means of racializing, gendering and sexualizing bodies precisely because temperature is perceived as objective, somehow outside of culture and beyond media. In other words, heat and cold are the perfect metaphors to recast social inequities as natural differences. Moreover, as thermal language activates listeners' senses, it layers these naturalized distinctions into a sensory regime; in other words, these distinctions are a way of making racism sensible.

Although a wealth of scholarship exposes the colonial, racist, and patriarchal legacies of environmental determinism, alternative formulations of culture and temperature have been scarce in the social sciences and humanities. An expansive scientific literature explains the physical dynamics of heat and cold, and fields from thermoregulatory science to engineering chart temperature's effects, but these largely avoid culture and embodied forms of difference (even though the science of thermoregulation itself acknowledges the difficulty of predicting thermal response). In this book I argue that the study of temperature cannot be left to the sciences, nor can it ignore culture. Analyses of the relationships between culture, heat, cold, and thermoception must be as complex as theories of images, sounds, and texts, which over the past decades of humanistic and social scientific work have extended far beyond mere determinism.

In one text that has emerged to formulate such a theory, Eva Horn calls for a cultural history of how thermal conditions have been known and imagined. Analyzing climate change discourse, Horn argues that images of inescapable heat offer "the sensory translation of a threat," one that can produce an affective shock and a "phenomenal sensibility" that might translate science—and the large, imperceptible processes of global warming—into political action.[43] Although this description of heat produces a sense of anxiety for some, it also functions to convey "a sense of a newly defined union of mankind as a species" and "a unity of all living organisms."[44] As a result, Horn writes, heat "may serve as a common denominator binding the lives of humans to everything alive that is non-human but equally impacted by rising temperatures and ocean levels."[45] The thermostat maker Ecobee recently put this sense of heat into play in an advertising campaign. The company invited climate change skeptics to a focus group on global warming and then slowly turned up the temperature in the room. Heat itself, Horn and Ecobee

imagine, can communicate a forceful message about the danger of climate change.

In contrast, Alexis Pauline Gumbs's speculative documentary *M Archive: After the End of the World* offers a radically different vision of how heat might be felt. Gumbs writes: "while everyone thought of global warming as an external phenomenon, it was happening on the same timeline within. the people on the planet were stars burning out."[46] In this theory of heat, it is not an external force that produces an affective shock but rather something that entangles and reverberates across scales. Later Gumbs continues, "we ourselves made a world too hot for our feet and tried to teach our children to walk in it."[47] The heating of the atmosphere and oceans is akin to the heating of coals, pavement, and ground. Gumbs's writing offers a different politics of thermal communication, oriented not by heat as a universalizing sensorial phenomenon but rather by heat as both an intimate and social process, with felt transformations in sensing bodies that cannot be disentangled from the social world they inhabit.

Media Hot and Cold approaches heat in this latter sense: as a medium of exchange, communication, and violence whose effects will inevitably be entangled on the ground. A close attention to how heat is modulated by thermal media reveals the fundamental fallacy of both environmental determinism and universal thermal communication. Even in the same geographic area, people are subject to vastly different patterns of thermal exposure and are shaped by diverging experiences of their material environments. As I describe in the first chapter, the maids who maintained the fires of aristocratic manors did not experience the cold winter in the same way as the people they served. Their bodies bore the brunt of thermal exposure and carried the responsibility for thermal stability. Who labors—in kitchens or in fields—is determined by the culture and economy of a given society, and the pattern of thermal exposures contours race, gender, and sexuality. In the twentieth century, although Ford Motor Company was the largest employer of Black autoworkers, and even though it appeared that these workers were paid salaries equivalent to those of white workers, they were often given hotter, more dangerous jobs in the company's metal foundry.[48] In turn, as labor economists document, this practice reinforced stereotypes that Black workers were "genetically suited for the hottest, dirtiest jobs."[49] These thermocultures not only extended long-standing histories of allocating thermal exposure based on race but also helped to reproduce race. Temperature is both a gendering and racializing project, especially as it is mobilized within thermal capitalism.

Thermal affects themselves are rarely transmitted directly. They are almost always refracted by thermal media: buildings, clothing, bodies, and technologies. Here is where McLuhan was right—there is no thermal message that is not shaped by the forms that reflect, concentrate, or redirect it. Over a lifetime, thermal media pattern exposures, resulting in senses of temperature that are as variable as ways of seeing. Epigenetic research (albeit conducted using mice and with problems of its own) has suggested that thermal exposures can even alter gene expression.[50]

Some of these thermal mediations are spatial: the dwellings people inhabit, the heating and cooling technologies that regulate ambient temperature, the way that architecture intensifies external temperatures (heat islands, wind tunnels, shade), the places people work (blast furnaces, cold distribution centers). The body itself is a thermal medium: the sense and effects of temperature are shaped by metabolic activity, which itself reflects socially structured access to food and water, as well as cultural practices. The sense of temperature and what heat and cold mean depend on who is cooking, who is standing close to the fire, who is forced to stay still, and who is forced to flee. Thermal mediations are also structured by temporal practices: what times people move, how long they have to labor, how and when they sleep. And yet other mediations are discursive: rooms painted red and blue, thermometer readings, weather reports. There is no unmediated temperature or unmediated climate. Even if heat has a language, there exists a multitude of dialects.

Put simply, climate does not determine behavior any more than television does. Heat and cold are differently accessed, received, sensed, and interpreted, even within a broadcast system. Matter is patterned through ambient transmissions and exposures, all of which are shaped—though not determined—by a multitude of social factors. The exposed subject "is always already penetrated by substances and forces that can never be properly accounted for," Stacy Alaimo observes.[51] And none of these substances and forces can be reduced to a single environmental milieu. While in any given moment, exposure to a draft or forced stillness might produce a sense of cold, across a lifetime or generations, exposures are layered into the body, making up one's sensory perception. Environmental determinist discourse is a violent fiction—one that grabs on to a tiny aspect of an environment at a single moment, erases all of its cultural histories and social inequities, ignores the bodily specificity of exposure, and uses this moment to naturalize a structure of power.

THE MEDIUM SPECIFICITY OF HEAT AND COLD

Even though it does not determine thermal meanings, the materiality of thermal media still matters. In the following pages, I describe the primary forms of thermal media, each of which is tied to, though not reducible to, the materiality of their operations.

The first is convective media, such as air-conditioning and ventilation systems. Convective media transform temperature by altering the motion of elements and molecules. While some convective media leverage the physical process of convection (the movement of molecules in a fluid), I also use this term to designate the broader operation of thermal communication through atmospheric forms. The ambient display of heat images can elicit past thermal exposures and operate as a form of atmospheric communication. Convective media are similar to what Yuriko Furuhata and Daniel Barber describe as climatic media, technologies that generate ecological milieus—but convective media often do so specifically through aerial, ambient, or particalized communication.[52] Thermal media, however, are not always climatic. Ice and thermoelectric wristbands, for example, relay a sense of temperature through conduction, the most basic form of heat transfer. Conductive media often capitalize on the physical process of conduction, manipulating temperature through physical contact. These media link bodies into material circuits of heat exchange.

While some thermal media rely on the direct convection or conduction of heat, in which elements and molecules (water, carbon, oxygen, silicon) become transmissions media, radiant media concentrate, refract, and deflect heat waves as a spectral activity. Radiant thermal media also have a distinct physical correlate: all bodies that have a temperature of greater than zero degrees Kelvin (–273.15°C/–459.67°F) emit thermal radiation in the form of waves. These wavelengths generally correspond to the body's temperature. Most entities in the universe emit radiation in the visible light or the infrared part of the spectrum. The sun emits radiation in the infrared range of the spectrum (with wavelengths above 700 nm), as visible light (400 nm to 700 nm), and as ultraviolet light (below 400 nm). Human bodies tend to emit radiation at around 10 μm (micrometers). The plume of a jet's engine emits radiation at around 3 μm to 8 μm (enabling heat-seeking missiles to locate it).

What is distinct about infrared thermal radiation, compared with visible or ultraviolet radiation, is that it's the form of electromagnetic radiation emitted by most objects, bodies, and phenomena that people have contact

with in everyday life. It is a form of wave communication in which bodies are immersed and to which they are often responsive. These emissions are not "heat" as we normally know it—they are not a transfer of energy but rather an electromagnetic effect of heat. In a seminal study of radiance, Rahul Mukherjee describes critical aspects of radiant infrastructures: even as they manage imperceptible energy, they are inevitably leaky, and they pull together the public and the private, the spark of development and the threat of contamination.[53] Notably for media theory, radiation moves even in a vacuum—the dissemination of radiant heat thus *requires no medium*.[54] Radiant thermal media often manage rather than simply relay: they organize the multitude of thermal emissions being sent at all times in all directions, most of which are sent in wavelengths undetectable by human vision.

These different material forms—convective, conductive, and radiant—underlie not only thermal communications but communications systems more broadly. Radio transmissions are electromagnetic waves (and as a result, the exploration of early radio dovetails with the exploration of infrared radiation, as described in chapter 4). Telegraph and telephone systems are conductive (and these connect to the development of thermoelectric components that form the foundation for personalized temperature devices, as described in chapter 2). However, while there are many intersections with visual, sonic, and haptic communication, thermal media have their own specificity. Thermal communication, whether messages sent between people in a classic human-to-human approach or messages disseminated environmentally, is defined by several key attributes, many of which diverge from traditional formulations of communications and media theory, especially the information theory descended from thermodynamics.

First, in almost all cases of thermal mediation, communication by heat often appears unintentionally, if it appears at all. People usually do not choose to emit heat in the same way they choose to speak or write words on pages. In many bodies, heat emissions and body temperature are regulated by the autonomic nervous system, which automatically manipulates not only internal heat but also breathing, blood pressure, and digestion. Hot and cold media are less often designed to generate heat themselves than to intensify or modulate apparently "natural" temperatures and already flowing emissions. They tend to work invisibly: the redirection of thermal movement by and large occurs outside the spectrum of visible light. There appears to be no obvious "sender" that is crafting heat signals in acts of volitional agency. As heat and cold are channeled through air, pipes, lenses, metaphors, colors, and buildings, the messages they transmit often seem

like ambient properties of a natural environment. Thermal media can produce multiple senders and receivers, all processing and reacting simultaneously. This results in what I describe in detail in chapter 3: a deferral of accountability to the environment, especially by the perpetrators of thermal violence. Thermal media such as a window dispositionally lead us to believe that the sun is heating us rather than feeling warmth as an effect of architects' decisions or our own social practices.

Second, because of their tendency to modulate thermal gradients, communications by heat are rarely discrete, with identifiable beginnings and ends. There are of course exceptions to this rule, several of which I describe in chapter 4: the heat ray telegraph and the directed millimeter rays of the US military's Active Denial System; the infrared transmissions that transport data across fiber-optic cables; and the blast of air conditioners felt upon entering and exiting a shopping mall. But most of the time it is hard to tell where heat ends and cold begins. The perception of thermal stimuli is more often a perception of an environment or an intensity. To engage with heat is typically to engage with an analogue gradient. Thermoception "is not like a thermometer," Vannini and Taggart write. "It is instead an atmospheric attunement."[55] It is not simply that thermal communications have a diffuse spatiality; they often have a temporal indeterminacy.

Third, thermal media often shape thermal subjects through the process of calibration. While calibration typically describes a test to establish the consistency of scientific instruments, it is also used to refer to the standardization of any set of measurement capacities, even those of populations.[56] Thermal media often attempt to standardize bodies as sensory instruments, establishing a normative sense of temperature through normative uses. Just as people learn to see through visual cultures and hear through aural cultures, the sense of heat and cold is conditioned through thermocultures, especially by technologies of temperature control and most deliberately, as I describe in chapter 1, by thermostatic heating systems and air conditioners. This calibration embeds lived routines and material orientations with a sense of hot and cold. As people receive heat signals, they are affected by temperature differently depending on the thermocultures in which they exist. Just as with vision and hearing, the "individual" understanding of thermal communications is actually a situated and collective knowledge.

Fourth, at the same time, felt sensations of hot and cold are always dependent on the particularities of the bodies that are feeling. The reaction of some bodily matter to heat is different from others, however identical they are in composition and however similar their environments. Thermoception

is conditioned by past exposures and cultural milieus. Although scientists have begun to document the complexity of these processes, mainstream studies of thermal comfort—the area of research that sets the basis for design of heating, ventilation, and air-conditioning—continue to use models in which culture is largely absent, as are race, gender, sexuality, ethnicity, and history in general. Despite the long histories of bodily calibration described throughout this book and despite the immense amount of research on individual thermal responses, heat effects and perceptions remain indeterminate.

Fifth, this is true in part because the sense of temperature is not merely a perception of an external state. It is a sensation both of external and internal environments, and it thus diverges from other modes of perception that have dominated media studies. "Thermal information is never neutral," Lisa Heschong observes. "It always reflects what is directly happening to the body."[57] Heschong points out that thermal nerve endings are not actually temperature sensors. They are heat-flow sensors. They monitor whether one's body is gaining heat or losing heat. Our sense of temperature, Boon Lay Ong writes, is "a reflection of the energy balance between our bodies and our environment."[58] When people sense temperature, they sense their own energetic state in relation to the world they inhabit. As Marina Peterson points out, since "heat moves spatially and temporally, through animate and inanimate bodies," it connects "the 'matter' of stone, air, and breath, drawing humans and objects together in collective forms."[59] Thermal perception is always a sensation of sameness and difference, while it simultaneously draws the body into such collective formations. Even endotherms, bodies that maintain a "stable" body temperature, are inevitably thermally entangled. Karen Barad argues that entanglement is not "any old kind of connection, interweaving, or enmeshment."[60] It does not presuppose that separate individuals join one another but rather that existence itself "is not an individual affair."[61] What I describe in this book as thermal entanglement is the inevitable intra-action of bodies, beings, and processes with heat and cold. The shape of all matter is fundamentally bound up with thermal conditions.

Last, because of thermal entanglement, temperature fundamentally affects when matter becomes media. Heat and cold alter matter's ability to hold a particular form and its ability to transform. Temperature shapes when matter can facilitate communication—when a window offers a view on a world and when it makes bodies susceptible to attack. Temperature sets conditions for contagion and limits on life spans. No matter what we

are composed of, prolonged composure is predicated on assumed temperature. And deviation from this temperature disrupts the rhythms and patterns of existence. Extreme cold incapacitates the paper on which words are printed, the electronic screens where they are displayed, the body and the air in which they are sounded. The overheating of voting machines prompts ballot recounts; the overheating of computers collapses data infrastructures.[62] As a result, beneath all traditional media technologies—textual, aural, and visual—is a set of thermal infrastructures and a thermal regime. The changing climate, as it shapes the conditions of possibility for these thermal regimes, will change not just thermal media but all mediation.

METALLURGY

Over the past several decades, media ecologies have radically transformed. They have become increasingly networked, yet they remain anything but horizontal. New corporations manage global communications, even as these signals transit long-established paths. A massive logistical infrastructure catalyzes media's expansion beyond its former frontiers. Digitization and databases enable new forms of invisible coordination. Protocols are ever more stringent, even as platforms market flexibility and the inclusion of difference. Personalized interfaces channel and redirect affect, generating compulsory habits and insatiable desires. Digital subjects are patterned by centralized systems and stored in massive warehouses. This technical and social reorganization, which has altered the circulation of text, images, and sounds, has also reshaped thermal media. At the same time, the reality and subsequent recognition of climate change has produced new forms of thermal knowledge and new experiences of temperature.

While digital systems and climate change have helped to generate a major shift in thermal mediation, this is not the first time that thermocultures have undergone such radical changes. *Media Hot and Cold* connects twenty-first-century thermal media to the early period of mass media and mass culture, when the audiovisual cultures of cinema, radio, and advertising, as well as the communications systems of telegraphy, telephony, and electricity, had a similarly transformative effect on the sensation of temperature. It is during this period, roughly from the turn of the century through the 1930s, and especially following World War I and the global influenza pandemic, that many of the patterns, technologies, and systems of thermal media in the United States first crystallized. And while in recent decades early twentieth-century thermal media have been reconfigured alongside

many other mass media, they continue to set the stage for present thermocultures and those of the future.

The particular cases in this book are not organized chronologically, even though each chapter unravels a genealogy of a thermal medium (including the thermostat, coldsploitation, the sweatbox, the heat ray, the infrared image, and the air conditioner). Rather, I bring these disparate examples together using a metallurgical approach.[63] Academic research often involves retrieving material from the depths of archives, interviews, and texts in order to expose what otherwise might remain hidden. In metallurgy, Gilles Deleuze and Félix Guattari explain, "an energetic materiality overspills the prepared matter, and a qualitative deformation or transformation overspills the form."[64] In contrast to the process of scholarly excavation, this book's metallurgical approach composites histories from already "known" cases, often materials that would not normally be thought together. I subject these examples to a new set of conditions in order to enact a qualitative deformation that activates resonances across and between them. The concepts above, each of which attach "thermal" to an existing area of cultural or media analysis (subjects, attractions, desire, colonization, neoliberalism), are tools of metallurgical analysis: they help to meld areas of study. In this approach, temperature is not an external force to be discovered or documented but something actively entangled in the analytic process. As a result, metallurgy often involves reading sensory contexts in materials that were meant to speak neither about heat and cold nor to each other.

While the overarching project of this book is metallurgical, individual chapters home in on specific genealogies of thermal media. In the first chapter I describe a foundational thermal technology for twentieth- and twenty-first-century thermocultures: the thermostat. This often-overlooked device is a critical interface between people and their thermal environments. It is a site where people learn how to become thermal subjects. They embed what Yuriko Furuhata describes as "thermostatic desire," a desire to posit the atmosphere as an object of human control, often via convective media.[65] This chapter tracks how early thermostats, like early mass media, were developed as part of a broadcast system. Paired with central heating and central air-conditioning, they helped to generate a sense of thermal homogenization and calibrated people as a thermal audience. Thermostatic subjects, I show, were intended to embrace thermal stasis and adopt technologies to reduce thermal fluctuation, and importantly, they were asked to experience the same temperature regardless of race, sex, gender, nationality, and ethnicity. The thermostat is not a neutral interface for a heating infrastructure;

it is a medium for temperature, one that is deeply connected to a cultural need for thermal evenness, stasis, and heteronormative domestic care.

Chapter 1 chronicles how the culture of thermostat use, like other media cultures, changed over the course of the twentieth century. A series of "thermostat wars" broke out over the "correct" temperature. Scientific research challenged the standardized thermostatic subject. In its place, thermal comfort science offered a new imagination of an adaptive thermal subject, one that was shaped by its thermal pasts and capable of adapting to thermal futures. Digital entrepreneurs developed new technologies, such as smart thermostats, that could accommodate diverging thermal desires. This digital approach to temperature encouraged each subject to be in control of their own thermal environment and, implicitly, to be responsible for mitigating climate change. As media transformed from broadcast to microcast, thermoceptive norms shifted from a desire for universal thermal standards to thermal personalization.

While the thermostat often embeds a desire for a lack of thermal sensation, the second chapter focuses on thermal attractions, the sensory pleasures of heat and cold. Thermal media, like all media, have genres. Chapter 2 describes how coldsploitation, a genre of sensational thermal media, exploited the cooling effects of images, sounds, architectures, and technologies for profit. Focusing on the emergence of this genre between the 1910s and the 1930s, the chapter documents a cinematic cycle of enormously popular "snow films." These thermal visions, a form of "haptic visuality" in which "the eyes themselves function as organs of touch," transmitted a sense of temperature.[66] At the same time as these films were released, the lobbies of movie theaters were adorned with elaborate Arctic scenes and radio shows broadcast polar narratives over the airwaves. Coldsploitation media, like so many other exploitation forms, enabled audiences to consume experiences of thermal difference while also legitimating—on a sensory level—projects of colonization. During this period, fans and air conditioners were also deployed in media environments, en masse, for the first time. Collectively these thermal media brought about a new way of consuming coldness. While ice, like newspapers and other nineteenth-century media, was a conductive medium often held in the hand, coldsploitation was a convective medium that shaped atmospheric communication.

Just as we are witnessing the emergence of new thermal subjects, so too are thermal attractions being reshaped in the current moment. The desire for cold temperatures is intensifying. "Last-chance tourism" to the Arctic offers the cold as an increasingly rare and valuable experience, drawing

upon a long history of thermal colonization. At the same time, personalized cooling systems that work directly on the body are proliferating. The Embr Wave, a heating and cooling wristband, allows users to give themselves personal temperature adjustments. Smart beds and bedding allow bedmates to each choose their own temperature. Ice vests can be worn under suits, and personal air conditioners are sewn into jackets. These targeted thermal communications are distinct from a century of convective media—using thermoelectric technology and direct touch, they attempt to extract bodies from threatening atmospheres and link them into digitized thermal circuits.

The third chapter turns to another form of bodily calibration—not stasis, adaptation, or attraction, but the enactment of thermal violence. As Kyle Powys Whyte, Heather Davis, Zoe Todd, and Kathryn Yusoff, among many others, have identified, environmental change is a long-standing means of enacting colonial and racial violence.[67] This occurs not only through the dramatic transformation of landscapes but in the everyday modulations of environmental exposures. Taking one example of thermal violence as its focus, this chapter describes the long history and contemporary forms of sweatboxing in the southern United States. Sweatboxing is a violent practice that directly manipulates the body's capacity to mediate heat. In the southern United States in the eighteenth and nineteenth centuries, enslavers weaponized the environment to punish and kill by placing people in wooden boxes in the summer sun or in cold, wet conditions and then restricting food and water. These cultural practices of overheating or freezing persist into the "afterlife of slavery" through policing and prisons.[68] They are advantageous to perpetrators because they offer a way to leverage the indeterminacy of heat effects—the fact that heat differentially affects its subjects—to defer accountability to the environment. It is difficult even to document murders via sweatboxing: many of the people killed have been listed as having died of "natural causes."

Following the long history of sweatboxing into the present moment and the overheating of prisons, this chapter demonstrates how one effect of climate change will be an extension of the human capacity for thermal violence. While some small legal victories have begun to assert thermal rights, such as the right to ice water in extreme heat, changes based on thermal objectivity not only fail to translate into compliance but also miss the ways that heat can be weaponized through a much broader set of practices: forced exertion and labor, the withholding of food or water, and the manipulation of movement and stillness. Instead of adopting thermal technologies

or consuming thermal affects, this chapter shows, it is necessary to develop a politics of thermal autonomy: a politics that is attentive to people's ability to regulate and mediate their own position within the thermal world.

The first half of the book focuses on recognizably thermal technologies—thermostats, temperature standards, ice, air conditioners, and sweatboxes—to show how these work as convective and conductive media to distribute heat and cold "content" to thermal receivers: communication here is largely a sense of heat directed from people to people. The second half of the book turns to forms more generally recognized as media, including telecommunications systems, cameras, and computers, to show how deeply entangled traditional media are with temperature. Chapter 4 focuses on the heat ray, a direct beam of thermal communication. In the early twentieth century, alongside the distribution of thermostats and coldsploitation media, many people were experimenting with using heat—rather than light or sound—as part of telegraph, telephone, and television systems. The heat ray telegraph produced signals with superhot searchlights. On the receiving end, a parabolic mirror caught these heat rays, increased the temperature inside a small horn, and ultimately produced a sound in an attached stethoscope. The listener interpreted such sounds, generated by thermal expansions and contractions, as the beginning and ends of dots and dashes. In this thermal medium, heat was generated by a single transmitter and directed to a thermal receiver, and the message was encoded in an existing language: Morse code, English, French, German, or binary code, among others.

This is an example of radiant media that leverages both the spectrum and the processes of convection. Other radiant thermal media of this time include Alexander Graham Bell and Charles Sumner Tainter's photophone, the infrared television, the fever machine, and radio shortwave cookers (that later morph into the microwave). Heat ray media, however, were not taken up as a means of mass communication. It was not until the development of the laser and the fiber-optic cable, a half century after these experiments, that heat rays became the medium of global communication. Today, the most expansive thermal medium is the internet. While the fiber-optic cables that carry internet traffic are largely described as transmitting signals via light, these cables do not use visible light. Data is sent around the world using infrared wavelengths at around 850 nm, 1300 nm, and 1550 nm. Our global telecommunications network is better described as a network of heat rays, a global system of encoding and redirecting infrared waves. Recently, the thermal sensitivities of these cables have come

to matter for climate change. New technology has been developed to transform the heat ray transmissions of cable systems into potential sensors for the environment around them: the internet now comprises the largest potential thermometer on earth.

The fifth chapter turns to another thermal medium that has become ever-present with the expansion of digital technology and the COVID-19 pandemic: the infrared camera. While the heat ray telegraph and infrared television failed to take hold in the early twentieth century, infrared photography emerged during this same period as a critical sensing medium, a means of registering bodies and objects from afar. Early infrared images dramatically transformed existing forms of thermal vision and cultivated a new thermoceptive regime, one that recast the world as a landscape of thermal reflectors and that imagined bodies and objects as potential thermal media. Today, digital technologies ranging from satellite imaging to autonomous vehicles rely not only on a web of infrared transmission but also on machinic thermoception. Algorithmic systems aggregate and expand infrared imaging in ever-new ways, offering new means of targeting and visual surveillance. Thermal images are woven through national security and public health. At the same time, infrared cameras are entangled with infrastructures of temperature control, used to define normative temperatures, and tasked with managing a volatile thermal landscape. Through these media, radiant emissions are becoming new sites for extraction, exploitation, and control.

All these digital systems, whether fiber-optic networks or infrared cameras, depend more than any media before them on temperature manipulation. The final chapter of *Media Hot and Cold* is a genealogy of digital media's immense need for cooling. It begins with the first air conditioners, which were made to stabilize media rather than to comfort humans. Without stable temperatures and air-conditioning, phonographs expanded and contracted, radio studios had to retune instruments, and film operators overheated in enclosed booths. Early air-conditioning systems cooled media production and manufacturing, making standardization and speed possible. Air conditioners are also essential to the preservation of media: without stable temperatures, much of media and cultural history would be completely lost. Digital systems build on this long history of media cooling and are today unable to tolerate thermal fluctuation. The trajectory of media's materiality has thus been largely from technologies that could survive vastly different thermal conditions to media that depend entirely on thermostasis.

For environmental determinists, tracking "the coldward course of progress" was a racist naturalization of Western dominance: they insisted that cool temperatures advanced civilization.[69] This coldward course of media is a social project that molds technology in this shape, privileging geographies with stable electrical infrastructure, energy resources, and certain climates. It is a thermal regime that ultimately enacts inequity in media access and institutions. Along with the previous two chapters, this genealogy shows how thermal infrastructures shape communication not only through the sensory forms of heat and cold but by conditioning traditional media operations during manufacturing, distribution, consumption, and preservation. Just as the history of temperature is entangled with the history of communications systems, the history of media technologies is likewise a history of temperature.

By bringing an array of disparate thermal media together—the thermostat, cold air, the sweatbox, the infrared camera, the heat ray, and the internet's infrastructure—this book opens up and broadens the lines of inquiry into thermal transmissions and affects. The content of these chapters will be familiar to some readers. The histories of the air conditioner and the home heating system are integral parts of the history of technology. The sweatbox is a well-known disciplinary technology in the history of the plantation and the prison. Cultural analyses of the Arctic and Antarctic have documented the significance of film in polar exploration. Media history has charted the early developments of the photophone and the television. Digital media studies has exposed the coldness of the data center. Histories and contemporary analyses of architecture have explored the critical importance of temperature in environmental design. As part of this book's metallurgical approach, I draw together foundational accounts from all of these areas, along with trade and industry literature, ethnographic studies, and scientific research on temperature.

Ultimately, the qualitative deformation I hope to achieve by bringing these disparate cases together is that of your own skin and the skin of others. I hope that you will feel these words. I hope your attention will be redirected to the multiple and contradictory ways that temperature affects bodies. I use the words *heat* and *cold* loosely to evoke sensation and affect. I write to a "you" without knowing who you are but knowing you are somehow sensitive to temperature. If understanding media entails understanding the ways we are positioned, hailed, and attuned through the material configuration of communicative forms, then the true project of this book is to leave you thermosensing differently.

IN 2020, THE COVID-19 PANDEMIC consolidated trends already emerging in thermal media. Infrared imaging cameras long used in medical and security operations were deployed as part of health surveillance systems in warehouses, transit hubs, and schools. Infrared spectroscopy was adopted for diagnosing COVID-19. Thermal images revealed the hidden trajectories of microdroplets through the air.[70] Social and economic activity were quickly transduced into infrared signals and zoomed through the internet's chilled infrastructures. Conductive thermal media, which hooked bodies directly into circuits of exchange, became ever more appealing in a moment of atmospheric contagion. At the same time, wildfires raged, ice sheets melted past the point of no return, temperature records were broken, and popular media offered stories on the "profoundly unequal" impacts of extreme heat.[71] More than ever, thermal media appeared as a solution to social problems—they would be indicators of health, a means of sustaining economic activity, and a way to manage bodies.

The pandemic also sparked a new wave of thermal research on the connections between weather patterns and viral spread. Some studies drew correlations between daily maximum temperatures and daily incidence rates of COVID-19, pointing out that diagnosed cases increased as the outside temperature decreased.[72] Others suggested that higher latitudes and colder climates fostered conditions for viral transmission.[73] Drawing from prior work, much thermal research operated within long-standing frameworks of environmental determinism. A century earlier, following the 1918 influenza pandemic, Ellsworth Huntington argued that of all possible factors, from a city's geography to its inhabitants' physiological condition, "the only one which shows any conclusive causal relation to the destructiveness of this particular epidemic is the weather."[74] Like the results of earlier studies, many of the climatic connections of COVID-19 relied on daily temperature readings or climatic averages, with little attention to the cultural entanglements of temperature that shaped exposures on the ground: architectures' differential mediation of heat; the ways that hot weather fostered gathering in cooling centers; the social stratifications of thermal reception.

Media Hot and Cold composites a sensory impression of this thermal regime, which was already in formation in the late twentieth and early twenty-first centuries but which became strikingly visible as temperature shaped pandemic conditions. The future of temperature, this book shows, will be deeply enmeshed with digital media and articulated as a reaction to

climate change. As the founder of one AI-based thermostat states, "We believe that together, we can change climate change."[75] Digital devices enable some individuals to micromanage their thermal environment, mitigating atmospheric effects while at the same time naturalizing a sense of neoliberal thermal control. Thermal technologies are legitimated by new strains of thermoregulatory science that suggest humans can take responsibility for their thermal well-being. At the same time, climate change expands the capacity to profit and enact violence using thermal affects. Infrared communications are dramatically altering the cultures of agriculture, security, and public health. Even as these thermocultures are described as "green," they capitalize on thermal instability and are enmeshed in an industrial-technological shift to distributed, high-energy computing and manufacturing that itself accelerates climate change.

Climate change and large-scale technological systems such as the internet are often discussed as global phenomena. They appear to exist beyond the scale of everyday life, human perception, and local politics. "Since we experience weather, not climate," Wendy Hui Kyong Chun writes, media are essential to registering global climate change and "opening climate up to cultural inquiry and political mobilization."[76] As many scholars recognize, climatic media support weather forecasting and progressive policy changes at the same time as they scaffold massive geoengineering projects. However large-scale coordinated changes alter temperatures on earth, they will do nothing to ameliorate long-standing practices of thermal violence. In other words, even if climate change were miraculously reversed, thermal inequities and harm would persist as they have for centuries.

In contrast, this book, attuning to the ways that people and media are entangled with heat, directs attention to the much more minute and intimate effects of thermal shifts. Climate changes will alter everyday rhythms and movements, changing the capacity to transmit or hold still. The power of temperature as a means of sorting, categorizing, and distinguishing will increase. Its ongoing entanglement with processes of racialization will continue. In ever-new thermal environments, there will also be new potentials and new blockages for mediation. The thermal resources needed to host internet traffic will become more scarce and the geopolitics of telecommunication will shift. New sets of thermopolitics are already emerging, not only around the Arctic ice and rising seas, but also in conflicts over the ability to create and maintain thermal zones. As Sheila Watt-Cloutier evocatively explains in *The Right to Be Cold*, Inuit culture and economic independence

"[depend] on the cold, the ice, and frozen ground," and "the great shifts in temperature and weather patterns [are] upending an entire way of life."[77] Climate changes will reverberate across thermocultural forms.

Media Hot and Cold offers a framework to address such shifts, analyzing the thermal media with which people are already engaged. I show in the following pages that social politics are *already* climate politics. Data protections would help to ensure thermal autonomy. Prison abolition would mitigate thermal violence. Access to local thermal media enables more community control over local thermal capacities, whatever the global thermometer reading. This ranges from the ability to alter thermostat settings to the insulating potential of buildings and fabrics. It extends from the recognition of vernacular thermal perceptions to the creation of new and equitable thermal practices. New thermal media, and even writing itself, can be used to calibrate different kinds of thermal subjects. Critical temperature studies need not only analyze from a distance. It can work generatively to reorient affective responses to the world of heat and cold.

Preface

1. Here I have been inspired by and extend the work of Jamie Skye Bianco, "#inhabitation" (multimedia/digital storytelling), *CCCC Online* 1, no. 1 (spring 2012), https://cccc.ncte.org/cccc/ccconline/v1-1/bianco.

2. Osman, *Modernism's Visible Hand*, 23.

Introduction

Portions of this chapter were previously published as "The Materiality of Media Heat," *International Journal of Communication* 8 (2014): 2504–8.

1. Klein and Nellis, *Thermodynamics*, 1.

2. See Eric Klinenberg's *Heat Wave* for a description of social infrastructure's redistribution of heat effects.

3. Lauren Berlant and Lee Edelman, *Sex, or the Unbearable*, 25.

4. As Elena Beregow suggests, thermal intersubjectivity is made possible "through the melting and mingling of bodies." Beregow, "Thermal Objects," 2.

5. One notable site where thermal communications (and thermodynamics) have been influential is in the development of cybernetics and associated media theories. See Dylan Mulvin and Jonathan Sterne's special issue, "Media Hot and Cold," in the *International Journal of Communication* in 2014; and Ernst, "Time, Temperature and Its Informational Turn."

6. Here I am inspired by the work of Dora Silva Santana on "tactile grammars" (Santana, "Trans* Stellar Knot-Works"), as well as by Melody Jue and Rafico Ruiz's articulation of the elements as heuristics (Jue and Ruiz, "Thinking with Saturation").

7. The gendering of temperature is both a social and a physiological phenomenon. Temperature is not only differentially felt according to social activity and clothing; it's also affected by hormonal and metabolic processes.

8. Hobart, "Cooling the Tropics."

9. Douglas, "Environments at Risk," 207.

10. Hess, "Standardizing Body Temperature."

11. Here I rely on both classic descriptions of communication as the processes of transmission and reception for information and on more recent expansions of media theory that extend communication beyond human-to-human messages to environmental phenomena that provide "conditions for existence" (see Peters, *The*

Marvelous Clouds, 14) and to the "interlocking technical and biological processes of mediation" (see Kember and Zylinska, *Life after New Media*, xiiv). I also invoke Lisa Gitelman's foundational definition of media as "socially realized structures of communication" (*Always Already New*, 7).

12. Fennell, *Last Project Standing*.

13. Day, "98.6."

14. Mbembe, "Necropolitics." For a discussion of thermopolitics, see Daggett, *Birth of Energy*; and Clark, "Infernal Machinery."

15. Here I join many other scholars, who have in recent years have extended Foucault's description of biopower to account for environmental processes. Energopower, Dominic Boyer writes, can help scholars to grapple with some of the "shockwaves set off by overuse of carbon and nuclear energy" and account for the way energy systems "have shaken the foundations of contemporary biopolitical regimes." Boyer, *Energopolitics*, 12. See also the formulation of ontopower in Massumi, *Ontopower*, and geontopower in Povinelli, *Geontologies*.

16. Royston, "Dragon-Breath and Snow-Melt"; Lara, "Affect, Heat and Tacos"; Vannini and Taggart, "Making Sense of Domestic Warmth"; Allen-Collinson and Owton, "Intense Embodiment"; Potter, "Sense of Motion, Senses of Self"; Classen, *Worlds of Sense*.

17. Ong, "Warming Up to Heat," 7. Historians of architecture, in particular, have developed numerous lines of inquiry into the relationship between temperature and culture. In *Modernism's Visible Hand*, Michael Osman tracks the ties between thermostatic systems, cold-storage warehouses, and regimes of regulation.

18. Barber, *Modern Architecture and Climate*, 9.

19. Ackermann, *Cool Comfort*; Adams, *Home Fires*; Chang, *Inventing Temperature*; Cooper, *Air-Conditioning America*; Middleton, *A History of the Thermometer*; Osman, *Modernism's Visible Hand*; Woods, *Herds Shot Round the World*.

20. Hutchison, "Journalism and the Perfect Heat Wave"; LeMenager, "Living with Fire"; Peters, *The Marvelous Clouds*; Ruiz, "Phase State Earth."

21. See, for example, Ruiz, Schönach, and Shields, "Introduction: Experiencing after Ice"; Schönach, "Natural Ice"; Radin and Kowal, *Cryopolitics*; and Radin, *Life on Ice*.

22. For a discussion of the thermal and the production of art objects, see Rubio, *Still Life*, 22. See also Elena Beregow's special issue of *Culture Machine*, "Thermal Objects," which assembles a range of inquiries into the artistic and performative dimensions of thermal objects.

23. Hulme, *Weathered*.

24. See Allen-Collinson et al., "Exploring Lived Heat"; and Vannini and Taggart, "Making Sense of Domestic Warmth." Alex Nading has suggested that ethnography can "break down the metaphorical and social forms of insulation that make heat seem sometimes global, sometimes invisible." Nading, "Heat."

25. Horn, "The Aesthetics of Heat"; Venkat, "Toward an Anthropology of Heat."

26. Fretwell, "Introduction: Common Senses and Critical Sensibilities."

27. McLuhan, *Understanding Media*.

28. Vannini and Taggart, "Making Sense of Domestic Warmth."

29. Serres, "The Origin of Language," 73.

30. Günther Selichar, *Screens, Cold*, 1997–2003, series, in *Offene Grenzen*, exhibition, Künstlerwerkstätten, Lothringerstraße, Munich, 1998.

31. Alter, Koepnick, and Langston, "Landscapes of Ice, Wind, and Snow."

32. Wollen, "Fire and Ice," 78.

33. Parisi and Terranova, "Heat-Death."

34. Bachelard, *Psychoanalysis of Fire*, 111.

35. Aristotle, *On the Parts of Animals*, 28.

36. Mann, *The Magic Mountain*, 271.

37. Mumford, *Technics and Civilization*, 78, 157, 259.

38. Lévi-Strauss, *The Raw and the Cooked*, 164.

39. Montesquieu, "Of Laws as Relative to the Nature of the Climate," 296.

40. Smith, "'Exceeding Beringia.'"

41. Jennings, *Curing the Colonizers*, 13.

42. Barber, *Modern Architecture and Climate*, 37.

43. Horn, "The Aesthetics of Heat," 2.

44. Horn, "The Aesthetics of Heat," 4.

45. Horn, "The Aesthetics of Heat," 4.

46. Gumbs, *M Archive*, 96; sentences in all lowercase in the original.

47. Gumbs, *M Archive*, 98.

48. Moreover, these workers were never promoted, so over the course of their careers they were not paid the same amount as their white counterparts. Foote, Whatley, and Wright, "Arbitraging a Discriminatory Labor Market."

49. Foote, Whatley, and Wright, "Arbitraging a Discriminatory Labor Market," 494.

50. Abe et al., "Histone Demethylase JMJD1A," 1566; University of Tokyo, "Enduring Cold Temperatures Alters Fat Cell Epigenetics," press release, April 30, 2018, https://www.u-tokyo.ac.jp/focus/en/articles/a_00602.html.

51. Alaimo, *Exposed*, 7.

52. Barber, *Modern Architecture and Climate*; Furuhata, *Climatic Media*.

53. Mukherjee, *Radiant Infrastructures*.

54. While it is true that radiant waves are the medium for any signals communicated, those waves themselves do not require a medium to move through space.

55. Vannini and Taggart, "Making Sense of Domestic Warmth," 66.

56. Soler et al., "Calibration."

57. Heschong, *Thermal Delight in Architecture*, 19.

58. Ong, "Introduction: Environmental Comfort and Beyond," 3.

59. Peterson, "Heat."

60. Barad, *Meeting the Universe Halfway*, 160.

61. Barad, *Meeting the Universe Halfway*, ix.

62. See, for example, the recount of more than 170,000 votes in Palm Beach County, Florida, after voting machines overheated in 2018. Maya Kaufman, "Palm

Beach County's Voting Machines Overheat and Force Recount of More Than 170,000 Votes," *WLRN*, November 14, 2018, https://www.wlrn.org/news/2018-11-14/palm-beach-countys-voting-machines-overheat-and-force-recount-of-more-than-170-000-votes.

63. In this project, I follow other experimental histories of media, such as Jacqueline Wernimont's *Numbered Lives*, that read mediation speculatively, "making a mess of apparent order in the service of alternative futures." Wernimont, *Numbered Lives*, 3.

64. Deleuze and Guattari, *A Thousand Plateaus*, 410.

65. Furuhata, *Climatic Media*.

66. Marks, *Skin of the Film*, 162.

67. Whyte, "Indigenous Science (Fiction)"; Davis and Todd, "On the Importance of a Date"; and Yusoff, *A Billion Black Anthropocenes or None*.

68. Hartman, *Lose Your Mother*.

69. GilFillan, "The Coldward Course of Progress."

70. Rodriguez-Palacios, Conger, and Cominelli, "Nonmedical Masks in Public."

71. Somini Sengupta, "This Is Inequity at the Boiling Point," *New York Times*, August 7, 2020.

72. Tobías and Molina, "Is Temperature Reducing?"

73. Mandal and Panwar, "Can the Summer Temperatures"; Lin et al., "Containing the Spread."

74. Huntington, "Influenza and the Weather."

75. Matt Rogers, "We Heart Home," Nest.com, April 13, 2107, https://nest.com/blog/2017/04/13/we-heart-home/ (site discontinued).

76. Chun, "On Patterns and Proxies."

77. Watt-Cloutier, *Right to Be Cold*, 230.

Chapter 1: Thermostat

1. Susan S. Lang, "Study Links Warm Offices to Fewer Typing Errors and Higher Productivity," *Cornell Chronicle*, October 19, 2004, http://news.cornell.edu/stories/2004/10/warm-offices-linked-fewer-typing-errors-higher-productivity.

2. Kira Cochrane, "Facebook Staff Feel the Chill in Cold Offices," *Guardian*, March 11, 2013, https://www.theguardian.com/technology/shortcuts/2013/mar/11/facebook-staff-chill-cold-offices.

3. Kingma and Lichtenbelt, "Female Thermal Demand."

4. Pam Belluck, "Chilly at Work? Office Formula Was Devised for Men," *New York Times*, August 3, 2015.

5. Anthony Lydgate, "Is Your Thermostat Sexist?," *New Yorker*, August 3, 2015, https://www.newyorker.com/tech/annals-of-technology/is-your-thermostat-sexist.

6. Jennifer Horn, "Change the Work Climate," *Stimulant*, August 30, 2016. https://stimulantonline.ca/2016/08/30/change-the-work-climate/.

7. Chang and Kajackaite, "Battle for the Thermostat."

8. Fernández-Galiano, *Fire and Memory*.