Radioactive Music: The Eerie Agency of Hildur Guðnadóttir's Music for the Television Series *Chernobyl*

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Abstract. The acclaimed television miniseries *Chernobyl* (2019) features an eerie soundtrack that musicalizes the silence of radioactivity. Hildur Guðnadóttir's score is composed of field recordings from a nuclear power plant, treated and fitted together in ways that blur the lines between music and sound design. The immersive qualities of the soundtrack provide television audiences with new means of sensing the invisible ecological consequences of human activity.

Introduction

In the book *Voices from Chernobyl* [*Tchernobylskaia Molitva*], author and Nobel laureate Svetlana Alexievich collected oral testimonies from survivors of the Chernobyl catastrophe. One of the stories in her book is that of a war photographer by the name of Sergei Gurin, who took his camera and traveled to the exclusion zone to document the event. When he arrived there, he found himself bewildered. Trained as a war photographer, he was looking for disaster as visual spectacle. But, as he recounts to Alexievich, "nothing's blowing up."[1] The cameraman finds only the surreal beauty and stillness of the spring bloom of the Belarussian countryside in 1986. He knows that everything around him is contaminated and highly dangerous, but how can he capture this invisible enemy on film? Eventually, the radiation that could not be registered on film is all too easily recorded on his own body, as his lymph nodes swell and he loses his sense of smell.[2]

This account from 1986 introduces the fundamental problem of how to document and mediate the phenomenon of nuclear radiation, as well as its human and ecological consequences. These same issues came to the fore in 2019 with the production of the HBO television miniseries *Chernobyl*, where radiation presented an audiovisual and aesthetic challenge, a challenge that was met by way of an innovative soundtrack featuring music composed by Hildur Guðnadóttir (b. 1982). This article details the ways in which the soundtrack makes present an otherwise invisible narrative element. To capture this, we provide close readings of key scenes in the television series, focusing our analysis on aspects of musical style, compositional techniques, and audiovisual effects. The integrated qualities of music and sound design facilitate an embodied experience of radiation made audible. We assert the cultural significance of this audiovisual operation, as it encourages a mass television audience to develop new forms of environmental understanding.

The analyses that follow reveal the soundtrack to be structured in ways that attune the audio-viewer to the ghostly agencies that haunt a contaminated world. In order to describe this, we adopt a concept-driven approach to close reading, turning to concepts such as Mark Fisher's "eerie," Timothy Morton's "hyperobjects," and Veit Erlmann's "resonance" as a means of delineating overlapping frames of reference that will inform our arguments and interpretations.[3] As

the aesthetic foundations of the *Chernobyl* soundtrack reside in its distinctive sonic qualities originating in the use of field recordings, it necessitates a method of analysis that foregrounds experientiality and is sensitive to the material and sensory aspects of phenomena. More specifically, we advocate an approach to close reading that is aligned with cultural studies and interdisciplinary studies of the arts, including musicology and sound studies. More thorough discussion of the methods employed is found in previous publications on close reading in the context of audiovisual media.[4]

Scoring "the Character You Can't See"

Hildur Guðnadóttir's impact on current audiovisual practices is easily quantified in terms of the number of awards she has received in the past couple of years: an Emmy, a Grammy, a Golden Globe, an Oscar, and a BAFTA award, among others. More remarkably, she has achieved this level of relatively mainstream success with a compositional approach whose experimental nature challenges and extends soundtrack conventions. Guðnadóttir is a cellist and singer known for her use of avant-garde techniques such as the use of feedback, extended cello techniques performed on unique custom-built instruments, and the combination of electronics with acoustic performance. Generally speaking, her work combines traditional composition and performance with elements of electroacoustic composition and sound art. All of this is evident in her music for *Chernobyl*. Importantly, she is the first woman to achieve this level of industry recognition. Her closest peer was arguably fellow Icelander Jóhann Jóhannsson, now sadly deceased, with whom she worked on the soundtracks for Denis Villeneuve's films *Arrival* (2016) and *Sicario* (2015), as well as the Icelandic television series *Trapped* (*Ófærð*, dir. Baltasar Kormákur, 2015). Guðnadóttir's music has no obvious niche, which in the Icelandic context is not unusual. She was cellist for folktronica group múm; while in the contemporary classical sphere, she has worked with Bedroom Community composers Valgeir Sigurðsson, Nico Muhly, Ben Frost, and *Chernobyl* collaborator Sam Slater.

The production of the musical score using location recordings was unique in the context of contemporary television music. Guðnadóttir was given the time and budget to embark on a compositional journey that is rarely ever possible in the framework of commercial television production. The composer was brought on board early in the development process and began working with field recordings before filming commenced.[5] The initial plan was to travel to Chernobyl itself to record the sounds of the power plant. In the end, this was not practically feasible, and Guðnadóttir instead traveled to a similar power plant in the town of Ignalina in Lithuania, where much of the series was filmed.[6] The plant at Ignalina closed in 2009, and is currently in the process of decommissioning, which is a thirty-year process during which access to the power plant is strictly controlled because the levels of radiation are still high. Guðnadóttir visited the plant together with score producer Sam Slater and the field recording expert Chris Watson (who contributed as a recording engineer at the power plant but is not credited). The three of them were allowed a total of just four hours inside the power plant, wearing full hazmat suits.[7] Guðnadóttir describes the motivation behind recording the sounds of the plant:

> I thought it was important that the music had a way to be the radiation . . . And to be able to do that, it was very important to understand what radiation is and what it feels like. So I went there [the Ignalina power plant]. And it was a little bit like being on a treasure hunt, because it's just so much material in there that you can record and so many sounds that are just

> fascinating. And it was a very important part of that process for me to not make the power plant do any sounds that it wasn't doing. Like, I didn't go in there and slam doors or bang on stuff. I just wanted to hear what it feels like to actually be there.[8]

While at the power plant, the musicians also collected an impulse response from the main chamber of the reactor room in order to construct what is called a convolution reverb: a digital simulation of the characteristic patterns of reverberation present in the physical space. This is ordinarily produced by recording reverberations from a sine wave frequency sweep from 20 to 20,000 Hz, but here it was made using the percussive sound of a dropped metal ball.[9] The resulting metallic reverb would have significant implications for the aesthetics of the music, becoming a kind of "soundmark," to borrow Barry Truax's term,[10] of the sonic character of the space. Concrete sounds recorded in the plant formed the basis of the compositions and these, together with Guðnadóttir's vocalisations among other elements, would be passed through the convolution reverb of the plant in order to construct the distinctive sound world of the series. Regarding the process of collecting sounds, she comments:

> The big solo musician of the score was this door, which made these incredible sounds. It was the door to a pump room. We weren't closing it or moving it at all. We just came up to the door with the microphone. A we were like, huh! Oh my god. There were all these high frequencies that were making these crazy, crazy noises. Almost inaudible but so high pitch, you really had to focus to hear anything. So I would do this door for hours and hours and hours, so I was like in minute 35.20 there's this sound, it was a melody, so I'd take those little snippets and it would become the melodic aspects of the score.[11]

The composer had a distinct "character" in mind when envisioning her work: not a human character or protagonist, or the character of a physical environment, but the forces and processes which affected both of these in the course of the disaster. Her main character was, in short, the radiation itself. She comments: "Because the radiation is the character as such in these events that you can't film and you can't see, but you need to be able to feel it, and I felt that the music was a good place to feel the radiation."[12]

Nuclear radiation is an example of what Timothy Morton calls *hyperobjects*. In Morton's definition, hyperobjects are "massively distributed entities that can be thought and computed, but not directly touched or seen. The simultaneous unavailability yet reality of the hyperobject require a radical new form of thinking to cope with it."[13] Guðnadóttir wrestled with this "simultaneous unavailability yet reality" of the hyperobject in her music for *Chernobyl*. Finding the musical voice of "the character . . . you can't see" involved a creative process of musical and sonic attunement to radiation, in the end coming up with a musical style that evokes hyperobjectivity in its very form. As Morton points out, hyperobjects are difficult to grasp for the modernist mind because we cannot map them or systematize them. We must then come to know hyperobjects through other strategies more intimate and more real. Guðnadóttir spent time familiarizing herself with the power plant at Ignalina as one local manifestation of the hyperobject. The resulting music is not a music that "depicts" radiation, it rather makes radiation sensorially present in the analogous, and also *radiating*, medium of sound.

We cannot perceive or know radioactivity in itself: we can only know it by its effects. When a uranium-235 atom becomes energized, picking up an extra neutron to briefly become the highly unstable uranium-236, the atom immediately splits, releasing an

ionizing charge in the form of electromagnetic radiation that will impact and alter the molecular structure of whatever finds itself in its path, whether that be earth, steel, or human DNA. This is a process that humans cannot see, but we *can* hear it. Modern devices for measuring levels of radioactivity are now digital, but the original Geiger counter was a completely analog device. It detected radiation events by sounding off a "click" whenever an ionizing particle made the gas contained in its tube conductive, briefly allowing an electrical charge to pass through. The clicking sound produced by the Geiger counter exemplifies the analogous relationship between radiation and sound, which is important for the role of the musical score in *Chernobyl*. When Guðnadóttir states that she wanted the music to *be* the radiation, she pinpoints the capacity of sound for providing a more intimate and embodied sensation of what radiation is.

Using the palette of sounds recorded at the Ignalina power plant, Guðnadóttir sculpted timbrally complex sheets of sound that are frequently nontonal. In both compositional method and resulting sonic qualities, the music is reminiscent of the mid-twentieth-century avant-garde, including the futurist sound-worlds of Edgard Varèse and the *musique concrète* of Pierre Schaeffer. These were musical expressions crafted amid modernist visions of technologized futures. Varèse's *Ionisation* (1931) searched out new ways of organizing rhythmic patterns and musical space inspired by current knowledge of particle physics, exemplifying the entwinement of art and science in a continental Europe on the brink of discovering the atomic bomb.[14] If Varèse's music exudes a technological sublime, other musical expressions have captured the horrors also contained in the splitting of nuclei. Kryzsztof Penderecki's orchestral work *Threnody for the Victims of Hiroshima* (1960) is a prominent example. The Polish composer originally titled his composition *8'37"*, but after hearing the first performance he decided to change it, and thereby dedicating its disorienting swirl of screeching strings to the victims of the atomic bomb. With its unrelenting dissonance and overall impression of sonic chaos, the work can be said to both depict violence and to enact it on its performers as well as its audience.[15] Guðnadóttir's music for *Chernobyl* is yet another musical engagement with the atom, one that reveals new facets of the nature of radiation in the context of new audiovisual aesthetics.

Vanishing Voices and Eerie Cries

It is worth reflecting on a consequence of Guðnadóttir's approach that would to some extent come to define the soundtrack. In a situation where both the sound designers and the composer relied heavily on field recordings from the same location, the two would inevitably come to resemble each other, and, in fact, the end result was a significant amount of overlap, which the collaborative team had to coordinate with care. Sound designer Joe Beal has commented that the project was particularly challenging because of the amount of overlap, even competition, between sound design and music, due to their fundamentally similar character.[16] Guðnadóttir, for her part, sees the effort to coordinate the two as worthwhile, given the prominent role that sound design plays in the series: "I think that might have been a direction that a few people might have been afraid to go in because there's been an aversion to having the music being too close to the sound design. That's something I heard after the score came out, where they called it musical sound design. But I think that's an outdated way of thinking. As sound design becomes more and more present, I think it's even more important for the music to work together with it."[17] The blurring of lines between score and sound design represents

an important new trend in contemporary soundtrack practice, as described by Danijela Kulezic-Wilson.[18] Arguing that "sound design is the new score," Kulezic-Wilson contends that the shift toward a more integrated soundtrack is based on a recognition of the inherent musicality of all the different soundtrack elements. Likewise, Kevin J. Donnelly observes that "film soundtracks now often evince a conceptual or aesthetic unity along the lines of musical principles."[19] In *Chernobyl*, such a musicalized coordination between score elements and sound design is done in ways that produce specific aesthetic effects that we describe with reference to Mark Fisher's notion of the eerie.

An example of this is found close to the end of the first episode. The scene begins with a close-up of plant worker Anatoly Sitnikov (Jamie Sives) looking obviously distraught as he steps out onto the roof of the ruined plant to determine if the reactor has exploded. He knows that it has, but this is a direct order he must obey. A pensive introductory passage seems to link this music to the preceding scene, situated in the pump room, as the music sounds almost like water passing through rusty pipes, with distorted upper partials emphasizing the higher octave. Masked behind sound design, principally, a low-pitch industrial rumbling interspersed with low rhythmic pulses—its entry sneaks up on the audio-viewer. The theme here is found in various scenes which deal explicitly with existential threats to characters or death. It begins with a chromatic descent through the tetrachord E♭, D, D♭, B♭, a common pattern in the ostinato bass grounds of Baroque variations, with an ensuing cadential ascent through the tones A♭, B, F, B♭, both sections of the passage end on the dominant. It is evident that the music, a somber lament, is building up to something. Indeed, as the second pattern begins, we witness the hapless plant worker, his eyes agape in resigned horror as he approaches the precipice above the ruined reactor with stilted steps (see Figure 1). A slow zoom out reveals the extent of the disaster, at which point the pattern is elaborated to include timbrally distinct tones mainly a minor third higher than those of the ground figure (initially G♭ and F). As in other scenes analyzed below, the dominant modality is minor, although timbre, ambitus, and the spatial qualities of the sound contribute greatly to the overall effect.

The lament pattern is transformed a third time, now darker in hue due to a downward extension in register, and eventually disintegrating into inchoate white noise and black smoke. The camera pulls back to an establishing shot of the site of the disaster, acousmatically disembodied high tones are joined by throbbing bass swells and surges—the so-called braaam effect, which is becoming increasingly prevalent in science fiction and fantasy soundtracks (e.g., *Inception* [2010]; *Arrival*). These elements combine to make the experience strongly visceral—like so much of the soundtrack, the music is grimy, grating and generally discomforting. As the ground figure disintegrates, it is joined by another barely human voice starting out at a high G♭ and sinking down in an extended glissando, eventually morphing into searing electronic noise. The sensation is of spiraling irrevocably downward in parallel thirds while projecting a glowing luminosity in the upper voices. The resulting effect might be compared with the molten core of reactor projecting glowing ionized particles skyward, while simultaneously boring down into the concrete foundations of the plant. Or perhaps a more apt simile would be the spiral movement of a double-stranded DNA helix, its sequences mutating due to radioactive contamination. And the music does get under your skin. Like the radiation that the series' protagonist, Valery Legazov, describes as penetrating everything it its path, the music is insidious and contagious: it is no

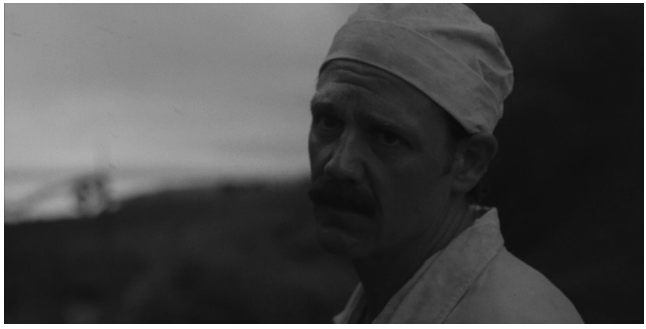

Figure 1. Chief engineer Anatoly Sitkov's (Jamie Sives) surveying of the disaster site from the plant's roof is accompanied by neo-Baroque lament figures and searing electronic noise.

respecter of boundaries. This whirlpool of minor thirds resembles the music of Baltic minimalists like Arvo Pärt or Gorecki, with its momentary suspensions and resolutions in perpetual canon-like motion—or the neo-Baroque grounds of American postminimalists, the passage's high tones mimicking an obbligato part, but with a ghostly pallor resulting from the digital processing of Guðnadóttir's voice. All of this is mixed together with an appreciation of timbre similar to that found in genres from IDM and post-rock to electroacoustic composition. Channeling dark electronic grime and overtone-rich sonorousness, genre boundaries fall away in music like this, which blurs clear-cut listener affiliations and corresponding social structures.

A cut takes the audience from the power station's billowing smoke to the dreary color palette of a windowless meeting room as the sequence completes its descent, where plant director Viktor Bryukhanov (Con O'Neill) and a suited henchman grill Sitnikov, whom they pressed into undertaking the suicidal reconnaissance mission. Their diegetic shouting is muted by Guðnadóttir's ghostly voice (the most powerful sonic element in the shot). Zoom out transforms into a zoom in as the music crossfades from melancholic neo-Baroque to out-and-out sound design and the clattering rhythms of footsteps—although this also has a musicality that is discomforting. Such awakenings are a trope of the series, two of which we see in succession here, as first, a hospital worker on night shift is prompted into action by the disconcerting sounds of her footsteps echoing in the hallway; and then Valery Legasov, the main star of the miniseries, is awoken from slumber by deputy head of the Soviet government, Boris Shcherbina (played by Stellan Skarsgård), the most obviously transforming character, who informs him of the disaster. These awakening are metonymically connected to a wider environmental awakening that is about to happen globally as a result of events at Chernobyl. A low-pitched industrial drone, probably derived from one of the sounds recorded at the Ignalina plan, extends down to rumbling sub-bass frequencies, subtending the grating bass frequencies of Skarsgård's voice on the phone. Both effectively communicate the gravity of the situation nonverbally—the message *and* the messenger literally grate the listener's ear.

Anthropomorphic sounds such as this, which are acousmatically disconnected from the machinery and/or bodies that produced them, electronically unbonded from their sources, take the soundtrack in an uncanny and eerie direction.[20] This is most obvious when it comes to sounds that are or that resemble vocal music, but also others, which approximate the sounds of organs or strings. Indeed, the ruined power plant, the city of Pripyat and its surroundings seem to epitomize these qualities. Mark Fisher sees

the eerie as bound up with perceptions of agency; more precisely agency that is found where none should be present and the opposite, an absence of agency where it should be.[21] In such instances, Fisher asks, what kind of agent is involved, if indeed there is an agent at all? The implication is that there is something inherently unknowable and therefore supernatural about such agencies and the desolate landscapes they reside in, which evades categorization and point toward *thingness* more than being: "What kind of a thing," Fisher tellingly writes, "was it that emitted such an *eerie cry*?"[22] The reference to a "thing" rather than a being is instructive: Guðnadóttir herself attributes agency first and foremost *to the radiation* that has been unleashed in the disaster. And the "eerie cry" is supplied auditively in the higher voices of her music. There is, as Fisher comments and Michel Chion has written on extensively, "an intrinsically eerie dimension to acousmatic sound," and it is this power that Guðnadóttir summons in much of her music.[23] If there is one characteristic that is inscribed upon the soundtrack in its entirety, it is this: the sense that everything and nothing is alive; and the agency we suppose is present, but cannot fully explain, is more powerful and relentless than the fragile actors who attempt to stem or stymie its progress.

Richardson has written about what he terms the disaffected qualities of postminimalist music; how it resonates the cultural memories of invoked stylistic referents but leaves them undefined, creating a hollowed-out or ghostly sense of absence in the context of a style that nevertheless invites corporeal responses.[24] Here, this quality is exaggerated by the use of concrete sounds detached from their sources, which calls into question whether what we are hearing is even music (presupposing, as in some definitions, that music should be humanly conceived). In many parts of the soundtrack, perhaps most of it, the sound world seems to possess an uncanny subterranean life in passages that resemble the howling, whining, or vibrating of mutant lifeforms. Even the ubiquitous clicking of Geiger counters has a quality that is almost insectoid: swarming and clattering, overwhelming auditory space; we can sense this in our perceptions of the actors gasping for air in a number of highly effective point-of-audition shots.[25] Haunting choral-like tones are heard as men in hazmat suits survey swampy land in the Pripyat exclusion zone at the beginning of one of the most traumatic episodes, episode 4, where animals left in the abandoned town will be sought out and shot by army conscripts. Similarly, the track titled "Waiting for the Engineer" on the soundtrack album has an almost monstrous quality as what sound like manipulated voice tones (possibly time stretched and reversed) surge up from the lower register.[26] Even the sounds of buses brought in to evacuate the citizens of Pripyat have a growling quality that points toward machinic more than organic agency.

The music for the evacuation scene in episode 2 (00:39) is closely related to the rooftop scene which we discuss above, tracing out the same descending tetrachord. Indeed, at the end of the third iteration of the pattern, we see Legasov and Shcherbina on an apartment rooftop, surveying the now emptied streets of Prypiat in a scene that recalls panoramas of Berlin in Wim Wenders's *Wings of Desire* (*Der Himmel über Berlin*; 1987). The higher voices of this sequence are almost angelically pure and pushed to the fore as the audience is shown that these soldiers are little more than children. As the montage continues, we survey the uncomfortable vista of sealed metallic coffins being lowered by a crane into a mass grave. The poignancy of the closing moments of episode 3 is spelled out as coffins disappear under concrete slurry, preceded by a close-up of a trembling Lyudmilla Ignatenko (played by Jessie Buckley), who is there to bury her

firefighter husband. Musically, the scene ends on a choral/mechanized drone on the tonic of the sequence, E♭.

In certain cues, the partial erasure of the boundaries between sound design and music that otherwise characterizes the soundtrack is less apparent. This includes a dirge-like chamber composition for choir, piano, and cello heard at the end of episode 4, which is called by the Icelandic name "Líður" on the soundtrack album, meaning "feeling" (it is in fact preexisting music: a track from Guðnadóttir's 2014 album *Saman*). The minor second dissonances in the choral voices, the gruff tone and sinking glissandos of the solo cello and the stolid piano pulse form apt commentary on the action of the scene, where a tracking shot takes us through the maternity ward of a hospital. Here we encounter Lyudmilla Ignatenko, whose radiation-poisoned baby did not survive its birth (this is a historical fact). The beginning of episode 5 similarly stands in contrast to the majority of the music. Although it is electronically produced from concrete sounds, like much of the music, it has to it a more sonorous, post-rock quality that represents "life as normal" in Prypiat on the day immediately preceding the disaster (The track "12 Hours Before" on the soundtrack album). The montage of the town is accompanied by a shimmering and overtone-rich pad playing ascending lines over a static major-second ostinato. The minor-key sonorities and abrasive sounds of the post-disaster world are here conspicuously absent and only return as a tracking shot reveals the main villain of the series, Anatoly Dyatlov (played by Paul Ritter), briefcase in hand, carrying the instructions for the fateful shutdown test that will be conducted at the plant twelve hours later. An aerial shot brings the plant into sight in the distance, and a low drone is momentarily heard, providing a foretaste of what will follow.

Radiating Music

One of the key moments where radiation is made sensorially present in the soundtrack appears halfway through the first episode (around the thirty-minute mark). The "Bridge of Death" scene takes place in the middle of the night of the explosion (April 26, 1986) as local residents of Pripyat gather on a railway bridge to watch what they believe is simply a fire at the power plant. The local residents are awed by what is happening, as the air above the power plant is glowing with blue light. This scene emulates the Cherenkov effect, which occurs when ionizing electrons are shot skyward at a speed close to the speed of light. Gazing at the blue hues in the air, a young woman comments, "it is beautiful," while children play in radioactive fallout raining down on them like snow (see Figure 2). This takes us into an audiovisual sequence that suspends the normal narrative flow: a full minute of slow-motion camerawork with no ensuing dialogue, allowing the audience to spend time with the uncomfortable dissonance of the beauty that is killing the characters on screen. The men, women, and children on the railway bridge are in this very moment being attacked by an enemy invisible to them but not inaudible to us.

For this particular scene, the music was scored to picture, meaning the composer had the finished edit of the scene in hand.[27] The music heard here, released as "Bridge of Death" on the soundtrack album, consists of both pitched and unpitched material, with a sense of tonality buried beneath layers of sharp, metallic noise. We can hear how Guðnadóttir molded the field recordings using the compositional logics of tempo, rhythm, harmony, and registeral spread. In the low-frequency zone, a slowly pulsating bass creeps upward in a steady rhythm. In a higher register, a series of pitches spell out harmonic directionality in a minor key.

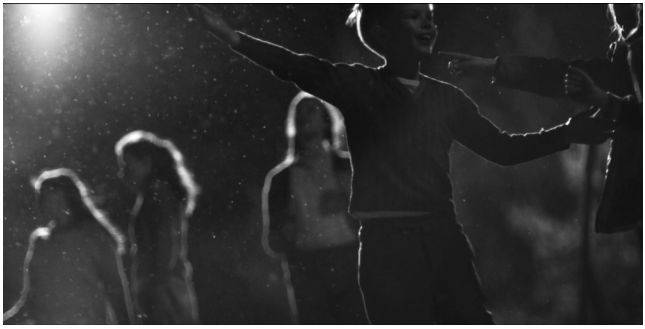

Figure 2. Children play happily amid airborne radioactive dust in the "Bridge of Death" scene. Harmonic dissonance and eerie vocal timbres encourage ambivalent audience responses.

These enter like bursts of sound, with their sharp attack piercing the soundtrack like electrons. The timbral characteristics are trembling or unstable: the sounds seem to "glow" like fluorescent lights. And if we listen closely, a human element is present as well.

As in the music for the rooftop scene described above, Guðnadóttir recorded her own voice and then processed it using the impulse response recordings from the power plant in Lithuania. In other words, the composer's voice was filtered using the acoustic information of a piece of metal being dropped on the floor of the power plant. Using a spectrographic visualization, we can better grasp the acoustic properties of this particular voice (see Figure 3). Its first entrance overwhelms the otherwise sparse musical texture. The filtered voice produces a particularly noisy spectrogram representation across the low and mid frequency ranges. The onset of each note is tonally uncertain, with abundant acoustic information adorning neighboring notes. The three-note phrase G, B, and E is prominent, spelling out an E-minor chord in first inversion. In Figure 3, these notes are marked in white boxes along with their prominent octaves. However, the notes C♯, D, and G♯ are also audibly present, producing a harmonic dissonance contributing further to the already harsh qualities of the music. In its audiovisual context, this highly dissonant voice accompanies the slow-motion cinematography, which focuses on the children playing among the radioactive ash and debris. The interaction of sound and images in this scene allows us to grasp the temporal and multigenerational consequences of radioactivity. Especially harrowing is the presence of the unhuman voice superimposed onto images of parents cradling their baby.

Bearing in mind Guðnadóttir's description of the radiation as a "character," the vocal elements in the score could be interpreted as literally the voice of radiation. But, as the vocal sounds are passed through the metallic noise of the convolution reverb, they are not always recognizably vocal, implying a ghostly agency that—from time to time—calls out from deep within the musical texture. In the "Bridge of Death" cue, the vocals do not resemble a human voice, yet certain qualities of timbre and phrasing nevertheless suggest an agency that acts somewhat like a voice. For Michel Chion, the phantom of the *acousmêtre* is a voice whose body or source is purposefully withheld from the screen. In *Chernobyl*, it is not that the presence of radioactivity is kept off-screen (it is in fact all over the screen at all times), but that it simply *cannot be seen*. The radioactive *acousmêtre* is an agent whose mysterious power seeps into every object onscreen, just as its voice permeates all areas of the soundtrack.

The presence of nuclear radiation in the atmosphere is one of the indicators of the

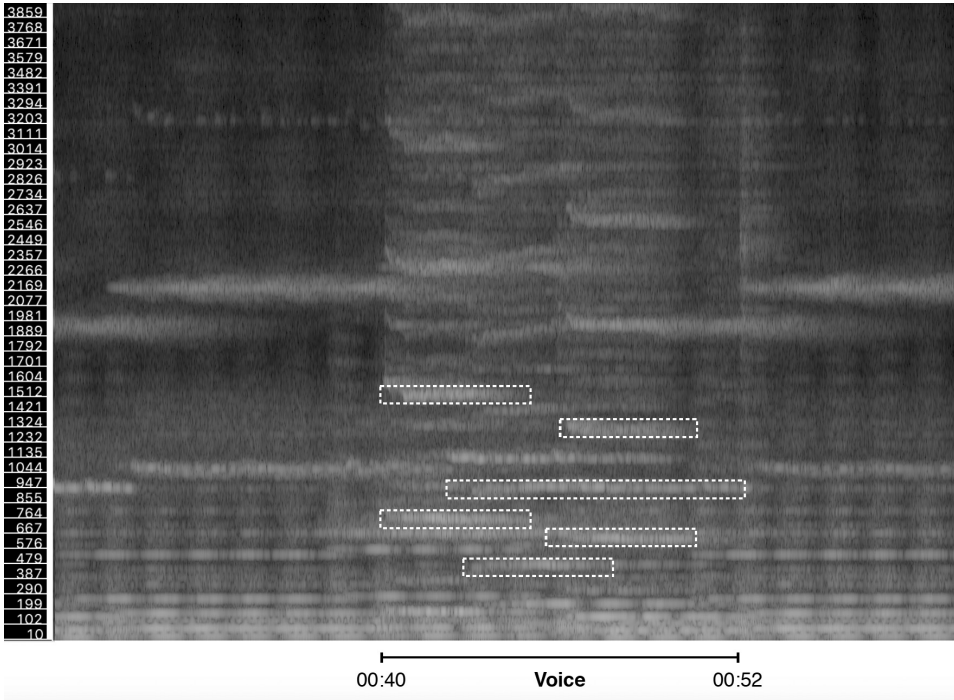

Figure 3. The first entrance of the voice at 00:40–00:52 in "Bridge of Death" produces a particularly noisy spectrogram. The notes G, B, and E are marked in white boxes along with their prominent octaves. The spectrogram reveals the amount of acoustic information present in neighboring notes, which accounts for the strong pull of the harmonic dissonance. The spectrogram was created using Sonic Visualizer 4.1. The time codes refer to the recording on the soundtrack album (Deutsche Grammophon 2019).

Anthropocene, an era characterized by ungraspable facts that can be productively approached through an aesthetics of the eerie. At a time when categories such as "nature" and "human" are fundamentally destabilized, the world appears stranger than ever. Eva Horn and Hannes Bergthaller write that "an aesthetics of the Anthropocene . . . needs to deal not so much with the alienation of humans from nature but with a more thoroughgoing alienation—the *becoming uncanny* of the life-world."[28] "Nature" is no longer a collection of inert objects to be viewed by a detached subject. On the contrary, as Amitav Gosh argues, nature now returns the gaze—it appears alive, unpredictable, threatening.[29] The Anthropocene brings an uncanny awareness of agency and consciousness that surrounds us, bringing new forms of intimacy with nonhuman phenomena. Guðnadóttir's music for *Chernobyl* attends to such agencies and intimacies. By scoring this character which one cannot see, the composer makes the imperceptible perceptible, but not by simply translating it into visibility in representational terms. The music is structured in ways that retain some of the temporal and spatial ambiguities that characterize radioactivity. Key moments in the television series, such as the "Bridge of Death" scene, encourage us to live with these ambiguities for a while. By suspending the narrative flow,

and placing primacy on the immersive audiovisual environment, the aesthetics of this scene in particular allow us to inhabit some of these strange and difficult sensations. This is one moment where the series attunes us to the realities of radiation, coaxing us closer to an understanding of what it means to live "in the time of hyperobjects," which is Morton's term for the Anthropocene condition.[30]

The "Bridge of Death" cue exemplifies how Guðnadóttir's work for *Chernobyl* harnesses the temporality of music (musical time) to suggest other temporalities (the time of nuclear radiation). This, in turn, prompts reflection on the many kinds of time indexed by the physical ruin that occurred in northern Ukraine. There is the particular kind of time—the modernist belief in progression toward the future—that characterized nuclear energy production in the Soviet Union as well as the culture of the "atomic cities" (including Pripyat), which were built in service of a Soviet future.[31] Its ruin now reminds us of the fragility of such unitary belief in a single utopia. Yet another kind of temporal layering is the simple fact that the authors of this article live in landscapes that to this day are haunted by the ghostly traces of Chernobyl fallout. As Karen Barad notes, invoking quantum field theory, Chernobyl is a "strange topology"; a superposition of past, present, and future.[32] Such a superposition characterizes the experience of watching and hearing the "Bridge of Death" scene. The suspension of narrative flow, aided by the immersive qualities of the audiovisual aesthetics, "arrests" a particular quality of time and in the process directs attention toward the nuclear futures set in motion by the catastrophic event. Both time and space are twisted and layered at Chernobyl, and the music gives us a sense of this, for instance, by way of the omnipresent low-frequency drones, a musical device that imparts a sense of stasis and unfolding simultaneously. Another important musical device that imparts temporal ambiguities is Guðnadóttir's frequent use of a very wide ambitus throughout the soundtrack, usually combining very low sub-bass tones with very high tones that seem to operate in different tempi.

In an analysis of recent science fiction film soundtracks by Hans Zimmer and Jóhann Jóhannsson, John Richardson, Anna-Elena Pääkkölä, and Sanna Qvick detail the ability of music to instigate alternate senses of time and space.[33] While the television series *Chernobyl* is not science fiction, the subject matter points toward a similarly "strange topology" of spatial and temporal dislocations and distortions that Guðnadóttir's music is in no small measure responsible for producing. A noteworthy precedent here can be found in the electronic score to Andrei Tarkovsky's science fiction classic *Stalker* (1979) composed by Edward Artemiev (b. 1937). One famous scene of this film shows its three main characters—Stalker, Writer, and Professor—as they travel into the mysterious "zone" on a motorized railway trolley. The visuals are composed of close-up shots of the trio's faces, denying the audience any view of the surrounding landscape, which remains stubbornly unknowable. The soundtrack hints at the strangeness ahead, however, as the regular clanking of the railway trolley is gradually and almost imperceptibly multiplied by Artemiev's electronic sounds, "signaling a gradual transition from the world of the everyday into the magical realm of the Zone."[34] Importantly, in this scene and throughout *Stalker*, there is much ambiguity regarding the borders of sound design and the musical score, resulting in an uncanny soundtrack where sounds can never be trusted. The trolley scene involves a deliberate slowing down of audiovisual tempo (its sheer duration exceeding four minutes) much like the suspension of narrative time during the "Bridge of Death" scene in *Chernobyl*, in order to express other and stranger kinds of time. In *Stalker*, the exact nature of

the zone is never revealed, but in hindsight it may seem to prophetically foreshadow the Exclusion Zone, the official name of the thirty-kilometer-radius perimeter that the Soviet authorities established around the Chernobyl power plant in the months after the explosion.[35]

There is a similar eeriness in *Stalker* to that found in *Chernobyl*, and both instances of the eerie are achieved with the aid of experimental soundtracks that blend sound design and music and that make evocative use of anthropomorphic sounds detached from their sources to lure the audio-viewer into labyrinths of strange presences and absences. In *Chernobyl*, this sonic configuration of eeriness achieves ecocritical significance as it attunes us to the spectral presence of radioactivity in the environment. As such, it allows us to sense the invisible ecological entanglements of human activity on the planet.

Power Lines and Historical Resonance: Some Concluding Thoughts

While Guðnadóttir's music is the principal focus of this article, the power of the soundtrack can be attributed as much to its absence in key scenes as to its presence and to the care with which the various aspects of the soundtrack were constructed. The absence of visuals and music in the opening sequences of all five of *Chernobyl's* episodes directs attention toward sounds that might not ordinarily be heard: those that take place within absent onscreen spaces and which emerge from and impact the bodies that occupy those spaces. These episodes begin in black screen with no music. In episode 3, we hear the sloshing of water, a Geiger counter and the breathing of workers, and in episode 4, the sounds of an elderly woman milking a cow.

Chernobyl is ultimately a series about flows of power—literal and figurative. The power (and agency) of a political establishment manifested in its uses of energy (also power), and the control of those *in power* over those who concretely regulate or withhold its uses (the power plant workers and those who administer the use of atomic energy). Who controls power and who has the power to interrupt its flow? What are the consequences of such interruptions, human and environmental? One of the gravest consequences concerning an individual involves the series' main protagonist. In episode 1, we hear sounds relating to what will turn out to be the suicide of the disgraced scientist Valery Legasov, whose openness concerning the gravity of the disaster and criticism of official policy set him at odds with the Soviet establishment, leading to this moment—his demise in apparent ignominy. But there is a twist. We now hear his breath, a cupboard door opens and closes, a glass is placed on a table, a drink poured, a cassette tape rewound. All are in close sonic focus, harsh and impactful. And the lo-fi voice of Legasov himself, making the tapes that will be his autobiographical legacy: the series opens as it will close with the line "What is the cost of lies?"—there is a fade from black and onto the bucolic scene of deer roaming in a forest clearing. As it turns out, this is the woven design of the sofa in Legasov's dingy Moscow apartment. A cat is spread out across the sofa. There follows an abrupt cut to the apartment's electrical meter. Is the implication that the apartment's electricity has been cut? If so, why and at whose behest? Where and what is the (eerie) agency determining this actual and metaphorical absence of power?

A disheveled desk comes into sight, followed by a visual cut to shoes on the floor and the legs of a chair. An eerie absence is implied. We hear Legasov's disembodied voice, but his body is missing, a cigarette still burns in an ashtray. Then a tracking shot brings the protagonist into sight as he presses the stop button on the cassette player

and finishes his drink. The embodied voice is restored as Legasov continues recording. The preceding disembodiment, audiovisual and auditory, is one of the most conspicuous characteristics (and *characters*) of the soundtrack and the series. And the conflation of power, (eerily detached and remote) agency, and capital is at the heart of what the series is about, as these three concepts were closely intertwined as causative factors leading to the environmental catastrophe that was Chernobyl (these days the name of the plant is synonymous with the disaster, just as one could say of Hiroshima, or more recently, Fukushima). The eerie, for Fisher, is constitutive of "capitalist realism"; although this could equally be said of a communist regime where scant resources and authoritarian leadership led to a culture of technologically and environmentally blinkered recklessness.[36] Those who control flows of capital (in this case the Soviet leadership and their servants) also control flows of power (literal and figurative), and when these flows are interrupted, as they were at Chernobyl and in the decisions leading to the disaster, the potential to awaken the ghostly presences that lie at the untamable (natural) heart of the machine is ever present. Guðnadóttir's soundtrack gives these ultimately untamable forces a voice; to be more precise, it gives them a character.

The series ends as it began with Legasov's lo-fi recorded voice; his message to posterity, which brings the series full circle. He repeats a phrase from the opening episode—"what is the cost of lies?"—and the visuals cut to black, followed by footage of the real Legasov and others who were caught up in the Chernobyl tragedy. Finally, we hear a Ukrainian male voice choir, the Homin Lviv Municipal Choir, performing "Vichnaya Pamyat," which is rich in parallel fourths and resounding bass octaves. The music has a raw and archaic quality that matches the gravity of the drama. This effectively "takes the series home." But what do we the audio-viewers take home from our experiences of the series? Undoubtedly, it *resonates* on many levels: environmental, political, and existential. It does not require much imagination today to relate to a story about politicians gambling with human lives and the environment for short-term political gain. Guðnadóttir's music resonates literally as well as figuratively, closing the gap between fictionalized documentary (or fake-fiction) aesthetics and experienced reality.[37] Interviews with the composer and the sound design team are replete with invocations of authenticity, of striving for realism and not wishing to fictionalize the soundtrack, while their interventions clearly take us beyond the actual events and locations. This is partly understood in terms of their desire *to make* real what was an invisible and largely also inaudible threat: radiation. So, where's the realism there?

By making invisible aspects of ecological reality sensorially present, the music and sound design provide television viewers with new means of coming to grips with radiation and its human and environmental consequences. To fully account for this, we can turn to Veit Erlmann's concept of "resonance," which might help to explain the role of aurality and embodied response in narrowing the gap between the portrayed story world and our experiences of it. Resonance, for Erlman, "entails adjacency, sympathy, and the collapse of the boundary between perceiver and perceiver."[38] Guðnadóttir's soundtrack is effective because we feel it in our bodies, directly and through multimodal processes of sensory exchange.[39] Undoubtedly this is increasingly the case in current audiovisual culture, and *Chernobyl* is a prime example of this tendency. In Guðnadóttir's output, this is no accident. Working with sensory experience and embodiment has been integral to this composer's conception of her work for some time: this orientation

is manifest in her relation to instruments, the cello, the singing body, and her uses of found materials and architectural spaces.[40] It is this physical and immersive approach to composition that brings home most effectively the human and environmental cost of Chernobyl.

NOTES

1. Svetlana Alexievitch, *Voices from Chernobyl: The Oral History of a Nuclear Disaster*, trans. Keith Gessen (London: Picador, 2006), 105.

2. Robert S. Emmett and David E. Nye, *The Environmental Humanities. A Critical Introduction* (Cambridge, MA: MIT Press, 2017), 111.

3. Mark Fisher, *The Weird and the Eerie* (London: Repeater Books, 2016); Timothy Morton, *Hyperobjects: Philosophy and Ecology After the End of the World* (Minneapolis: University of Minnesota Press, 2013); and Veit Erlmann, *Reason and Resonance: A History of Modern Aurality* (New York: Zone Books, 2010). For more on the concept-driven approach to analysis, see Mieke Bal, *Travelling Concepts in the Humanities: A Rough Guide* (Toronto: University of Toronto Press, 2002).

4. John Richardson, "Closer Reading and Framing in Ecocritical Music Research," in *Music Moves: Musical Dynamics of Relation, Knowledge and Transformation*, ed. Clarissa Granger et al. (Zürich: Georg Olms Verlag, 2016), 157–93. See also John Richardson, "Ecological Close Reading of Music in Digital Culture," in *Embracing Restlessness: Cultural Musicology*, ed. Birgit Abels (Hildesheim, Germany: Georg Olms Verlag, 2016), 111–42.

5. Epicleff Media, "Hildur Guðnadóttir Needs an Outlet for Her Darkness," *Score: The Podcast*, podcast audio uploaded to YouTube on May 21, 2019, 1:05:40, https://youtu.be/ouNgcKYpWPs, 26:00–28:00.

6. The use of sound recordings made at the Lithuanian plant could be viewed as a compromise were one to assume that documentary-like authenticity was somehow integral to the production team's conception of the soundtrack. Authenticity is complicated, to say the least, in this instance, as historical truth was stretched almost to breaking points in many other respects, as has been commented on extensively in social media. The fact that the Ignalina plant was of a similar design to Chernobyl imparts some level of resonance with the sensory world of Chernobyl. But strict or literal realism does not appear to have been the main point of the composer's approach. Sensory resonance, a concept we will return to below, is a more accurate description of what we would claim Guðnadóttir was endeavoring to achieve.

7. Sam Slater, telephone interview with the author, February 14, 2020.

8. Hildur Guðnadóttir, "Hildur Guðnadóttir on the Details of Composing in Cubase," Steinberg, uploaded on January 31, 2020, YouTube video, 12:16, https://youtu.be/Nht-1TRrV6k, 3:25–4:45.

9. Slater, interview.

10. Barry Truax, ed., *Handbook of Acoustic Ecology*, World Soundscape Project, Music of the Environment Series, no. 5 (Vancouver, BC: ARC Publishing, 1978), 111. See also Noora Vikman, "Looking for the Right Method—Approaching Beyond," in *Soundscape Studies and Methods*, ed. Helmi Järviluoma and Gregg Wagstaff (Helsinki: Finnish Society for Ethnomusicology, 2002), 106.

11. Hildur Guðnadóttir quoted in Jane Hannah Cohen, "Sickening Silence: Hildur Guðnadóttir's "Chernobyl" Soundscape Brings Radioactivity to Life," *Reykjavík Grapevine*, June 29, 2019, https://grapevine.is/icelandic-culture/movies-theatre/2019/06/07/sickening-silence-hildur-gudnadottirs-chernobyl-soundscape-brings-radioactivity-to-life/.

12. Hildur Guðnadóttir quoted in Vala Hafstað, "Hildur Wins Grammy for Score to Chernobyl," *Iceland Monitor*, January 27, 2020, https://icelandmonitor.mbl.is/news/culture_and_living/2020/01/27/hildur_wins_grammy_for_score_to_chernobyl/.

13. Timothy Morton, "Poisoned Ground: Art and Philosophy in the Time of Hyperobjects," *Symplokē* 21, no. 1 (2013): 37.

14. Anne C. Shreffler, "Varèse and the Technological Sublime; or, How Ionisation Went Nuclear," in *Edgard Varèse: Composer, Sound Sculptor, Visionary*, ed. Felix Meyer and Heidy Zimmermann (Woodbridge, UK: Boydell & Brewer, 2006), 290–97.

15. Ariana Phillips-Hutton, "Repertoires of Remembrance: Violence, Commemoration, and the Performing Arts," *Journal of the British Academy* 8, no. 3 (2020): 63.

16. On the collaboration between composition and sound design in *Chernobyl*, sound designer Joe Beal has commented: "Aspects of the music and our design elements ended up being very similar and it was a bit much in places. It was an interesting process having to pick our way through that and decide which element to lose—whether it be a stem of Hildur's score or a few tracks of our design—because they were competing with each other. It was an interesting process working out the relationship between design and music because at times they were very similar." Joe Beal quoted in Jennifer Walden, "Why 'Chernobyl' Sounds So Sublime, Authentic—and Haunting," A Sound Effect, June 6, 2019, https://www.asoundeffect.com/chernobyl-hbo-sound/.

17. Hildur Guðnadóttir quoted in Jan Błaszczak, "The Sound of Radioactivity," *Przekrój Magazine*, December 10, 2019, https://przekroj.pl/en/culture/the-sound-of-radioactivity-jan-blaszczak.

18. Danijela Kulesic-Wilson, Sound Design is the New Score: Theory, Aesthetics, and Erotics of the Integrated Soundtrack (Oxford: Oxford University Press, 2020).

19. Kevin J. Donnelly, "Extending Film Aesthetics: Audio Beyond Visuals," in *The Oxford Handbook of New Audiovisual Aesthetics*, ed. John Richardson, Claudia Gorbman, and Carol Vernallis (Oxford: Oxford University Press, 2013), 357–71.

20. On processes of source bonding in electroacoustic music, see Denis Smalley, "Space-Form and the Acousmatic Image", *Organised Sound* 12, no. 1 (2007): 35–58.

21. Fisher, *The Weird*, 11–12.

22. "A sense of the eerie seldom clings to enclosed and inhabited domestic spaces; we find the eerie more readily in landscapes partially emptied of the human. What happened to produce these ruins, this disappearance? What kind of entity was involved? Fisher, *The Weird*, 11.

23. Quote in Fisher, *The Weird*, 81. See especially Michel Chion, *The Voice in Cinema*, trans. Claudia Gorbman (New York: Columbia University Press, 1999).

24. John Richardson and Susanna Välimäki, "Disaffected Sounds, Temporalised Visions: Philip Glass and the Audiovisual Impulse in Postminimalist Music," in *The Ashgate Research Companion to Minimalist and Post-Minimal Music*, ed. Kyle Gann, Keith Potter, and Pwyll ap Sion (Farnham, UK: Ashgate, 2013), 219–37. See also John Richardson, "On Music Criticism and Affect: Two Instances of the Disaffected Acoustic Imaginary," in *Critical Musicological Reflections: Essays in Honour of Derek Scott*, ed. Stan Hawkins (Farnham, UK: Ashgate, 2012), 139–58; and John Richardson, *An Eye for Music: Popular Music and the Audiovisual Surreal* (Oxford: Oxford University Press, 2012).

25. In film and media studies, "point-of-audition shot" refers to diegetic sound perceived by a particular character, the aural equivalent of a point-of-view shot. Daniel Chandler and Rod Munday, "Point-of-Audition Sound," in *A Dictionary of Media and Communication*, 3rd ed. (Oxford: Oxford University Press, 2020), https://www.oxfordreference.com/view/10.1093/acref/9780198841838.001.0001/acref-9780198841838-e-2070.

26. Hildur Guðnadóttir, *Chernobyl (Music from the HBO Miniseries)*, Deutsche Grammophon 2019.

27. Slater, interview.

28. Eva Horn and Hannes Bergthaller, *The Anthropocene: Key Issues for the Humanities* (London: Routledge, 2019), 101.

29. Amitav Ghosh, *The Great Derangement: Climate Change and the Unthinkable* (Chicago: University of Chicago Press, 2016), 30.

30. Morton, *Hyperobjects*.

31. Kate Brown, "Marie Curie's Fingerprint: Nuclear Spelunking in the Chernobyl Zone," in *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene*, ed. Anna Tsing et al. (Minneapolis: University of Minnesota Press, 2017), g33–50.

32. Karen Barad, "No Small Matter: Mushroom Clouds, Ecologies of Nothingness, and Strange Topologies of Spacetimemattering," in Tsing et al., *Arts of Living*, g103–20.

33. John Richardson, Anna-Elena Pääkkölä, and Sanna Qvick, "Sensing Time and Space through the Soundtracks of *Interstellar* and *Arrival*," in *The Oxford Handbook of Cinematic Listening*, ed. Carlo Cenciarelli (Oxford: Oxford University Press, 2021), 385–406.

34. Tobias Pontara, Andrei Tarkovsky's Sounding Cinema. Music and Meaning from Solaris to The Sacrifice (New York: Routledge, 2019), 13.

35. *Stalker* was loosely based on the novel *Roadside Picnic* (Пикник на обочине), written by Boris and Arkady Strugatsky and published in

1972. In the novel, the zone is the result of an alien visitation. Tarkovsky's film, however, does not hint at any extraterrestrial origin.

36. Mark Fisher, *Capitalist Realism: Is there no Alternative?* (Winchester, UK: Zero Books, 2009).

37. For an overview of documentary film aesthetics that recognize "the porous nature of the borders that distinguish films that document real-world events from those whose imagined landscapes promise fictional escapism," see Holly Rogers, "Introduction," in *Music and Sound in Documentary Film*, ed. Holly Rogers (New York: Routledge, 2015), 1.

38. Veit Erlmann, *Reason and Resonance*, 10. See also Susanna Paasonen, *Carnal Resonance: Affect and Online Pornography* (Cambridge, MA: MIT Press, 2011).

39. We refer to the sensory experiences charted, for instance, in Laura Marks, *Touch: Sensuous Theory and Multisensory Media* (Minneapolis: University of Minnesota Press, 2002; and Michel Chion, "Sensory Aspects of Contemporary Cinema," in Richardson, Gobman, and Vernallis, *Oxford Handbook of New Audiovisual Aesthetics*, 325–30.

40. In interviews, Guðnadóttir has often referred to sensory impressions as integral to her approach when working on *Chernobyl*. Regarding her visit to the power plant in Lithuania, for example, she comments: "I wanted to explore what a nuclear disaster sounds like—to go into the plant, put on the gear, walk through the huge spaces, smell how it smells." In the same interview, she comments on her relationship with her main instrument, the cello and the voice, as intimate and corporeal: "When it comes to instruments, you can't get any closer to yourself than with the voice. The cello as well, it sits against your chest, so there's a direct connection with your lungs and your expression." Guðnadóttir quoted in Jelena Ćirić, "Full Bodied Sound," *Iceland Review*, September 16, 2019, https://www.icelandreview.com/culture/full-bodied-sound/.