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Sound Matters: How Sonic Formations Shape the Nuclear Deterrence and Non-Proliferation Regimes

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Sound matters for international political sociology. Drawing upon literature from cultural geography and sound studies, we argue that sound contributes to political dynamics that are constitutive of world politics. To capture these dynamics, we offer a set of conceptual frameworks to analyze sound. First, we differentiate the concept of sound from noise and show the importance of doing so. Second, we introduce “sonic formations” as a means of capturing how sound contributes to world politics. Third, we make the case for analyzing sound’s historicity, adaptability, relationality, and performativity (SHARP) in any given context. Fourth, using sonic formations and the SHARP framework, we examine an illustrative case study: the nuclear deterrence and non-proliferation regimes. By focusing on the role of sound in these regimes, our preliminary findings demonstrate the utility for the field of undertaking additional work to capture the wider significance of sound. This includes its contributions to shaping relations of power.

Les sons ont leur importance pour une sociologie politique internationale. En nous appuyant sur des études en géographie culturelle et les ‘sound studies’, nous démontrons comment le son contribue à des dynamiques politiques constitutives de la politique internationale. Nous proposons un ensemble de concepts afin d’analyser la place du son dans ces dynamiques. Nous commençons par différencier le concept de son de celui de bruit tout démontrant l’importance de cette différenciation. Nous introduisons ensuite le concept de “formations sonores” afin de saisir les manières par lesquelles le son contribue à la politique internationale. Nous avançons ensuite que l’étude de l’historicité, de l’adaptabilité, de la relationalité et de la performativité (Eng. SHARP) d’un son constitue la dimension analytique de ces formations sonores. Afin de démontrer la pertinence des sons dans une sociologie politique internationale, nous utilisons le concept de formation sonore et la cadre analytique ‘SHARP’ afin d’analyser les régimes de dissuasion et de non-prolifération nucléaires. Nos conclusions préliminaires démontrent cette pertinence et invite à entreprendre des travaux supplémentaires afin d’en étendre l’étude en sociologie politique internationale, notamment comment les sons contribuent à former des relations de pouvoir.

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El sonido es importante para la sociología política internacional. Nos basamos en la literatura de la geografía cultural y los estudios de sonido, y sostenemos que el sonido contribuye a dinámicas política que, a su vez, son constitutivas de la política internacional. A fin de capturar estas dinámicas, ofrecemos un marco conceptual para analizar el sonido. En primer lugar, diferenciamos el concepto de sonido del de ruido y señalamos la importancia de hacerlo. En segundo lugar, introducimos “formaciones sónicas” como un medio de capturar cómo el sonido contribuye a la política internacional. En tercer lugar, defendemos el análisis de la historicidad, la adaptabilidad, la relacionalidad y la performatividad del sonido (historicity, adaptability, relationality, and performativity, SHARP) en un contexto determinado. En cuarto lugar, mediante el concepto de formaciones sónicas y el marco de SHARP, examinamos un caso ilustrativo: los regímenes de disuasión nuclear y de no proliferación. Al enfocarnos en la función del sonido en estos regímenes, nuestros hallazgos preliminares demuestran la utilidad de nuestro marco para la sociología política internacional, constituyendo una invitación a la realización de trabajos adicionales que contribuyan a capturar la importancia del sonido y su rol en la constitución de relaciones de poder.

“[M]an [sic] is affirmed in the objective world not only in the act of thinking, but with all his senses The forming of the five senses is a labor of the entire history of the world down to the present.”

(Karl Marx, *Economic and Philosophic Manuscripts of 1844*, 1988, 108–9)

Introduction

Our starting premise is that sound matters in the field of international political sociology. But if sound matters, how can we theorize empirical questions related to the international through the sonic? How might being attentive to sounds, their production, emission, recording, and recollecting, alongside practices of listening and hearing, enable new questions and problematizations within international political sociology? More specifically, how do sonic formations (see below) contribute to practices of accumulation, identity, violence, and/or sociability that various approaches to international political sociology have sought to investigate?

In this paper, we make a preliminary attempt to conceptualize sonic formations and how we might apply them within the field of international relations (IR) from an international political sociology perspective. Our starting point is inherently transdisciplinary (Shapiro 2012). We draw from cultural geography and sound studies to build our conceptual framework. This framework is open to different research explorations and seeks to approach sound as a social phenomenon productive of relations of power. We concede that different epistemic and methodological orientations have different views as to what these relations of power might entail. Therefore, our framework seeks to respect these differences while providing a heuristic tool that can be used by all of them. As in cultural geography and sound studies, we are interested in studying “what sound does in the human world, and what humans do in the sonic world” (Sterne 2012, 2). This will enable the field of international political sociology to incorporate how sound affects world politics (or the politics of worlds). This endeavor thus joins a longer-standing interest in how humans, their relations of power, and their relevant manifestations (e.g., political institutions) shape the international.

In order to make a case for integrating sound to broaden and deepen the investigation of power relations in international political sociology, we explore how sound

has been discussed in the field. We identify two important contributions made by this literature. First is its engagement with music and/or voice. Second is its emphasis on sound as a signifier of meaning. Building upon this work, we suggest that it is also fruitful to consider sound as a productive force that does things in conjunction with its meaning-making properties. We then offer a conceptual framework to integrate sound writ large in order to capture how sounds shape our social and political worlds in a way that extends beyond the epiphenomenal. We forward three conceptual tools. The first is to make a case for sound, rather than noise, as our overarching anchor concept. The second is to forward the notion of sonic formations. The third is to argue that the best way to analyze the sounds that constitute sonic formations is to examine their historicity, adaptability, relationality, and performativity (SHARP). We then apply these conceptual frameworks to examine the sonic formation underpinning the global nuclear deterrence and non-proliferation regimes. In doing so, we aim to provide a novel reading of how these regimes are shaped by sound. This reading, in turn, deepens our understanding of how relations of power permeate through these regimes.

An International Political Sociology of Sounds

The central aim of this paper is to provide an analytical framework that enables scholars to be attentive to sounds in order to advance our knowledge of how power functions as well as how the human sensorium may impact upon world politics. We believe that the inclusion of sound in the knowledge production of an international political sociology requires a transdisciplinary approach. By developing a conceptualization of sound as a social phenomenon and tracing its connections to relations of power, we hope to contribute to answering concrete questions regarding the types of sonic “data” that constitute and affect our social and political worlds. More specifically, we wish to introduce the concept of sonic formations. We do this to demonstrate how they may contribute to the dynamics of violence, accumulation, domination, resistance, and diplomacy. More broadly, we are keen to explore how international political sociology might benefit if our modes of knowledge and conceptual apparatus extend beyond vision, the predominant sensory modality in western knowledge production (e.g., Bailey 1996, 55–56; Classen 1997, 402–3)? To achieve these aims requires mapping how sound has been understood in the literature and how it has featured across a range of pioneering work.

What then is sound? Sounds are vibrations that are transmitted by pressure waves through a medium such as air or water. When we “hear,” vibrations in the air have been transduced by nerve impulses that are then interpreted by our brains. We are surrounded by sounds. Some sounds may draw our attention, while others are largely ignored. Yet sound, compared to visuality, has been largely absent from the field of IR. Recent exceptions have been explorations of sound as music and/or voice. Reflecting the paucity of studies of sound in IR, Franklin (2005a) recollects how several of the contributors to her edited volume wondered: “Why had we not thought before about the links between music and politics?” (2005a, ix; see also Shapiro 2001). Similarly, Ramel and Prévost-Thomas (2018a) forward an “acoustic turn” in IR that focuses on music and musicology (Ramel and Prévost-Thomas 2018b, 2). Although musicologists and cultural theorists have already engaged with music and the international, for example, Jessica Gienow-Hecht’s (2009) *Sound Diplomacy* or Paul Gilroy’s (1993) *Black Atlantic*, IR has only recently begun to catch up. As such, when questions arise on the importance of sound to IR, they are usually attached to music or musical metaphors (e.g., Franklin 2005b, 9; Pruitt 2007, 2013).

There are two main ways that sound as music has been analyzed from international political sociology perspectives in IR. First is as an object of study through the unfolding of IR; music is thus forwarded as a conduit through which motivations, influences, and/or interests operate. In this sense, the underlying question is what can

world politics tell us about music? (see [Marès and Fléchet 2013](#); [Ahrendt, Ferraguto, and Mahiet 2014](#); [Ramel and Prévost-Martin 2018a](#)) Second, as demonstrated by Franklin's volume, is an approach influenced by Jacques Attali's understanding of sound-as-music. Sound-as-music is "a way of perceiving the world" a "tool for understanding," and even a form of theorizing about the world ([Attali 1985\[1977\]](#), 4; see also [Saïd 1992](#), 37). Thus, the question is how can we theorize about (world) politics "through music" ([Attali 1985\[1977\]](#), 4, original emphasis). Sound-as-music, therefore, becomes a way of probing the accepted contours of (world) politics such that we might understand them in novel ways.

Using sound to probe the accepted contours of (world) politics can also be found in Susanna [Hast's \(2018\)](#) work on the war in Chechnya and Michelle [Wetzel's \(2018\)](#) work on strategies of resistance for crossing borders in sub-Saharan African contexts. Both raise the question of the connections between the analysis of what is made audible through music or voice (what we call "sound-as-meaning") and what is made possible politically through "sound-as-doing." The complex, contingent, and contextual connections that bring sound as meaning and doing together can also be found in work that has examined voice and silence in IR. This has often reached divergent conclusions ([Hansen 2000](#); [Grayson 2010](#); [Dingli 2015](#); [Guillaume 2018](#)). The productive aspect of sound as a social phenomenon producing relations of power need not be by design nor is it exclusive to the practices of meaning-making.¹ Rather, the existing literature makes a case for recognizing the continuum along which sound-as-meaning and sound-as-doing connect. Yet, it does little to reflect on sound as such. In order to consolidate this continuum and its potential to broaden the inclusion of sounds into international political sociology, we argue that we should not assume *a priori* that any particular sound is meaningless "noise." Moreover, while meaning-making *does* things by shaping our understandings and practices, we should also remain attentive to what sound does beyond such meaning-making processes. We introduce the concept of sonic formations below in order to capture these important dynamics.

This conceptualization of sound as both a productive and representative phenomena has a longer lineage in cultural geography and sound studies (e.g., [Schafer 1977](#); [Bailey 1996](#); [Revill 2000, 2016](#); [Kelman 2010](#); [Kane 2015](#); [Gallagher 2016](#); [Gallagher, Kanngieser, and Prior 2017](#)). Here, the phenomenology of sound can be understood as effects that arise through sounds that shape and connect physical environments, social milieus, and individual perceptions ([Revill 2016](#), 246 engaging with [Augoyard and Torgue 2005](#), 9). Within this literature, there has been a concern with exploring the dynamics produced between the material-phenomenological properties of sound and the way these are "imagined, represented, and performed in ... politics" ([Revill 2000](#), 610). Sound has thus been argued to be a performative force. Performative here encompasses "interpellation," the process by which individuals are constituted as subjects via "a quotidian practice, submitted to a precise ritual" ([Althusser 1995](#), 226 note 116). Interpellation is not a causal force but rather ways by which subjects are potentially, and with much uncertainty, invited to become ([Butler 1997](#)). As such, the argument is that sound does things not only through its representational and/or signifying properties, but also by its sheer material-phenomenological effects on subjects. For example, with the air raid siren, the sound generated is not just a sign of a possible impending attack. Its enactment becomes the attack itself, whether or not one takes place. It catalyzes a set of measures that should be used to mitigate the negative consequences of being subject to aerial bombardment. And an air raid siren produces particular subject positions

¹This also does not mean that an intentional sound cannot have unintentional effects (e.g., the resulting shell shock of artillery barrages during the First World War) or that a sound designed for one use cannot be diverted to other ends (e.g., sonic torture via extremely loud music, see [Cusik \(2016\[2006\]\)](#)).

within these measures (e.g., civilian or first responder) (Adey 2009). But in what other ways might sound be embodied?

Alongside its performative force, literature in cultural geography and sound studies has emphasized the role of the sound in the creation of political geographies of affect. These political geographies are the spatio-temporal configurations in which sound acts upon the understandings, feelings, properties, and practices of people, actants, events and materials, increasing the probabilities of particular outcomes arising more than others (Gallagher 2016, 45). It is here in the literature where the connections joining sound and bodies become most prominent. The concern is with how sound directly contributes to spatio-temporal configurations to create affective atmospheres “via vibrations, pitches, volumes, frequencies, harmonies, and disharmonies” which act upon and move other bodies, including subconsciously (Gallagher, Kanngieser, and Prior 2017, 626). For example, sounds are weaponized and used against individuals and populations (see Volcler 2013[2011]). A growing literature has discussed the presence of sound in conflict zones (see Goodman 2010; Daughtry 2015; Fregonese 2017), or in the management of public spaces (see Akiyama 2009; Radovac 2013). Moreover, work has suggested the historic importance of the sonic expression of rhythm to maintaining the cohesiveness and effectiveness of units about to enter battle through the instantiation of embodied affects (Protevi 2010).

Thus, based on the existing literature across a range of disciplines and approaches, there is a strong case for an international political sociology of sounds that seeks to capture the productive power of sound across the continuum of meaning-making, representation, and embodiment. A key challenge is how best to do so? More particularly, what concepts provide sufficient precision to delineate what sounds do with rigor for an international political sociology of sound? In the next section, we present a pragmatic conceptualization of sound—sonic formations. We believe that sound can make a growing contribution by developing its operational relevance to social relations of power. To do so will require taking into account that sounds produce situations, subjectivities, spaces, and events. Capturing these dynamics requires consideration of how sound has a historicity, adaptability, relationality, and performativity (SHARP).

Conceptualizing Sonic Formations: Historicity, Adaptability, Relationality, Performativity

An international political sociology of sounds requires engaging with what sound is and what it might do in a given context. The literature on sound provides multiple definitions that suggest different forms of analysis. We can only refer readers to these questions (e.g., Bull and Back 2003; Sterne 2003, 2012; Pinch and Bijsterveld 2012b; Gallagher 2016). The aim of our contribution is to introduce key *problématiques* for an international political sociology of sounds. What might be analyzed through sound can remain an open question. As Jonathan Sterne makes clear, however, any specific research on sound “at least implicitly” should take a position in onto-epistemic debates about what sound is, as our “choice has direct consequences for what gets studied in terms of what counts as the fundamental phenomenon under investigation” (Sterne 2012, 8). We, therefore, offer an operational definition as an invitation for further conceptual and methodological development. From our position, the priority is to establish the social and political dimensions of sound. To paraphrase Michel Pastoureau’s work on color (2010, 240, see also Andersen et al. 2015), sound is “more than nature, [frequencies], [the ear] or the brain; it is a society that ‘makes’ [sound], which gives it its definition and its meaning, which sets its codes and values, which organise its practices and determine its issues.”

We have therefore made a deliberate choice to use the concept of “sound,” rather than “noise.” The former is more inclusive and less normatively connoted than the

latter. It enables us to speak of a variety of sonic phenomena that can be analyzed by the social sciences and humanities. “Noise” generally possesses a negative connotation (see [Sim 2007](#)). According to Peter [Bailey \(1996, 50\)](#), noise is a specific category of sounds “that register variously as excessive, incoherent, inarticulate or degenerate”; a noise “rarely claims our full attention until it reaches the status of nuisance or worse.” What constitutes noise, rather than sound, is largely subjective while also reflective of social constructions of what constitute pleasant auditory phenomena; what may be “a nuisance to some may be a resource and a delight to others” ([Bailey 1996, 50](#)). Given that the boundaries dividing noises from sounds are objectively indistinct, their division is both contextual and subjective (see [Revell 2000, 599](#) with reference to [Firth 1998, 100](#)). As [Attali \(1985\[1977\], 6\)](#) suggests both context and subjectivity here are infused with constitutive relations of power, as sounds “and their arrangements ... fashion societies.” Having made our case for sound rather than noise, we will turn to how to conceptualize sonic formations. Sonic formations help us to capture what sounds do and how they do so. We then turn to the nuclear deterrence and non-proliferation regimes as an illustrative case study in the penultimate section of the paper.

Sonic Formations

A sonic formation consists of sound, or collection of sounds, and their relationalities. It produces contextually specific understandings, feelings, rules, subjectivities, and practices.² Sonic formations are empirically defined by their sonic historicity, relationality, adaptability, and performativity (SHARP). These four dimensions, in turn, can be delineated by the political dynamics they produce, their spatial limits, and their temporality. Thus, sonic formations and their effects are not fixed and must be subject to sustained empirical investigation. Analytical questions (see especially, [Pinch and Bijsterveld 2012, 11–12](#)) to guide such investigations could include:

- “who was allowed (or not allowed) ... to make sounds and where and when this occurred”? ([Pinch and Bijsterveld 2012, 8](#));
- how is sound spatially distributed and productive of the spaces and/or subjectivities of (world) politics?;
- what types of sound are associated with the production of hierarchies and orders within (world) politics?;
- how have certain individuals, groups, and/or institutions connected to (world) politics made sense of what they have listened to?;
- how does sound connect human beings and sensory technologies with the objects, machines, and bodies they are monitoring, controlling, surveilling, targeting, etc.?
- how do listening practices, including those mediated by technologies, generate new forms of knowledge?;
- what perceptual skills develop and circulate in relation to sound in world politics and how are these connected to particular listening devices or technological apparatuses?;
- how do sounds generate forms of belonging and exclusion in (world) politics?

² In this way, we can think of sonic formations as similar to Michel Foucault’s concept of discursive formations ([Foucault 2010\[1969\]](#)). The main difference would be that sonic formations imply phenomenological and embodied experiences not necessarily included within Foucault’s conceptualization.

Once we have established the particular contours of a sonic formation, we can analyze how it produces political dynamics as well as their spatial and temporal configurations. By political dynamics, we are interested in the material-phenomenological properties of sound and, to return to [Revill \(2000, 610\)](#), the way these are “imagined, represented, and performed in ... politics,” including how they create political people/spaces/things/events. These political dynamics connected to sound never work in isolation. They are always operating in conjunction with other senses, practices, technologies, and discourses ([Revill 2000, 610](#)). Therefore, sound is political. It shapes how different actors, spaces, things, and events are made political and/or act, or are acted upon, politically. To transpose [WTJ Mitchell’s \(2002, 170\)](#) dictum on visibility, the point is not just to demonstrate how political dynamics produce sounds that are important to an international political sociology of sounds. Rather, it is also to encourage the investigation of *how sound itself produces political dynamics* that are important for an international political sociology. To capture how sound produces power relations, we advance four dimensions that constitute the contours of any given sonic formation. Sonic formations have a *historicity*, *adaptability*, *relationality*, and *performativity* (SHARP). In some cases, the importance of sound can be tied to specific sonic phenomena. In other cases, it is the practices surrounding the identification and interpretation of sound to which we wish to draw attention. Regardless, the point is that sound (re)produces, enables, shapes, makes possible, contests, and/or reflects relations of power central to the key practices of world politics. Sound is both substantially mediated—as sound cannot exist in a vacuum and requires a substance to give it presence—and mediating. Sound “always concerns a *relational* making simultaneously involving production, transmission, reception, and interpretation through and within entities and materials” ([Revill 2016, 245](#), our emphasis).

Therefore sonic formations participate in relations of power by “cutting, redistributing, and by implication making and remaking experience,” spatialities, and temporalities politically ([Revill 2016, 246, 249](#)). The ways by which sonic formations can be problematized (i.e., as an empirical object of analysis) can take on multiple forms. They can be technological (e.g., an audio playback device producing a space for community formation through collective listening), physiological (e.g., the capacity of the human body to hear across a limited number of frequencies and how spaces may be controlled via these limitations), cultural (e.g., acculturation and/or socialization into specific soundscapes³), material (e.g., matter through which sound waves must travel), and historical (e.g., the embeddedness of sounds in a particular time and place). The questions behind the empirical relevance of sonic formations relate to the extent to which sound mediates between phenomena and political dynamics: what gets transformed through these mediations and how do these transformations transpire?

Historicity

Historicity refers to how our ability to produce, manage, record, hear, and listen to sounds is imbricated in relationships that are within and beyond the hearing body. In other words, our relations to sounds are connected to their social, cultural, political, and economic contexts. This historicity is also connected to questions pertaining to the history of the body ([Sterne 2003, 12](#)) and, by extension, to questions “situated among vectors of power and difference” ([Sterne 2012, 8](#)). While not denying the importance of the natural dimensions of sound, to depict a sound as “natural,”

³We take soundscapes to be spaces constituted by, and composed of, specific and distinctive sounds, or combinations of sounds, that enable people to identify, categorize, order, and differentiate a space (or type of space) from others. This includes the social, cultural, and political relations interpellated by such spaces. The term “soundscape” originates with R. Murray [Schafer’s \(1977\) *The Tuning of the World*](#) reprinted in 1993 as *The Soundscape*. As Ari Kelman highlights ([2010, 214](#)), Schafer’s original definition of soundscape is not purely descriptive as the notion is imbued with “ideological and ecological messages” that hierarchically order sounds.

outside of its historicity and its links to society and politics, privileges the “static and transhistorical ... qualities of sound” (Sterne 2003, 14–15). By taking into account that sound is culturally, historically, and relationally situated opens up sonic analyses to account for its “own politics, historicity and cultural” domain and how this affects what we study (Sterne 2012, 8). The historicity of sound invites a rethinking of existing conceptual categories, such as different political spaces (from the sovereign state to diasporic communities) within IR that are often understood to be outside of our senses. For example, Revell (2000, 604) argues that if we are “pitched into discourse ... then the discursive is embodied in sound, rhythm, timbre, and vibration ... the auditory must therefore be tied to formation of subjectivity and its spatial constitution.”⁴

This raises the question of if sound has “... an active role to play in the organisation of social, economic, and political spaces” constitutive of the international and how it plays these roles in specific empirical cases (Revell 2000, 597)? For example, every Boeing F/A-18 Super Hornet Fighter aircraft is equipped with a cockpit warning system known as “Bitchin’ Betty” in the US Air Force. Voiced by Leslie Shook, the effectiveness of the warning system is attributed to how it sounds (Bachman 2016; Boeing 2016; Schogol 2016). Her Tennessee accent (itself a product of several socio-historical processes) in combination with its pace, pitch, and tone elicits visceral responses independent of the warning message being conveyed. Moreover, the US military has traditionally used women’s voices in warning systems, again reflecting broader socio-historical configurations, including their distinctiveness in predominantly male environments (Bell, Schultz, and Schultz 2000).

Adaptability

Adaptability refers to how when we listen to/hear, smell, taste, see, and feel, either “directly” through the human senses or via technical (and conceptual) instruments, we always are engaged in a process of adaptation from a specific input (e.g., physical pressures, chemical molecules) to a sensorial or representational output. In other words, we should not necessarily think of sensory input as “a zero-sum game, where the dominance of one sense by necessity leads to the decline of another sense” (Sterne 2003, 15–16). With sound, this has often led to an idealization of “hearing (and, by extension, speech) as manifesting a kind of pure interiority” (Sterne 2003, 15–16). By its physical experience, sound, or any sense, cannot be analyzed by privileging what is heard above all else. For example, sonar technology is both a sonic and visual representation of sound pulses and waves. There is therefore a synesthetic adaptation at work, converting inputs to our senses, effects on our cognition, and any additional information captured by our senses (Bailey 1996, 54; Pinch and Bijsterveld 2012, 22). This synesthetic adaptation can be techno-social, and by extension it can also be socio-political, thus connecting it to the historicity dimension of sound. In other words, based on our experience, training, and context, there are sounds we hear, or actively listen for, while ignoring others (Sterne 2012, 8).

We can take the ending of the First World War as an indicative example. For combatants on the western front, the noise of four years of terrible violence was replaced by a quieter soundscape when artillery barrages ceased at 11:00 am on November 11, 1918.⁵ The sonic dimension of this transition was recorded by a single sonograph.⁶ Entitled “The end of war,” it captured acoustics in the minute

⁴Rhythms are also identified within this literature in conjunction with the work of Henri Lefebvre on rhythmanalysis (Lefebvre 2004[1992]). We have collapsed rhythm under our other four formations for two reasons. First, as a sonic dynamic, rhythms can comprise a soundscape, medium of knowledge, performative force, or political geography of affect (or parts thereof). Second, Lefebvre’s analysis of rhythms was much broader than those exclusively conveyed through sound.

⁵We are indebted to Cian O’Driscoll for this suggestion.

⁶The sonograph was recorded by sound ranging equipment placed on the front line used to identify enemy artillery positions based on the sounds of guns firing, munition trajectories, and explosions.

prior to cessation of hostilities and in the minute that followed.⁷ As Stéphane Audoin-Rouzeau (2014, 9–10) notes, the before and after of the war materialized in the juxtaposition of noise and silence, capturing in reverse the paradox of the frontline experience during the conflict: on the one hand, eerie silence, and then suddenly, on the other, the cacophony of industrial warfare. This paradox is further striking as no audio recordings of the frontline exist, apart from this visual representation, even though audio recording technologies were readily available. This absence of the sonic traces of the war is even more perplexing as its soundscape was a central component of emerging technologies for managing modern warfare as well as the sensory world of its combatants. Sounds were at the heart of many stories about the war experience. They were also a source of the physical and psychological scars soldiers brought home with them as well as the attention paid to sound and noise in post-war societies (Bruel 2014, 121–22; Volmar 2014).

Relationality

Relationality refers to connections sounds have to each other, other senses, and other things, alongside practices of listening/hearing, emitting/producing, and recording/inscribing that establish subjectivities, spaces, events, and situations. These connections arise because sounds have a historicity and are always in a process of synesthetic adaptation. On the one hand, “sonic phenomena [are] in relationship to one another—as types of sonic phenomena rather than as things-in-themselves—whether they be music, voices, listening, media, buildings, performances, or another other path into sonic life” (Sterne 2012, 3; original emphasis). Even when we think of sounds that *a priori* do not seem to contain a strong cultural dimension, for example, those that are dismissed as “noise,” they still never “can be wholly defined in isolation” (Bailey 1996, 54; Revill 2016, 245). On the other hand, sounds are always connecting, placed in conjunction, and resonating. This can involve individual listeners, groups of people, material networks and configurations, events, situations, or spaces. In sum, these factors help to constitute the “relational geography” of sound (LaBelle 2010, ix, xxi, xxv; see also Franklin 2005b, 8).

The governance of gun violence in urban centers is exemplary of these kinds of relationalities of sound. Acoustic gunshot detection systems have been developed in response to concerns over levels of gun crime. They are supposed to identify, record, and pinpoint the location of gunshots in a given area to help police respond as well as to identify hot spots of criminal activity, often in conjunction with other crime governance systems such as COMPSTAT (Lake 2017; Aguilar 2018). To work effectively, they connect sounds to recording and geolocation technologies, as well as artificial intelligence systems and/or human personnel trained to discriminate between gunshots and other similar sounds (e.g., firecrackers or automotive backfires). Acoustic gunshot detection technologies are most often installed in “high crime” areas in urban centers (though mobile devices have been used by the US military) which are often disproportionately inhabited by marginalized communities (Lake 2017, 5). With accusations that the acoustic equipment can also be used for audio-surveillance of conversations, the sound made from gunshots has become yet another channel for increased levels of surveillance of already marginalized communities by the state security apparatus.

Performativity

Performativity is the last dimension we would like to highlight. The different forms of emergence and enactments of sound are productive of subjectivities, situations, events, and spaces. This performative dimension is perhaps most easily found when it is expressed as voice or music, and it can even be applied to silence (see

⁷The Imperial War Museum in London asked a company to recreate the soundscape based on these visual representations; see <https://codatocoda.com/blog/making-a-new-world-armistice-soundwave/> (last accessed July 23, 2019).

Ferguson 2003, 59–62).⁸ Extending the performativity of sound into notions of collective belonging, French cultural historian Alain Corbin studied the functions of church bells in the French countryside during the nineteenth century. Corbin (1994, especially chapter 2) makes the point that bells constituted the space of a community by serving as a means to communicate announcements to its members as well as demarking the constitutive boundaries of that village community. People who believed themselves to be a part of a community but were located outside of earshot of the bells would complain to the local authorities they were unable to hear them. The bells thus produced and performed a “relational geography” between villagers and the village: being able to hear the village church bells was constitutive of “belonging” to the village.

Currently, we can see a similar dynamic in relation to the space of the global financial market. The start of the trading day on the floor of the New York Stock Exchange commences with the ringing of the bell, both providing a ritualistic intervention into the soundscape of finance capital while symbolically bringing together traders from around the world into an imagined community of financial competition and exchange. Beyond the performative constitution of communities, we can think of sounds as participating in the production of other performative subjectivities, spaces, situations, or events.

To conclude, sounds do things that are of import to world politics via their historicity, adaptability, relationality, and performativity. What we hear, how we hear, and who hears are fundamental to key (geo)political dynamics that shape the international. Thus far, the existing literature has advanced our knowledge of what sound does; however, much of this has been focused on music and/or contextual explorations of sounds *in situ*. To begin to make broader connections across time and space, we believe that sonic formations and the SHARP framework can help to reveal relations of power produced through the human sensorium in world politics that have thus far been underexplored. In the next section, we demonstrate how the analysis of a sonic formation through SHARP can deepen our understanding of key global arrangements that combine international, political, sociological, technological, and embodied elements.

The Nuclear Deterrence and Non-Proliferation Regimes as a Sonic Formation

We conceptualize the nuclear deterrence and non-proliferation regimes as a sonic formation in order to provide a preliminary demonstration of how to capture what sound does in world politics and why this might be important for international political sociology. Our selection of this sonic formation is based on three rationales. First, deterrence and non-proliferation are well-established areas of study within the discipline (Powell 1990; Sagan 1996/97; Egeland 2019). Second, while there is disagreement within the literature about the importance of any particular element that might be contributing to these regimes, as well as their legitimacy, there is generally a consensus of what could be included such as underlying behavioral models, key actors, institutions, forms of technology, international agreements, rules, norms, and practices (e.g., Klein 1994; Mutimer 1998; Hamidi 2020; Sagan and Waltz 2012). Thus, sound becomes a least likely case given its almost total absence in discussions to date, particularly in comparison to the visual dimensions of deterrence and non-proliferation (e.g., MacDonald 2006; Vuori 2010; Särämä 2014). Finally, the nuclear deterrence and non-proliferation regimes, regardless of normative positions, are of existential importance to world politics given the potentially cataclysmic

⁸We are consciously omitting the *problématique* of silence and noise. As Peter Bailey (1996, 53) reminds us, silence can be a form of “noise” by the “significant absence” of sound. Silence frequently denotes not only its opposite but its suppression by countervailing forces, while as the extensive list of well-worn modifiers . . . demonstrates, silence is rarely empty.”

consequences of gross mismanagement. Thus, we believe that they are highly relevant for demonstrating the importance of sounds and the role of sonic formations.

The sonic formation produced via the nuclear deterrence and non-proliferation regimes includes sounds which structure how these regimes function. This includes material and perceptual elements that are mediated by, and through, sounds. At this point, two methodological issues require attention. First, our analysis is itself “soundless,” containing no archival material of the sounds under investigation.⁹ This relates to the inaccessibility of examples of the sonic phenomena pertinent to the case as well as some of the sounds being imperceptible to the human ear. While secondary sources provide sufficient empirical material to reach reasoned conclusions, we nevertheless would want to stress that these must be treated as preliminary. Going forward, an international political sociology of sounds will have to involve mapping and building accessible sound archives (similar to work undertaken with images). Second, by exploring mediations that involve sounds, physical materials, technologies, and bodies, the analysis of sonic formations adds to emerging forms of inquiry that move away from dichotomous categories (e.g., the material and ideational or the discursive and phenomenological). It also joins literature that seeks to conjoin different “levels of analysis” (e.g., the micro, meso, and macro) through processes. Here we do not offer a pseudo-causal model in which one dimension or level necessarily impacts upon the others, but rather seek to empirically demonstrate how any given dimension or level is necessarily connected to others through sound. We will now examine the sonic formation produced, focusing on the historicity, adaptability, relationality, and performativity of the sounds within it. In doing so, we will demonstrate how sound contributes to political dynamics at the center of these regimes.

The nuclear deterrence and non-proliferation regimes are based on monitoring and surveillance apparatuses that have a *historicity*. They have emerged from contexts that have shaped their current forms and included possibilities for other forms that were not realized. Since the 1950s, one of the central dimensions of the nuclear deterrence regime for NATO and the United States has been the development and deployment of the SOund SURveillance System (SOSUS). This system has connected military, scientific, and commercial ocean science toward the strategic goal of implementing a global surveillance regime for Soviet, then Russian, submarines (see [Weir 2006](#)). SOSUS is a long-range and early-warning anti-submarine system that uses passive sonar ([Whitman 2005](#)) and was selected over a short-range anti-submarine system using active sonar championed by the British. The different preferences for sonar systems highlighted the competing views over how ocean surveillance should be performed during this time period ([Robinson 2014](#)). Moreover, these debates and disagreements among allies over what type of sonar system and geopolitical strategies (i.e., global versus local) were best to counter the threat of Soviet submarines were reflective not only of “the changing role that Britain and the United States were about to play on the geopolitical chessboard” but also of how the management of Western geopolitical aims would be accomplished “through the placing of invisible “electronic ears” underground, on land, at sea, and in space all around the globe” ([Robinson 2014](#), 119).

The close connections between scientific and military spheres in the development of sonar in general, and SOSUS in particular, also enable the contemplation of the historicity of the nuclear non-proliferation regime through sound. The very possibility of a *Comprehensive Test Ban Treaty* (CTBT, signed in 1996) relies on the ability to identify clandestine underground nuclear tests and to differentiate them from industrial explosions “in mining, quarrying and civil engineering projects” that use chemical explosives ([Denny 1994](#), 1-1). The very possibility of the CTBT rests on being able to verify compliance while not generating false-positives and/or

⁹We thank a reviewer for raising this important methodological point with us.

false-negatives. To this end, the United States, under the aegis of the Department of Energy, designed a field experiment—the non-proliferation experiment (NPE)—precisely aimed at measuring the differences between industrial explosions and nuclear detonations. The data were then made available so that clandestine nuclear tests could be detected. This capability, which underpins the CTBT and the larger non-proliferation regime, relies on an international monitoring system comprised of seismic, hydroacoustic, infrasound, and radionuclide sensors that are located across the globe (see <https://www.ctbto.org/specials/who-we-are/>). Moreover, the ongoing involvement of scientists and civil society actors in the non-proliferation regime is, in part, enabled by these inter-sensible dimensions where they function as external listeners and interpreters of the sonic data that are collected (see [Dahlman 2013](#); [Patton 2018](#)).

From conditions of possibility imbricated within the historicity of sound within the nuclear deterrence and non-proliferation regimes, we now turn to their adaptability. The importance of the adaptability of sound in the sonic formation of nuclear deterrence is centered on second-strike capabilities that have been implemented by many nuclear powers. This has been catalyzed and countered through the possession of three types of watercraft: ballistic missile submarines, cruise missile submarines, and attack submarines tasked with “hunting” the other two types. At the heart of second strike capabilities, understood by key actors to be an essential aspect of the delicate balance underpinning nuclear deterrence, is the need for ballistic and cruise missile-equipped submarines to avoid detection so that they can deliver their nuclear payloads if required. Thus, throughout the world’s oceans, attack submarines seek out the locations of ballistic and cruise missile submarines that, in turn, seek to evade them.

Central to this cat and mouse game is the role of sonar and sonar operators. Sonar is only as effective in detecting enemy submarines as its operator who must interpret with great precision echoes received back from ultrasounds, in order to determine the type, course, and proximity of objects through devices that transduce sounds into audio and visual representations (see below). Beyond extending “the field of perception” for an operator, sonar also divides “perceptual labour between people and machines in a way that associate[s] the former with the hermeneutics of echoes and the latter with the extraction of locative information” ([Shiga 2012](#), 371). With the help of scientific knowledge developed in oceanography and hydroacoustics to facilitate and increase the precision of underwater targeting, sonar operators must develop the “capacity to separate the echoes bouncing off ... target[s] from ambient noise, including echo-like reverberations,” or even biological sounds (like whales) ([Shiga 2012](#), 370–71). Sonar, and sonar operators, has been implicated in international crises such as the Gulf of Tonkin incident and the resulting escalation of the Vietnam war (see [Moise 1996](#), 125–26, 140, 165–66). The technology has also been deployed outside of marine environments as with the use of converted anti-submarine sono-buoys with microphones that were deployed across Vietnam to help determine the locations of the “Ho Chi Minh Trail” from 1967 to 1973 ([Deitchman 2008](#)).

Sonic adaptability is also a key element of nuclear weapons and thus the non-proliferation regime. Nuclear weapons testing has always been shrouded in secrecy, involving subterfuge, bluffing, and double-bluffing in attempts to conceal or overstate nuclear capabilities. With the establishment of the CTBT, the need to conceal nuclear detonations has become important given the potential costs in terms of international sanctions. As mentioned above, to help with verification elements of the ban, the International Monitoring System (IMS) was introduced. The IMS is a global network of sensors to detect visual, radiological, seismic, and sonic markers consistent with a nuclear detonation in order to determine if a nuclear detonation has taken place, where it likely took place, and its approximate strength ([Wolverton 2015](#)). Sonic markers, particularly ultra-low frequency infrasounds, play an

increasingly important role in the monitoring processes as underground testing facilities have become preferred sites due to their ability to better conceal the tell-tale visual and radiological indicators of a nuclear blast. As human beings are incapable of hearing infrasounds, these data must be adapted by transposing it (and other sonic transmissions like seismic data) into visual forms using “algorithmic calculations and graphic representations,” which cannot only detect detonations but provide credible evidence of the type of device tested (e.g., fission or fusion) (Gallagher, Kanngieser, and Prior 2017, 630; Siegel 2017). Thus, a global sonic monitoring system has joined GPS satellite-based detection to provide the IMS with a surveillance infrastructure that draws upon multi-sensory input and the adaptability of sound to provide evidence of probable nuclear detonations.

We now move the relationality of sound within the sonic formation shaping the nuclear deterrence and non-proliferation regimes. To capture the relationality of sound within nuclear deterrence, sonar operators are an ideal illustrative example. As mentioned above, the analysis of sound by sonar operators is largely multimodal, with visual signifiers from different instruments playing a key role in the identification of sounds. Sonar operators are important to contemporary navies; they “are looked upon highly, and are constantly depended on for the ship’s and crew’s safety” (Hedrick 2015). Furthermore, sonar operators are central to the larger configuration of individuals, devices, protocols, practices, doctrines, and institutions that constitute the architecture of nuclear deterrence. Since the early 1950s, they have been the subject of scientific attention about how to best select individuals for the role in light of their potential to develop acute listening skills. Sonar operators have also received extensive “training in sound detection and recognition, largely behind closed doors” as their central role in the architecture of deterrence was seen as requiring secrecy (see Bijsterveld 2019, 29–33). A key question then requiring further investigation is how do sonar operators shape the “relational geographies” that constitute the subjectivities, spaces, events, and situations of a submarine or ship that are also co-located within broader geopolitical contexts? What seems a rather abstract question has unfortunately been, as we have noted, at the heart of important international crises such as the Gulf of Tonkin incident (see Moise 1996, 125–26, 140, 165–66).

In terms of the nuclear non-proliferation regime, the relational geography of sound is connected to the infrastructure that was created via the CTBT and the IMS global network. Following Badenoch and Fickers (2010, 12) and Larkin (2013, 328, 335–36), we can define infrastructures as “mediating interfaces” bringing together material, institutional, and discursive structures. An infrastructure, like the CTBT via the IMS global network, thus establishes channels of mediation that connect disparate elements together into purposeful activity; however, in doing so, it also “excludes and segregates and establishes new hierarchies” (van Laak 2004, 55) such as those constituted by different parties within this regime (e.g., NPT-designated states, other nuclear powers, those seeking nuclear capabilities, and rogues). For example, those states who already are in possession of nuclear weapons, are largely unaffected by this infrastructure, as most have no need for nuclear tests to develop their arsenal due to the introduction of computerized modeling (e.g., the most recent series of French nuclear tests was in the mid-1990s; see Whitney 1996). As an infrastructure, the CTBT qua IMS presents its “forms of political rationality that underlie technological projects,” by laying bare the modes of governance and governmentality that arise from it (Larkin 2013, 328). This dynamic is generated through the political rationality of NPT nuclear states and their ability to monitor other states (via sound) to ensure that the NPT holds. This contributes to a non-proliferation discourse that privileges those who have nuclear weapons relative to those who do not. Sound thus contributes to the maintenance of a particular nuclear order. Moreover, monitoring technology means that states trying to develop nuclear capability face the double bind of trying not to be heard while being unable to simulate nuclear

explosions via computers because they lack the precise empirical data generated by tests to do so.

The performativity of sound in the sonic formation constituted by the nuclear deterrence and non-proliferation regimes is linked to some of the more spectacular aspects of nuclear weapons. A nuclear detonation, and therefore the accompanying sonic blast, is performative of being part of a community of states with nuclear capabilities; beyond the metaphorical, a nuclear detonation is a sonic signal that a state can, and wants to, be heard by others (Dunn 1977, 97). Not only does a nuclear detonation instantiate a collective identity that is recognized intersubjectively, it also enacts a new situation that affects the behavior of other states, particularly if it serves as definitive proof of an actor's capability (see Nacht 1981, 194–95, 199–200, about US reactions to such events). An interesting case in point here is Israel, which has had the capability to conduct a nuclear test from the late 1960s onward; however, it is believed that it did not do so immediately to avoid two problems: (1) catalyzing a nuclear arms race in the Middle East and (2) souring its relations with the United States, which, at the time, was opposed to Israel becoming a nuclear power (Rabinowitz and Miller 2015, 55–56). While many believed that it had a nuclear capability, Israel's view was that “an unadvertised, untested nuclear device is not a nuclear weapon” (as quoted in Rabinowitz and Miller 2015, 56). It is thought with a high degree of probability that the only test detonation of an Israeli nuclear device took place in the South Atlantic during September 1979 and was originally attributed to the South African government. In a very controversial assessment of the event, the Carter administration publicly declared that this was not a nuclear detonation, an assessment which has never been challenged by succeeding US administrations (Rabinowitz and Miller 2015, 65–66). Thus, this case illustrates how sound is imbricated into the performative enactments at the heart of the politics of non-proliferation. It also reveals the importance of how states are heard, and how states choose to hear, to the subject positions that result.

As noted above, the CTBT via the IMS infrastructure, does not solely mediate material phenomena between states and institutions; nuclear detonations, monitoring practices, and the different signs (geological, discursive, and so on) that are produced through these processes, also symbolically mediate the relational imaginaries that they sustain (Larkin 2013, 329, 332–34). As Hugh Gusterson has argued with regard to nuclear weapons (1999), an argument we believe can be extended to the CTBT, what is actually performed through this infrastructure is a specific world order that justifies the maintenance of an asymmetry of capabilities among key actors. In turn, this performance is then transposed into a discourse of danger toward those who seek to become nuclear powers. The othering at work, usually connected to the perceived “third worldish” character of nuclear power-seeking states, prompts the question of how material and symbolic infrastructures, such as the CTBT via the IMS, can help us to analyze the imperial logics behind the imagined worlds of nuclear powers (van Laak 2010; see also Biswas 2014). Nuclear detonations, as they are detected, monitored, and attributed to specific actors by the IMS, enact specific subjectivities—e.g., the rogue state—and a specific space—i.e., a world order premised on the unequal distribution of nuclear weapons. The result is to represent the discovery (via sound) of clandestine nuclear activity by those discursively positioned as untrustworthy as a symbol of the righteousness of an order that maintains that unequal distribution. While this critique is longer-standing, the recognition in the literature of the importance of sound to its reproduction is not.

From the discussion above, we can see how sound and the sonic formation produced by the nuclear deterrence and non-proliferation regimes are able to connect the international, political, and sociological through (geo)political spaces, social milieus, and individual bodies (e.g., in the form of listeners). While sound is being mediated, we would wish to make clear that the contributions of sound to these regimes are not merely epiphenomenal. Sound is productive within them,

generating both meanings and effects that shape the global nuclear order. Thus, our analysis helps to emphasize the need to look more widely at the configurations of people, institutions, technologies, and practices to which sound contributes. Moreover, sound helps to expose how the material, discursive, and phenomenological operate together to constitute world politics.

Conclusion: Advancing Sound Matters in International Political Sociology

This article has sought to make an original contribution to international political sociology by proposing the concept of sonic formations and an analytic framework based on sound's historicity, adaptability, relationality, and performativity (SHARP). In forwarding these frameworks, we have sought to generate research questions that will advance the understanding of the role of sound in world politics and how sound contributes to key dynamics. Drawing from existing work in cultural geography and sound studies, we have sought to build upon treatments of music and voice in the existing IR literature to demonstrate how sonic formations contribute to the constitution of specific understandings, rules, subjectivities, and practices connected to world politics. Furthermore, through an illustrative case study, we showed how sonic formations are analytically relevant, productive, and important to the management of, transformations in, and challenges posed by, the nuclear deterrence and non-proliferation regimes. While by no means exhaustive, we believe that this initial application provides evidence of the potential empirical relevance of sound for world politics alongside the value of analyzing sonic formations via SHARP. It does so by showing how sound, as a material property subject to techno-cultural infrastructures, shapes an important regime in world politics while contributing to broader configurations of power that define the international. Moreover, in providing novel insights into how particular configurations of norms, regulations, technologies, power, physics, and human physiology come together through this sonic formation, we believe that continuing attention to sound has the potential to shed new light on how micro, meso, and macro level phenomena can be linked in world politics.

Through our exploration of sound, we hope to have added to the growing literature that argues that levels of analysis are inextricably intertwined. For example, the international system of deterrence rests, in part, on the ability of nuclear-equipped submarines to remain hidden from the highly trained ears of sonar operators while non-proliferation relies on the ability of monitoring systems to credibly detect and distinguish an underground nuclear detonation from an earthquake. In both cases, sound is connecting environments, social milieus, and perceptions within a form of global governance that influences the ability of a state to challenge, or maintain, the "balance" of the international system and inter-subjective identities that emerge through it. While it is difficult to causally connect these intertwined levels, a focus on sound as a social phenomenon enables us to weave them together through modalities that shape relations of power. Going forward, future contributions to an international political sociology of sounds may wish to turn to analytical concepts such as soundscapes, or affective atmospheres, in order to provide answers to how sound can be operationalized as a site for the ongoing analysis of our many political worlds.

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