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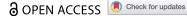
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# Preemptive listening: a roundtable discussion about sirens

Francesca Laura Cavallo [ID]ᵃ, Paul Dorfmanᵇ, Judy Edworthyᶜ, Lisa Laviaᵈ, Gascia Ouzounianᵉ, Irene Revell [ID]ᵃ, Aura Satz [ID]ᵃ and Joel Sternᶠ

ᵃContemporary Art Practice, Royal College of Art, London, UK; ᵇScience Policy Research Unit, University of Sussex, Brighton, UK; ᶜSchool of Psychology (Emerita), University of Plymouth, Plymouth, UK; ᵈNoise Abatement Society, Brighton & Hove, UK and The Urban Institute, Heriot-Watt University, Edinburgh, UK; ᵉFaculty of Music, University of Oxford, Oxford, UK; ᶠSchool of Media and Communication, RMIT University, Melbourne, Australia

**ABSTRACT**

Nested within the crisis of our attention economy, the siren is undergoing a profound transformation, prompted by our ongoing alarm fatigue and noise pollution, as well as the near-obsolescence and inefficiency of public sound system broadcasts. Employing an interdisciplinary approach from specialists in the field of sound studies, behavioural psychology, policy advisors and creative practitioners, this roundtable article aims to unpack the critical potential of reimagining sirens, extending physically beyond ear-centred listening, conceptually beyond immediate timeframes, and opening up to new collaborative methodologies across academia, industry, artistic networks and more, to tackle today's urgent need to recalibrate emergency signals for the immediate and the distant future.

## Foreword

How does the siren produce and shape a listener? Does an alarm have to be alarming? How can we address alarm fatigue, both as lived reality and as a metaphor for our current state? And how can sirens speak to dangers in the distant future? Many sirens are relics from WW2 and the Cold War, repurposed to communicate the threats of extreme weather, a collective commemorative pause, or resurrected to test disaster preparedness. The siren serves as a worldwide cipher of potential trauma, an emblem of climate catastrophe, a mouthpiece for sonic governance. In parallel, we are transitioning from loud alarms heard collectively in the public sphere, to vibratory text alerts received individually on personal mobile devices. *Preemptive Listening* is a practice-based research project funded in part by AHRC and centred around an eponymous documentary film by artist Aura Satz which re-imagines sirens and emergency signals (2024a). The film is also the basis for developing an associated archive of more than thirty new audio interviews with a broad multidisciplinary range of voices,[1] including the project's five Advisory Board members who comprise this roundtable: Paul Dorfman, Judy Edworthy, Lisa Lavia, Gascia Ouzounian, Joel Stern. Convened by the project's

researchers Francesca Laura Cavallo, Irene Revell and Aura Satz, we took key phrases from the individual interviews we had conducted with each of these five Advisory Board members as a starting point for this Roundtable discussion – that took place via Zoom on 10 July 2023 - building on our original research and their prior input. Throughout the project's preliminary research process and creative production, we have employed a twofold approach: the film is both a diagnosis of shifts in emergency signal communication, and a series of propositions, speculating new siren sounds for new understandings of emergency and crisis management (Satz 2024b, 2024c). This is reflected in the two main questions that drive the roundtable: How does the siren produce and shape a listener? And how can we conceptualise a "good" siren? In the following transcription we have elected to keep the conversational and sometimes anecdotal tone of the exchanges in line with the project's wider interview methodology, attempting to highlight individual voices as much as the polyvocal group.

This discussion aims to expand our understanding of who listens to sirens and how. It questions the efficiency of our inherited sirens, and the capaciousness of our conceptual frameworks of emergency – primarily used to signal a singular incident (e.g. fire) and an immediate responsive course of action. It is an attempt to rewire our listening with the help of experts/researchers and to reassess the inherited soundscapes associated with the siren; moreover, to question whether our crisis management signalling systems are perhaps part of the crisis. When thinking of warning, we invoke the right to "equality of survival" (Scarry 2011). In our research to date, we have seen that in fact warning and safety are not equally distributed: some listeners become the "warned" whereas others become the "threat" (Satz 2024a). This in turn leads us to think further that some sirens are indicative of a failure of infrastructure and care.[2]

Rather than simply putting forward a better siren, we are also advocating for less need for sirens, more mutual aid and preventative measures (health care, climate protection and regeneration, resilient architecture etc), as opposed to increased warning which is often part and parcel of the vicious cycle of criminalisation, incarceration, climate cata-strophe, etc. Indeed, taken further the "siren" may even be itself a diagnostic paradigm through which we might understand power relations and address critical questions of (sonic) governance. These reflections become even more relevant when one shifts the attention from a state of immediate emergency to the long-distant future (e.g. nuclear waste disposal, deep future toxicity). The question of "who sounds the alarm" and "in the interest of what" is essential, as is a greater focus on the modes of listening implied by the siren. How can we expand our listening practices towards a more just system of warning that moreover encompasses more-than-human entities? What would a siren for the intertwined human, non-human and more-than-human sound like?[3]

## How does the siren produce and shape a listener?

Lisa Lavia: People's perception of sound is a psychobiological response (Basner et al. 2014; Clark, Crumpler, and Notley 2020; Münzel, Sørensen, and Daiber 2021). Psychologically, sound is related to our sense of safety and sense of wellbeing (Sayin et al. 2015). Soundscape research is focused on how sound is received/heard/listened to rather than primarily focussing on the sound source (as in traditional acoustics) (Schafer 1977;

Schulte-Fortkamp et al. 2023). Unlike other environmental pollutants or other nervous system stimulants, we cannot just measure and assess the impact of sound based on levels. It's important to employ an aural diverse and neurodiverse perspective, as sound affects us holistically (Drever and Hugill 2022). So, to whatever degree you feel, or sense, or hear a sound, you're experiencing it throughout your whole body, mind and emotions (Stallen 1999). The solutions are not necessarily *turn key*, if we can use that phrase, because they require transdisciplinary coordination, understanding and evidence (Riedel et al. 2021). We should be thinking around techniques of facilitating "perceived control", giving communities agency to decide how they want to be warned, so that the siren is also shaped by, rather than actively imposed upon, the listener (Hatfield et al. 2002).

Aura Satz: You seem to be pointing to a huge paradigm shift from a sound that exists in laboratory conditions and a listener that exists in the test conditions, of that vacuum, to a more holistic approach, understanding listening as partaking, impacting, being changed by its environment and so forth.

LL: I think that's part of the challenge. Paradigmatic shifts need to happen across research methodologies and disciplines, as well as context-based research (Davies et al. 2013; Schauppenlehner-Kloyber and Penker 2015).

Francesca Laura Cavallo: Is mapping out all these psychobiological-environmental factors that affect how people respond to sound even possible? Is it an epistemological challenge that we can genuinely resolve with better tools?

LL: It's partly epistemological in terms of, I would say, the *research response* to the problem (Fenech et al. 2021; Méndez-Martínez 2022). Part of the human psychobiological response is indeed linear and can be directly mapped to sound levels and certain known conditions. But research shows that only accounts for about one third of the identifiable human response to sound, while the other two thirds of the human response can be accounted for by one third of what the acoustic field calls *non-acoustic factors*, or some might understand as, *human factors*, and one third *other/unknown/unexplained* factors (Guski 1999).

Judy Edworthy: I completely agree with everything that Lisa just said. And I think that, of course, in the end it's in the hands of the funders, because these kinds of approaches are very expensive and I wonder if there are enough people in the world who can talk that articulately about sound and noise, who actually grasp that there's an issue. And there are many dimensions to that issue. I would give a very prosaic answer to the question, how does a siren produce and shape a listener? I'll outline five important points about how people interact with sounds that are intended to warn them.

Firstly, the false alarm rate is very important. This is possibly not an issue with sirens specifically, but people will match their response to alarms more generally depending on the alarm's false alarm rate. Some medical device alarms are 98% false, for example. So, what that means is that almost all of the time, they're signalling problems that don't exist. What the science shows is that people will match their response rate to what they perceive to be, or actually is, the false alarm rate (Bliss and Dunn 2000; Bliss, Gilson, and Deaton 1995).

Secondly, part of your response to any sound which is signalling that you should do something will be due to *stimulus-response learning*. So, if you learn that a sound means *x*, you will go and do *x*, like Pavlov's dog. When the bell goes, you will feed the dog, or the dog will expect to be fed. It's very simple stimulus-response learning.

The third thing is there are lots of associations between sounds and meanings in a more abstract sense. For example, a key concept with sirens and alarms is the level of urgency. So, we know lots about how we can engineer a level of urgency or non-urgency into a sound so that it sounds appropriately urgent (Edworthy, Loxley, and Dennis 1991; Haas and Edworthy 1996; Hellier and Edworthy 1989). The first response people almost always make if you design a set of sounds intended to be alarms, is, "Oh, well, that's not urgent enough", or "that's too urgent". They've got a very strong sense that somehow the alarm should match the importance, the hazardousness, the seriousness of the hazard, whether it's relevant or not. And the other thing is that sounds can represent concepts, for example, a high pitch can represent something in the sky, a low pitch might represent something on the ground, and there are all sorts of other abstract representations. But, of course, if you know what a sound means, it doesn't really matter what that sound is because you've learned it.

The fourth one is there are noise responses that you cannot avoid. If a sound is very loud, the body will react in a particular way. There are startle responses and so on (Ising and Kruppa 2004). And of course, sirens are very loud. They have to be because they need to cover a huge area. So, if you're right up close to one, then the effect on your body and your head will be important.

And then the fifth one is that people like to move to sound, an activity known as *entrainment*, where people like to keep in time to a sound. You see it with children, they can't stop themselves from moving to a sound. So, the relationship between sound and movement is very strong as well. You'll notice when you get on a plane, they play nice walking-on-a-plane music because people will move in time: it's quite calm music but it's got a beat and it's trying to encourage you to get on the plane at a sensible pace that is neither too slow nor too demanding.

Irene Revell: With false alarms, is that then training people not to listen?

JE: That's part of the problem with alarm fatigue: they've learned to ignore alarms.

IR: And how does that then play into this point you've raised previously, that people aren't good at listening, in general. Why are people so poor at listening?

JE: Well, I'd be interested to see what Lisa says about this, but I think we're just bombarded by sounds from everywhere, many of which are not necessary. As a listener it is a better strategy to decide that none of them have any meaning than to decide that you have to work out which of those have meaning and which of those don't. Music, sound, all those kitchen devices that make all these sounds, and our television makes a thousand sounds that we didn't have before. But how do you decide which ones you should be listening to? You can't. It's like attempting to know what's wrong with your car when you're not a car mechanic.

LL: I think I would counter: people are actually good listeners in the main. We find this if we take people on sound walks. The principle of sound walking is *encouraging* people to engage in active listening and people can find that incredibly enlightening (Drever 2020). People who maybe heard nothing before often comment how *much* they hear when they actively listen. So, I think there's an issue of people not being trained to listen actively, but I think that can also be linked to what Judy was saying, people blocking out sounds, selective listening. But that's related partly to our brain function: it's linked with survival. Because the brain is interpreting the meaning of sounds, that's very energy intensive. The default setting of the brain is to be as efficient as possible to save energy, *to help* us (Oxenham 2018). So, if the brain has attached a meaning to something, "oh, that's just that car alarm going off again, it's annoying but doesn't mean anything, there's nothing wrong, I can't do anything to affect it" - whatever the subconscious appraisal might be – if there's no threat or we don't need that information at that time, then the brain works actively to tune those things out, to preserve our energy for other things we do need. That is part of the underlying psychobiological response (Martins and Froemke 2015). So, it's not that people don't listen or won't listen or can't listen. It's that they're in environments where they're preserving themselves for what's important to them.

AS: That's a really interesting segue into Gascia's research and the ways in which sounds are not just lived experience but can be triggers for traumatic memories.

Gascia Ouzounian: Yeah, that is interesting because when I was thinking about this question, I was thinking that a conventional idea of the siren, which I know is not how your project, Aura, is treating it, but in many people's conception of sirens, we are presuming that there is a benevolent state that seeks to take care of its citizens and is going to signal danger. But that's not always the case. States can obviously be harmful, and they can maim and kill their own citizens or residents. And so, I was thinking about what happens to the siren in that context. How is the dangerous state sounded? What does the alarm become and what is the clandestine alarm or the underground alarm? I have been studying experiences of sound and listening in different contexts of war and genocide; the Armenian Genocide, the 2014 war in Gaza, and more recently I've been studying experiences of listening in the Holocaust, specifically in the Warsaw Ghetto (Ouzounian 2023a, 2023b). I was thinking about how sound and listening operated in that context when there is a kind of *death space* which is being produced by the state.

I will just give one example to explain my thinking around this right now: a lot of European Jews who were persecuted and exterminated during the Holocaust reported that hearing knocking sounds, for example, was a really important aspect of their experience, particularly as they were in hiding. In the Warsaw Ghetto this is really important because people were hiding for many years at a time. And so those kinds of sounds of knocking which are signalling the danger of the Nazis, occupying forces, or the Polish police, the auxiliary forces, are signalling danger. So, it's a threatening sound that they're listening for. But they also are anticipating it all the time. Sometimes they're in hiding for years. So, it's not only when the sound occurs and they're terrified, but it's also in the *anticipatory listening* to sounds that don't necessarily exist or don't *yet* exist, which is also an important aspect of their experience. I was thinking about what happens to listening in that context. Listening

itself becomes a site of violence. And this anticipatory listening to sounds that don't actually exist means that the whole relationship to listening changes because it's no longer, let's say, a way of connecting to the outside world in the way that listening is often framed. It's actually a way of connecting to death and anticipating death for those people.

I was also interested in the kind of long-term trauma that can ensue from that. And there is this interesting quote from a Holocaust scholar, Christian Gerlach, who wrote "Echoes of Persecution" (2018). He talks about how this Italian journalist is visiting the home of a Jewish Italian writer and just knocking on the door really startles her. And this is 15 years or so after the Holocaust. The journalist says that the writer "had appeared tense and hesitant when opening the door and had looked at [the journalist] with the face of all Jews who had gotten to know the horror of the doorbell". So, I'm also interested in how the violence of sound and the trauma that happens to listening, and listening as a site of injury, can extend beyond the immediate period of a harmful or violent event. And how that kind of pre-emptive listening, anticipatory listening, can create a different kind of state of anxiety, dread, terror among listeners, long after violence has occurred.

AS: That's so interesting. The film [and AHRC project] title *Preemptive Listening* undoubtedly overlaps with this idea of *anticipatory listening*. But throughout the project I have been conscientiously moving it away from the space of trauma or the potential of re-triggering that trauma. Instead, I'm trying to think of *Preemptive Listening* as a way of setting the intention for listening, which taps into what Lisa and Judy are saying, assuming that listening can also be re-trained. The siren as a paradigm builds on previous trauma, ostensibly learns from it, and provides a signal, a pre-emptive gap before that past can repeat. So in some ways the focus on trauma is indicative of a cycle of hypervigilant reactivity, or anticipatory catastrophising, but in both the spoken word and the new sound compositions featured in the film we have tried to identify alternatives.

FLC: I wonder if this is linked as well with what Judy was saying about sound that produces a learned response. So, no matter what the sound is, you have a conditioned response because you have had to learn to respond to that sound. So, in this case, the learning you've had is the trauma you are talking about, Gascia, that's the learned response.

GO: For me, many of the ideas that Judy was proposing and working with in the empirical context, they bear out in various ways in what witnesses and survivors of different wars and genocides and conflicts report in terms of their experiences. I think we tend to think about listening as a kind of process. And there's nothing wrong with that. But what was becoming apparent for me is that it's also the *relationship* that a person has *to* listening, you know, how they relate to that act that is also important to consider. And as you're saying, Aura, when listening itself has become a site of trauma or violence, can it become something else? Can it be retrained? Can it one day become a site of healing, for example, or a site of connection in the way that resists the violence that occurred?

LL: This links in to how the brain processes trauma – listening is a spectrum, and we're all on that spectrum. At the positive end of the spectrum, it's like, the sounds being heard promote health and wellbeing (Radicchi et al. 2021), whatever that means for the person

in their environment (Andringa and Lanser 2013). The opposite end of the spectrum is the sounds heard can create a trauma response, like fear or anxiety, where the body and mind are locked into this type of response to a sound (Hahad et al. 2024). So, it's important to understand the spectrum of where people are when they're relating to a particular sound or trying to design what they think the right sound should be. And understanding that that spectral response is directly related to how the brain processes *any* sound in relation to the primal starting point of "am I safe? Is the signal I'm hearing telling me that I'm safe?" (Van den Bosch, Welch, and Andringa 2018). If the answer to that question is immediately *yes*, then the brain can move on from that. But if the brain cannot *understand* that you're safe, then it triggers the release of stress hormones, and does everything it can to help you to try to get yourself safe (e.g. prepare to act, stay alert) (Wood et al. 2022). Likewise, the opposite side of that is that techniques to help retrain the brain to re-associate safety or comfort or health with certain sounds can be used. That's where, for example, the science of epigenetics comes in (Shang and Bieszczad 2022), or the use of psychology-based approaches like Cognitive Behavioural Therapy (Aazh et al. 2019) – different techniques will work for different people. But it's important to understand that that is part of the overall universe, if you will, that needs to be considered when designing a sound, let alone doing any retroactive steps to help people to retrain how they're listening to/experiencing/interpreting a sound.

GO: May I add one more thing that you're probably already taking into consideration, Aura, and maybe this entire group? This term that Steve Goodman has of *unsound*, latent sounds, or inaudible sounds (Goodman 2012). So, he's talking about this sonic force, this idea of bass materialism, these very low, below-the-threshold-of-hearing sounds that can cause fear and dread among a population: the affective dimension of that *unsound*. I'm similarly interested in a category of sounds that we could think of as *not-yet-sound*. And the pre-emptive listening or anticipatory listening to sounds that do not exist yet or that are not audible yet: that's also a dimension of the emotional and affective effects that sound can have. Again, not only in terms of the audible sound of alarm but also the not-yet-sound, the unsound, the inaudible sounds, the sound that we can't hear yet.

Paul Dorfman: Sirens in the broadest sense (as warnings) are not listened to, partly for political reasons (the Zeitgeist, inefficient risk communication). The problems are also semiotic in that often we are warning about unknowns, uncertainty, or complex problems.

   Some alarms do actually need to be alarming – but we need to conceptualise it as an "interactive process" where people are able to hear the alarm – physically but also politically – and act upon it. One of the main issues in effectively communicating risk is to always provide a possible solution or way out. It's impossible for me to talk about nuclear without talking about renewables (Dorfman 2023). So, coming back to questions of the message, it's important to provide a way forward. It's a question of agency. What can I do about it? Can I do something about it?

   For many years climate has been the ultimate question about an ultimate warning. However, until quite recently, the response has been muted, unheard. So, there's a key distinction between listening and being heard. And involved in that are questions of empowerment, of agency. In other words, whatever the warning is, what can be done

about it within everyone's lived experience, in everyone's everyday lives? In terms of empowerment, it seems important to be able to say "here are solutions, here are ways forward" - here are renewables, here's solar and wind power, here's energy efficiency and management, power storage, interconnection, central and distributed smart grids (IRENA 2024).

Joel Stern: How does a siren shape a listener? I think it's important to stay with the fundamental questions. What is a siren? Does a siren have to be a sound? Is it always manifest in the presence of a sound or is it sometimes in the absence of a sound, as Gascia just put it? Can a siren be figured as something that is missing from a soundscape, *unsound* as Christof Migone and others theorise (Goodman 2012; Migone 2012); or the way that Lawrence Abu Hamdan has framed about the construction of silence in Syrian prisons (2017). Can we think of silence as alarming, as producing a state of emergency? What makes a sound a siren, or to put it another way, how does a sound become a siren? Does a sound become a siren when it crosses a certain threshold, for instance, the moment the separation between public and private or inside and outside collapses? Does a sound become a siren through its circulation, distribution, capacity to penetrate or puncture certain architectures? And then; what is a listener in relation to a siren? Is it a person or a group temporarily constituted by all hearing the same sound at the same time? In the case of something that is broadcast *en masse*, does the notional listener include non- or more-than-human listeners?

In my work on "machine listening", I've been thinking about the way devices, infrastructures, and networks process sound (Dockray, James, and Stern 2022, 2023a, 2023b). That is obviously ontologically different to living creatures. So, what is a siren for machines? What is a siren for animals? I recently came across the Earth Species Project,[4] a research lab using large language models to try to decipher animal communication. One of the researchers, Aza Raskin, talks about creating "synthetic animals" that can communicate with their organic counterparts in the wild, and for instance, broadcast alarms or warnings of danger in "crow" or "whale" language. While I am sceptical of AI hype, tech boosterism (you could say "alarmed" by the hubris of these statements), I think a basic point is that listening is so diverse it is not easy to generalise a "listener". We could, acknowledging this multiplicity, say there are *many* sirens and listeners, and in certain ways, the listener produces the idea of a siren through associations and understandings of sound.

An anecdote came to mind about another "alarm", the haptic vibration of a mobile phone you feel in your pocket, that alerts you to a message or call. The vibration was invented by engineers as a silent alarm because people were switching their ringtones off to avoid disturbing others. I recall a story about an engineer going out soon after the feature was added, and then noticing people constantly and compulsively reaching and checking; that the phenomena felt almost seismic or environmental. When engineers checked the figures on the implementation of the feature after a few days, there had already been tens of millions of vibrations sent out in that short period of time. Tens of millions of times that concentration, focus, and attention was interrupted. This is the alarm as a form of capture within an attention economy. Shortly after the vibration feature was introduced, a secondary phenomenon started occurring, *phantom vibration syndrome*, where people constantly perceive a vibration that is not there, something that

has been called "ringxiety", a portmanteau of ring and anxiety. Perhaps this phenomenon is proximate to the *anticipatory listening* or *preemptive listening*, explored in Aura's film. We are held in a constant state of heightened attention, and begin to anticipate, or almost hallucinate the alarm. The alarm then operates not as a spectacular intervention, but as a liminal day-to-day ambience. We are in a constant state of low-level alarm, and we don't always even know whether the siren is going off.

AS: I think that's a really good point. The entire project stems from the diagnosis that we have internalised the alarm, it is in us. But I'm trying to get it to this point where actually we can aim towards a recalibration or a deflection of that. So not surrendering at the point of diagnosis but actually trying, through some form of proposition, to go elsewhere.

## How can we conceptualise a 'good' siren?

LL: It's been so refreshing to hear everybody's comments and to see the linking together of certain thoughts and ideas. And, really, almost what we're demonstrating here is an example of what it could be like – participatory sound design. In other words, sounds and meanings are very contextual. To the point that Joel made, I concur completely. From the work of the soundscape research community, certainly one of the initial tenets is that any sonic intervention has to be developed in context with those who are affected (Lavia et al. 2016). Identifying who the stakeholders are is one part of the process, because it's not always obvious: it's everyone who's potentially affected. What does that universe look like? What are the effects? What are the potential actions (Xiao, Lavia, and Kang 2018)? There's a lot of preliminary work that needs to go into developing what could become the design parameters for what that warning device or sound-signal looks like or is intended to sound like and the effects on the listener[5] (Worrall 2019).

FLC: So, there's a very interesting tension now between the desire to create sustained research and incorporate all these interdisciplinary approaches, almost like a critical response or wanting to problematise these different aspects. For example, I was curious about how this idea of the phantom vibration links with the idea of false alarm, because in a way it's almost like a false alarm that happens in your body?

JE: With the false alarm example, the alarm has actually sounded; whereas the phantom vibration hasn't actually happened at all. And I was going to say that one of the things that really is standing in the way of the approach that Lisa advocates is that people that make devices of all sorts, they tend not to think about sound that way. They often think about sound at the last minute. Let's imagine you're designing a new medical monitor. Quite a lot of thought and effort will be put into the visuals but very little thought into the auditories because the manufacturers don't necessarily know enough about sound. There isn't a rich language for it. Once you've got beyond, "I prefer that to be a little bit louder or a bit lower in pitch", I think you've lost the average user, so that's an issue. I think that education about sound, soundwalks for example, are a great way to help people to think about sound, and to articulate thoughts.

In terms of designing better sound, well, I could go on endlessly about how you could design a better, more ergonomic alarm. There are all sorts of things you can do to make them more effective *and* easier on the ear. That's part of the problem with many existing sirens – of course they have to be very loud to spread over a geographical area. So, if you want to reduce the sound levels, do it a different way, don't use a siren at all. You can make the remaining sounds much more gentle. You can make sounds more meaningful by making much clearer metaphors for the thing that they're representing. You can make them repeat at different levels of urgency. You can make them auditory objects. One of the problems with some alarm sounds is that they're not discernible if two of them are going off at once: if you use more realistic sounds that are clearly separate auditory objects, the things that we're used to listening to in real life, then you can hear several at once. We've known since the early 1980s, with Roy Patterson's guidelines (Patterson 1982) on how to construct alarms, that you can make them change in urgency, you can make them pause for communication. We've known for more than 40 years how to make them better. But it's the will to do it that still isn't quite there. Still, medical devices make horrible sounds, even though there is a new standard (IEC 2020). This standard advocates the use of much more meaningful and much less irritating alarm sounds, which have been demonstrated to be superior in almost all ways to the tonal, beep-like alarms that are currently used (Edworthy et al. 2017; McNeer et al. 2018). Things make horrible sounds when they could actually make nice sounds that would be just as, if not more, effective.

JS: I have a couple of observations in response. When I was discussing haptic vibrations in mobile phones, obviously they were invented as an alternative to the ringtone, as people switched their phones to silent. The point I was making was that they replace the audible siren with something functionally similar, but essentially inaudible. There is a drift between sensory registers when we talk about the siren. The question, "how should a siren sound", gives way to a broader question of "how does a siren operate", leading into "who deploys the siren, on which subjects and in what contexts?" The question of *what is a good siren* is a political question. That is not to discount the necessity of infrastructures that alert us to danger, but only to say that a *good siren* would be deployed in ways that are socially and politically needed and wanted. That would be the primary question before we come to techniques or aesthetics. I may be slightly suspicious of aesthetic preferences and judgement in general because I've spent so long enjoying music that many people might classify as "unpleasant noise", and I have a strong attachment to a notion of beauty that is dialectical and ever-changing. But mostly I would assert the primacy of the political question; not "what should a siren sound like", but "what should it do in the world?"

JE: I want to ask Joel a question. Many sirens are there for something in the environment that is going to happen quite quickly, like a flood. So, does it matter to you who decides whether to signal the flood or not? Would you rather it was decided by a committee of lay people, or would you prefer a flood expert to be alarming you? I mean, if it's political, and it matters who tells us and who decides, how do we resolve that?

AS: Yes, all of this has been playing out in the film in one way or another, and I don't necessarily have an answer, but I think the point around the siren is that it both summons and creates a community, creates a group of listeners just by way of how it works, and therefore also implies a form of governance. Likewise it potentially implies borders or is there to reinforce the border. And so, especially the chapter that I'm working on now, it's all about a siren for *some*, like Gascia was saying, perhaps a listener who is threatened by that form of governance versus someone who the siren protects within that form of governance. But I guess there's a whole range of additional dilemmas folded into this question like what do we want to be alarmed about? Or to pick up on Paul's point, what are we capable of actually listening to when we are alarmed? The other day Ilan Kelman said, "well, you know, if there's a nuclear catastrophe, do we even want the siren two minutes before? Maybe we just want to live those last two minutes in peace without having the warning and the knowledge of the end".[6]

So, what we're talking about on the one hand is that some alarms are necessary and I think everyone would agree an ambulance siren has a very different reading to a police siren, for example, or a flood siren, as Judy was saying. And then perhaps we might, generally speaking, agree on the necessity for certain groups of people being involved in the decision-making process. So again, coming back to this idea of participatory or deliberative democracy, what do we need to be warned about and how are we warned and who is the warning for? The siren both holds together and completely dismantles all of those questions. Another thread in relation to this idea of alarm fatigue, being desensitised or the way that a state of alarm is being instrumentalised: one of the interviewees featured in the film, Daphne Carr, notes that actually, many sirens are ultimately the result of neglect or failures. Even if you think of flood or climate emergency sirens, they point to a lack of preventive attention to infrastructure or attention to, for example, the cascading effects of $CO_2$ emissions. So, in this kind of utopian reading, there would actually be less sirens because there would be less necessity for them: we would only sound or activate the ones that are truly necessary and truly inevitable. And in an ideal scenario, we would agree that that siren is necessary, and we would have the tools to respond to it.

LL: Right now, in our present environment, I would say very unfortunately we are in a state where, yes, "someone" – not a participatory process – makes a decision on what we all need to be notified of and then "someone", in government generally, decides for the rest of us what that's going to be. But unless we change the way those decisions are made, then we're going to continue to have the problems in relation to sirens that Joel's been pointing out, where other people are making decisions on what the sound "should" be and therefore what people "should" do in reaction to that sound. I mean, that has lots of inherent problems because our concepts of agency and perceived control are intrinsically linked with our sense of safety (Smith and Kirby 2011).

And let's say the general political reasoning is, boiled down to, "if you want us to save your lives, then do you want us to make this decision?" It's like, well, actually, I want both. But what I'm asking for is a different type of decision-making process (Hakiman and Sheely 2023). As that's what really upsets people, certainly in relation to sound, because the underlying sentiment there is "if you cared

enough you would listen to me and the fact that you're making decisions and putting the de facto responsibility on me that it's to save my life, it's for my benefit, well, that doesn't necessarily make me feel safer. That makes me feel suspicious, because what else are you deciding for me without my knowledge?" (Legacy 2017).

And I suggest this links to Gascia's work. We certainly see this in trauma responses to sound. As long as people feel that they do not have sufficient information to feel comfortable with letting somebody make a decision for them, leasing agency comes at a cost: "fine, I'm willing to let you make a decision for me when I believe I can trust the rules by which you're making that decision". But when that trust cycle is broken, people do not feel safe (Zafari and Koeszegi 2021). And then they enact not feeling safe in different ways, tuning out, acting out or whatever. So, this is the current situation, and Paul's comment said it: yes, somebody is going to make a decision that some people will be happy with, and some people won't. But how do we get upstream from constantly making these warning decisions in a crisis? How do we get back to the design stage of that? (Bobbio 2018).

GO: Yeah, exactly. I think as Lisa has just been saying, and as Joel said about the political basis of the siren; this is the fundamental question out of which other questions around aesthetics and technology emerge. And Lisa's point about trust and mistrust. Fundamentally, it's impossible to disentangle the question of what is a good siren from the question of trust and trust around information, and the politics of information and disinformation, misinformation. I think in many societal contexts there is so much mistrust. You can see it on the Right as well as on the Left: mistrust operates in different ways, according to one's political leanings. So, it's very difficult to go from that place of mistrust to a less critical and more appreciative sense of being warned and that being meaningful to someone. I just think it's impossible to see it outside the scope of information, and what that level of trust is in relation to information.

PD: Everything that's been said so far makes a lot of sense to me. As discussed, climate is key here. And for people like me who've been worrying about this for 30 years, it's actually a relief that one is hearing the alarms being sounded now. Until now the warnings have been "phantom intermediaries" (Mort and Michael 1998) – unheard, excised from policy response. For me, it's more about not providing final solutions, but rather providing practical, doable, feasible ways forward. Part of this involves embedding enhanced participatory democracy within the representative decision-making processes (Dorfman et al. 2010). In STS [Science and Technology Studies] and SSK [Sociology of Scientific Knowledge] terms, this represents the co-construction of knowledge, of power – the co-construction of how we do stuff (Latour and Woolgar 1979).

Participatory inclusion set within the parliamentary representative system involves enhanced agency, enhanced trust-bearing. The question is how to do this? Key is being process-driven rather than outcome-driven. If one is outcome-driven, participatory processes tend to fail because people see through it. Real engagement has to be process-driven in order to engender trust, which is absolutely key to everything, and also key to the notion of agency. In other words, yes, it is meaningful to me. It has meaning to me, therefore, I will follow this advice.

AS: Paul, there was something we discussed previously, around the idea of getting used to living with uncertainty and that actually many things can't be modelled. And the more we go into this kind of machine learning, modelling of the future, the less accurate some of the predictions are. Perhaps the way that we understand warning and future needs to be adjusted as well in relation to how we epistemologically respond to the idea of a certain or an uncertain future.

PD: Yes, that's right. Quite rightly, much of our knowledge construction has been built on the logical empirical scientific process, the renaissance idea that "things will get better", things will progress and we will better understand things, we will know things. Yet, in terms of some of our newer key shared dilemmas we seem to be in a position where we both know but we don't know – and this involves coming to terms with uncertainty. Before, there was an element of certainty, now it's also about uncertainty, complexity, indeterminacy, latency – viewed through the lens of interpretive judgement (Dorfman, Fucic, and Thomas 2013). And if there's one thing that the COVID Pandemic has shown us, it's that coming to terms with uncertainty is a deeply problematic epistemological issue in a communal sense. In terms of climate and other human/environmental concerns, it seems important not to oversimplify complex realities. Making peace with and coming to terms with the social, the subjective aspects of science seems central. This seems to be part of where we are: trying to be comfortable with being uncomfortable.

FLC: I absolutely agree with this. I have another question about this idea of co-construction of knowledge and co-creation. So, you know, we are talking about warnings, but actually maybe the process of co-creation of knowledge should happen at an earlier stage, focusing on the knowledge and understanding of risk. Because I suppose it comes down to the differences of position in which we are exposed to risks.

AS: I was just going to say that, maybe bringing it back to Judy's point earlier, the siren is in a sense a deferring of attention, because if I start thinking about all the different levels of risks involved in the world, there are some things that I'm going to understand and some that will go straight over my head. So, I guess we're also talking about different levels of our capacity to actually engage with and understand some of the risks or threats that we're facing in the world.

IR: I think we're coming close to wrapping up, but first I wondered if, Joel, you wanted to respond to Judy's provocation a little while back?

JS: Judy asked about a flood siren and, in a scenario where the town is about to flood, whether we should ask a committee to co-design the warning signal, or whether we should just sound it! Obviously not, the priority would be to do anything possible to avert or reduce imminent danger. However this does not mean we shouldn't also ask the broader question. As Gascia said, we wouldn't want to separate the question of the siren in war from the politics of warfare more broadly. Why is there bombing in the first instance?

JE: That's precisely why it always worries me. Well, we throw out this general question that somehow applies to everything when it doesn't. You've got to look at each little thing in turn, so that's really why I asked you.

JS: I was trying to speak to the danger of generalising about what a siren is, and what a listener is, and point to the need to acknowledge the irreducibility of different contexts. But I appreciate the way in which the urgency of certain situations might render these kinds of theoretical questions problematic.

AS: I really appreciate your point, Joel. But I think, again, part of the trajectory of this project has been to think of the sirens that we understand to be good, maybe because we have enough trust, say, in the medical profession. So, we do think that an ambulance is needed and an ambulance siren is necessary and medical devices maybe don't have to be alarming or fatiguing in the way that they are. But also, we want a doctor to be appropriately alerted to the patient's needs. So that kind of siren is, I think, the archetype of how we might understand other sirens. I feel like what we're really aiming for in this project is a kind of realignment of the siren towards what it could be, a siren that is for care, because ultimately it can be. And in many situations, it is. In other situations, it's weaponised, it's distorted, it's indicative of a coercive form of governance or a racist or apartheid system of understanding who the siren is for, etc. So, I think these diverse sirens do operate within a spectrum that we could maybe try and mould one towards the other, if that makes sense?

## Afterword

The ways in which we listen to sirens are shaped by acoustics, psychology, perception, environment, psychobiology, lived experience, trauma, and politics, and so there is no simple formula for a good siren. Designing and crafting fair, just and efficient alarm systems becomes an increasingly complex endeavour. Sirens can herald war and threaten the vulnerable; good sirens give us an opportunity to escape before the disaster; alarming sounds can jolt people away from danger or may startle them so much they freeze or panic. There are internalised sirens, absent sirens, sirens we have stopped hearing, sirens we do not trust, and sirens we wish we had heard. Sirens compete with each other in our attention economy, and trauma can manifest itself through alarmed responses to any sound or vibration. As listening can become a site of violence itself, perhaps it is not better sirens that we need but better, more inclusive, participatory and interdisciplinary processes to create them. We envision processes where sonic interventions are developed with those affected so that trust can be restored, where the qualities of the sound (and its levels) are not an afterthought but respect people's alarm fatigue and their right to live in an environment that promotes wellbeing. These sirens will come from a source we trust, will not extract our attention as a commodity and will not exert repressive power; they will increase our sense of safety by merely existing, and when they ring, they will indicate a way out. The question of how and when this may even be possible remains open. Perhaps one of the major problems within the siren is its focus on short-termism, emergency crisis management, when in truth many of the risks we face require both immediate short-term responses as well as long-term, preventive and resilient crisis communication and

management methods. Ultimately, one of the most efficient ways forward, as suggested by this roundtable, is that we radically change our design paradigms to incorporate *pre-emptive listening as a process, "listening with the future in mind"*. (Satz 2024c)

## Notes

1. To date these include interviews with the following that will be available at the project's completion via the RCA Research Repository (in addition to the aforementioned Advisory Board members): Khalid Abdalla, Jennifer Lucy Allan, Asantewaa Boykin & Niki Jones, Zeynep Bulut, Daphne Carr, Henry Daw, Arturo Escobar, Carina Fearnley & Ilan Kelman, Jennifer Gabrys, Evelyn Glennie, Eleni Ikoniadou, Adrian Lahoud, John Levack Drever, Erin Matariki Carr, Margarida Mendes, Koji Nagahata, Alison O'Daniel, Rick Prelinger, Mhamad Safa, Hilel Schwartz, Hikaru Suzuki, Jason Waite
2. This last point is articulated by Daphne Carr, organiser and police sound weapons scholar, in Satz' film (2024a).
3. These last questions are articulated by Erin Matariki Carr, Maori legal scholar and activist in Satz' film (2024a).
4. See https://cloud.google.com/blog/transform/can-generative-ai-help-humans-understand-animals-earth-species-project-conservation Last accessed: 19 February 2024,
5. For an example of aural diversity and hearing differences, which need to be considered in sound design, see the infographic at https://auraldiversity.org/infographic.html [Hugill, Andrew. 2022. "Aural Diversity Infographic". Version 1.6 published 23 October 2022. Last accessed 2 April 2024.]
6. This comment was made by Ilan Kelman in the Voice of Warning workshop at UCL Warning Research Centre see https://www.ucl.ac.uk/institute-of-advanced-studies/music-futures/funded-projects/funded-projects-202223/voice-warning Last accessed 19 February 2024.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

## Notes on contributors

*Francesca Laura Cavallo* is a curator, art historian, and interdisciplinary researcher whose work focuses on the intersection between art and the activation, management, and perception of risk. Her work includes writings on Pre-enactment, Survival Manuals, The Aesthetics of Risk, and a decade-long commitment to creating platforms that allow artists, researchers and the public to explore risk through exhibitions, workshops and performances. These have included Brazil Footprint00's festival's three editions (Barbican, Science and Industry Museum and the British Museum) and programmes at Turner Contemporary, Manifesta 11, and the ICA. Francesca is an AHRC Research Associate on Preemptive Listening at the RCA, where she teaches across different departments. She is an affiliate of the UCL Warning Research Centre and an Honorary Research Fellow at the Centre for Indigenous and Settler Colonial Studies, University of Kent.

*Paul Dorfman* is Visiting Fellow, Science Policy Research Unit, University of Sussex; Chair, Nuclear Consulting Group; Member, Irish Govt. Environment Protection Agency Radiation Protection Advisory Committee; Member, International Nuclear Risk Assessment Group. Paul served as

Secretary to the UK Govt. scientific advisory Committee Examining Radiation Risks from Internal Emitters; led an European Environment Agency response to Fukushima; served as Expert to the European Economic and Social Committee; Advisor to the UK Ministry of Defence Nuclear Submarine Dismantling Project; Adviser to the French Govt. Assemblee Nationale relative à la Faisabilité Technique et Financière du Démantèlement des Installations Nucléaire.

*Judy Edworthy* is Professor Emerita of Applied Psychology at Plymouth University. She has extensive experience of alarms research, design, and implementation across the work domain including clinical, process control, and transport. She is author of many of the key publications in this area and has recently led a project to update and improve the alarm signals associated with a global medical device standard. She has also carried out research on the cognitive psychology of music and the design and evaluation of written warnings and safety information. She was the recipient of the US Human Factors and Ergonomics Society Hal W Hendrick Distinguished International Colleague award in 2021.

*Lisa Lavia* is Managing Director of the Noise Abatement Society and conducting doctoral research at Heriot-Watt University. She investigates and develops soundscape practice, education and policy and is a member of ISO working groups on soundscape and non-acoustic factors (NAFs). Recent projects include helping inform development of the Environment (Air Quality and Soundscapes) (Wales) Bill and the Noise and Soundscape Plan 2023-2028, the Welsh Government's first statutory national strategy on soundscapes; advising the UK Government, Defra, regarding NAFs generally and for selected indoor soundscapes; providing oral evidence to the House of Lords "Inquiry into the neglected pollutants: the effects of artificial light and noise on human health". Her research interests include sound, perceived control, mental health, social justice and engagement.

*Gascia Ouzounian* is Associate Professor of Music at University of Oxford and Principal Investigator of Sonorous Cities: Towards a Sonic Urbanism (SONCITIES). Her work is concerned with understanding sound in relation to space, urbanism, and violence. She is the author of *Stereophonica: Sound and Space in Science, Technology, and the Arts* (MIT Press 2021) and *The Trembling City* (forthcoming from MIT Press). Her recent projects include Scoring the City, a series of workshops exploring experimental notations for urban design; the collaborative edition *Acoustic Cities: London & Beirut;* and Concrete Dreams of Sound, a research programme and Open Lab exploring sonic materialities at daadgalerie in Berlin.

*Irene Revell* is a writer and curator who works with artists across sound, text, performance and moving image. Much of her work since 2004 has been with Electra, and she has close involvement with collections including Electra's Her Noise Archive and Cinenova: Feminist Film + Video. She recently completed her doctoral thesis, *Live Materials*: Womens Work, *Pauline Oliveros and the Feminist Performance Score* at CRiSAP where she has taught on the MA Sound Arts since 2014. With Sarah Shin she is currently editing *Bodies of Sound: Becoming a feminist ear* (Silver Press, 2024). She is an AHRC Postdoctoral Research Associate on Preemptive Listening, at the RCA.

*Aura Satz* is an artist who works with film and sound, and a Reader and Tutor at the RCA. Recent exhibitions and events include Kunstnernes Hus; Te Uru Gallery; the Walker Art Centre; Amant Foundation; Sonic Acts; Onassis Stegi; Harvard Observatory; Smithsonian NPG; LOOP Barcelona and more. Her research project 'Preemptive Listening' (2024) was funded by a 2 year AHRC fellowship hosted at the RCA, and culminated in her first feature film. After a world premiere at MoMA NY, the film won the New Vision award at CPH Documentary Festival in Copenhagen, and was celebrated across three days at Tate Modern with a series of associated performances and a symposium.

*Joel Stern* is a Research Fellow at School of Media and Communication RMIT University, and co-lead on the Machine Listening project with Sean Dockray and James Parker, a platform for collaborative research and artistic experimentation, focused on the political and aesthetic dimensions of the computation of sound and speech. Machine Listening emerged out of Stern's previous work, with James Parker, on Eavesdropping, a multifaceted project staged at Ian Potter Museum of Art,

University of Melbourne, and City Gallery, Wellington, addressing the capture and control of our sonic worlds, alongside strategies of resistance. Between 2012-2022 he was Director of Liquid Architecture.

## ORCID

Francesca Laura Cavallo 🔟 http://orcid.org/0000-0003-4041-4999
Irene Revell 🔟 http://orcid.org/0000-0002-5993-3871
Aura Satz 🔟 http://orcid.org/0000-0003-2179-0868

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