**Getting to Know Noisiness: Moving on Concepts and Debates for (Aero)mobilities and Atmospheres**

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We can find other ways to listen to the political, material and aesthetic echoes of air, oscillating in aerography and resonating outward (Engelmann, 2015, p. 79)

Noise composes atmospheric sensibilities. Itself atmospheric, noise amplifies ways of thinking and sensing the atmospheric: as a logics of indeterminacy, as a physicality of the ephemeral, and as an entanglement of air-body-matter (Peterson, 2017, p. 69).

**Abstract**

Aeromobility and air travel are known to produce multilevel experiences of sound, ultimately resulting in social and environmental struggles against noise pollution. Different studies that address aeromobile sounds and atmospheres, however, do so while using highly different concepts, approaches, tools, and methods which often create disconnects between different disciplines and their capacity for dialogue. Drawing primarily on a study of Ben Gurion International Airport, and on a nonrepresentational approach to aeromobile sounds, their experience, representation, and sensing – by people and technologies – this paper provides conceptually informed empirical accounts of different ways to get to know noise, while addressing the gaps they create between different fields of knowledge. The paper concludes that nonrepresentational thinking is a valuable pillar with which shared grounds between academic discourse, practitioners, policy makers, and the public could be progressed, offering wider considerations of noise, its constitution, outcomes, and futures in aeromobile geographies and airport planning.

**Key Words:**

Aeromobilities, Noise, Affective Atmospheres, Noise Pollution, Airports, Planning

**A Introduction**

A growing body of interdisciplinary work is interested in affective atmospheres and their relationship to mobility (Adey et al., 2013; Anderson, 2009; Anderson & Ash, 2015; Barry, 2020; Bissell, 2010a; Gandy, 2017; McCormack, 2008). These studies range from discussions over the experience of mobilities and their spaces and infrastructures in terms of the atmospheres of shared encounters or ‘passenger atmospheres’ (Bissell, 2010a), to what Paul Simpson (2019) has recently called the ‘Elemental Mobilities’ of the weather world and affective ambiences (Jensen et al., 2015) .

 Airports are hubs for mobilities. They serve as important and popular cases to investigate the relationship between mobility, globalisation, infrastructure and socio-spatial relations. Airports are assemblages (Salter, 2008) characterised by mobilities and flows of information, goods, and people (Berger, 2006; Fuller, 2002; 2003), intensive consumerism (Gottdeiner, 2001), technology and virtuality (Dodge & Kitchin, 2004; Knox et al., 2008), and as enacting freedom/surveillance at different levels (Adey, 2004; 2007; Augé, 1995; Chalfin, 2008; Hasisi et al., 2012; Salter, 2004). Airports and aircrafts signal unique kinds of atmospheres ranging from the indifference of their inhabitants, through stressed moments of mobility at checkpoints, to stagnant periods of stillness. Elliott and Radford (2015) and Urry et al. (2016) spend most attention on the engineering of particular consumption focused atmospheres, co-designed to smooth out stressful experiences, even the fears of the security checkpoint. In contrast, Lin (2015) and Budd (2011) have explored the classed and gendered atmospheres of the aircraft cabin.

Approaches which more directly attend to the environmental disadvantages of airports and air travel, consider, inter alia, aircraft noise and the complexities it produces. For example, Budd (2009) gives attention to top-down regulations, geo-political considerations, and legislation, as well as to bottom-up socio-environmental struggles against aircraft noise and pollution which constitute airports, air travel, and airspace, and Oosterlynck & Swyngedouw (2010) re-politicize struggles over aircraft noise in light of the national government of Belgium’s attempts to postpoliticise socio-environmental issues and concerns. While these approaches view the airport as producing complex multilevel experiences, they tend to overlook the affective capacities of aeromobile noise apparent in airports and the landscapes that constitute them and their environments.

It is interesting that approaches dealing with the affective atmospheres of air travel and aeromobility often overlook the issue of noise, as much as approaches that study aeromobility and attend to noise lack connection to the experiential, relational and affective. Noise is a common association with ‘moving things’ (e.g., cars, wind, turbines, and running engines), and as such with airports and air-travel. Furthermore, it usually contributes to the portrayal of the facilities as ‘public-bads’ – heavy infrastructures that may accrue wider benefits for a general public but prove very costly for their host communities (Aldrich, 2008), especially because of rising noise, air pollution and an expanding footprint. In the US and Europe major efforts have sought to reduce the negative impacts of aircraft noise (Nelson, 2004). As a result, the planning and operation of airports and the governance of flight routes now unevenly necessitate policy that purports to collaborate with local communities, examine and investigate potential negative impacts of airports and aeromobility, as well as determine the means to reduce them (May & Hill, 2006).

In this paper we explore how noise encourages us to re-examine the constitution of mobilities and its infrastructures. While we take for granted the footprint of an airport, we tend to overlook the wider confusing ecologies of movement that make up an airport as a complex entity. When an aircraft flies in the sky we can experience its sounding well before, and at other times, well after its apparent visual presence. Perhaps this is an apt metaphor for the disorientating effects of noise, and the disconnect of not only mobility, sound and visual perception, but between how we engage with noise with regard to airports, infrastructures and mobilities. As Evan McDonough (2018) has put this so well, we might say that such a disconnect is fostered by a ‘cognitive dissonance’ between multiple layers of the urban fabric within which aeromobilities move and deform through infrastructures and effects that reach from the ground into the sky. The ways those layers are governed and known seem forever separated, between the abstract ‘governance of the relationship between vertical-expansive infrastructure’, of ‘flight paths projected through the upper layer of the urban realm’, and what he calls ‘the lived experience in the residential areas on the surface of the earth below.’ (2018, p. 140)

The divisions McDonough (2018) expresses are also present in the academy. There are socio-spatial relational studies that tend to examine urban atmosphere in such a way that noise becomes part of a kaleidoscope of senses and feelings made palpable by researchers and participants (Doughty et al., 2016; Gallagher, 2016; Gandy, 2017; Johanssen & Bell 2012; Peterson, 2017; Revill 2013; Sun Eidsheim, 2011). Other human geographers study the relations between sounds and space in different urban settings, focusing on nonrepresentational studies of geographies of sound (Doughty et al., 2016; Duffy et al., 2016; Gallagher & Prior, 2014; Kanngieser, 2015). Gallagher (2016), for example, traces sonic affects as vibrational movements and their unfolding to sensations, perceptions, feelings, and emotions depending on context, and Kanngieser (2015) offers several propositions of sound with which it becomes possible to ‘…challenge hegemonic and violent forms of subjectivation; forms that have produced this Anthropocene moment’ (p. 80). Other studies enquire about the association between sensing bodies and the experience of sound, specifically with regard to how these experiences produce urban places (Berrens, 2016; Pink, 2008; Simpson, 2011; Thibaud, 2011). While not necessarily attending to the unique attributes of aeromobile noise, these approaches provide novel tools to think about and analyze the complexities urban sounds bring about.

Yet, these studies’ approaches seem incommensurate with other – often more positivist or practical/professional – disciplines. Policy studies on noise and approaches favoured by airports themselves, often draw on more ‘hard’ sciences to make positivistic arguments. They tend to be pursued through disciplines such as engineering and transport planning in which individuals or communities are often viewed as passive consumers of planning and policymaking. Noise, in these contexts is derivable from objective measurements, systems of sensors, made visible through contour maps and is potentially governable through policy, legislation and regulation.

And yet, both these discussions of noise have shared interests; they make an effort to *listen* to sound in order to make it a palpable, apparent, or present phenomenon to address. They attempt to understand how sound interacts with people even if, alas, they draw on highly different concepts, tools, and methods for tracing these engagements and their outcomes.

The paper draws primarily from research conducted between 2013-2016 on Ben Gurion International Airport (NATBAG) expansion project tracing the associations between humans and more-than-humans which participate in the planning process of the airport. NATBAG presents an interesting case of an international airport, which, like other airports, it is operated as a contested site where multilevel interests are simultaneously at stake.[[1]](#endnote-1) The planning process of its expansion began in the 1970s and is still ongoing. Using content analysis and in-situ in-depth interviews,[[2]](#endnote-2) the study focused on the affective registers of aircraft noise and their relations with human bodies as well as with the urban atmospheres of ‘noise-polluted’ areas. By in-depth interviews, connections between various actors and actants initiated and maintained through the NATBAG planning process were traced. Following snowball sampling, 23 informants were interviewed: officials, opposition communities’ representatives, and activists. Since interviewees have emphasized data derived from official sources, content analysis formed an integral part of the scrutiny to include analysis of outline plans and blueprints, governmental committees meeting protocols, surveys and economic reports, newspapers’ articles, court rulings, and Facebook pages of communities struggling against NATBAG expansion.

Along with the Israeli focused observations, the paper provides wider accounts of getting to know aircraft and airport noise – what we call aeromobile noise – as a way to bring insights and a conversation between different perspectives. Thinking with Marina Peterson’s (2021) writing on atmospheric noise and attunement, we examine moments of noise ‘consumption’ as apprehended by different actors, noise definitions and measurement, its representational and nonrepresentational attributes, transformations of sound to noise and vice versa, the atmospheres derived by noise, and the methodologies in use for attending to noise. We try to find shared grounds from which academic discourse, practitioners and policy makers could benefit.

 The first section addresses interdisciplinary studies of airports, their planning, operation, and environmental impacts. The second part addresses nonrepresentational studies of sound, noise and mobility and their potential to the research of aeromobile sound and noise. The empirical discussion *Making Noise: People, Senses, Metrics, Technologies* explores a less divisive and more sympathetic approach to the way airport and aviation noise is measured, made sense of, navigated and countered. The paper concludes that the myriad ways to get to know and attend to noise contribute to the disconnections between disciplines that study noise. However, it is suggested that a nonrepresentational approach to noise and mobility could provide some commensurable grounds on which the varied fields studying the becoming, outcomes, and future of noise and aeromobilities might build.

**B Noisiness: airports, infrastructure, mobilities**

In this section we set up some of the impasse we see within contemporary research on airport and aeromobility noisiness. In the second part we suggest that turning to some aspects of nonrepresentational theory can help us to understand how sound and noise can be variably sensed, felt, known, understood, referred to, and through that we reconsider the divisions between different approaches to noise.

***Airport Studies, Infrastructural Mobilities and the Social Construction of Aeromobile Noise***

Since the late 1990s, airports have undergone a surge of interdisciplinary interest in study. Not only seen as major economic nodes in urban-regional and national development (Blanton, 2004; Gillen, 2011), airports have been recognised as extraordinary interchanges of mobility and the performance of identity (Adey et al., 2012; Elliott & Radford, 2015; Shilon & Shamir, 2016), as well as key sites of security and protest (Adey, 2004; Bröer & Duyvendak, 2009; Salter, 2004; Suau-Sanchez et al., 2011). Although airports raise multiple considerations for their planning and operation, binding together multiple domains (Boucsein et al., 2017), the field of airports studies has been distinctly bifurcated along disciplinary boundaries. These boundaries tend to run along disciplinary lines that relate to different engagements of disciplines and scholars with concepts, methods, policy and policy debates. Within this wildly differentiated field, approaches towards mobility and sound vary markedly.

Planning literature often provides models of airports in relation to the urban environment and depicts possible impacts of airports on regions/cities due to their location, functionality, and socio-economic benefits/disadvantages: Blanton (2004) deals with the potential of airports as engines for urban growth, Gillen (2011) and Van Wijk (2008) focus on policymaking and governances in regard with the economic potentials of airports for different urban settings, Freestone and Baker (2011) review airports’ typologies and models as shaping urban forms, and Knippenberger (2010) and Schlaack (201) address the ways airports are integrated and interacted with cities and regions. Environmental and noise experts tend to provide cause-effect analyses of airports impacts, such as aircraft noise and public health analyses (Black et al., 2007; Franssen et al., 2004; Stansfeld et al., 2005), noise management and control (Clarke, 2003; Netjasov, 2012), and aircraft noise modeling (Ozkurt, 2014; Sari et al., 2014; Zaporozhets & Tokarev, 1998).

On the contrary, studies of social scientists (e.g., sociologists, anthropologists and human geographers) often provide conceptual and theoretically driven and sometimes phenomenological accounts of airports, mainly in regard to the airport as a lived space, along with the production of social identities and differences (Adey et al., 2012; Chalfin, 2008; D’Andrea, 2006; Elliott & Radford, 2015; Shilon & Shamir, 2016). Airports have been understood within theorizations of global places (Augé, 1995; Horvath, 2004; Lecomte, 2013), and as the quintessential sites through which mobility and flow can be examined (Fuller, 2002, 2003; Knox et al., 2008; Dodge & Kitchin, 2004). Aeromobilities, from these perspectives, are subjective, experienced and lived both by individuals and collectives whether in constant movement or in more stillness. Airport noise is less tangibly examined, except perhaps in Dutch sociologist Christiane Bröer’s (2002) genealogical research on the social construction of airport noise in the Netherlands (see also Cidell, 2008).

Bröer’s work was crucial in attending to the semi-realist assumptions she saw underpinning sociologists of risk such as Ulrich Beck, and the apparent unproblematic relationship assumed between aircraft noise or ‘dose’ and the apparent ‘annoyance’ of communities to that noise. As she explained:

Aircraft noise intrudes into socially constructed silences. In the first fifty years of aviation, this was hardly a problem. The sound of aviation induced admiration and fantasies of luxury. On Sundays, people flocked to airports to find out about the extravaganza of the jet set. In the sixties, Amsterdam Airport Schiphol was the largest tourist attraction in the Netherlands. It attracted about one million paying visitors a year (Dierix & Bouwens, 1997). These days, aviation is much less a sign of progress. At least, it is now strongly debated. Annoyance has become an accepted social problem (Bröer, 2002, p. 2).

Bröer suggests that the dose-annoyance circle was produced by political technologies that attempted to anticipate it becoming a problem. For Bröer this is suggestive of noise as a ‘social construction’, in that it ‘turned sound into aircraft noise’ which essentially meant the way sensations as a result of a propagating wave were transformed into a political ‘problem’, and ‘through the political practices that were meant to contain a problem in the first place’ (Bröer, 2007, p. 50).

 As Marina Peterson has remarked in her research on LAX, airports are actively trying to reverse this process through almost the same technique of mapping sound contours and through sound data recorded by microphones which pits a putatively objective measurement of ‘sound’ against subjective complaint of ‘noise’. As one airport employee tells her, ‘We want to turn noise into sound’ (2017, p. 78). Peterson concludes that ‘now inscription supersedes perception’ (p. 78).

 It might seem then, that the impasse we have identified within policy, practice and academia is an unsurprising one, and the product of incommensuarable epistemologies and ontologies. But we want to suggest that these different approaches towards airport and aeromobile noise and sound could work more productively together. To do so, we turn to approaches derived from nonrepresentational theory and aesthetics that might *mobilise* how we know and – following Peterson (2021) – ‘attune’ to aeromobile noise. With this turn we attempt to provide a wider ground or sympathetic base for policy, practice, and academic theory and research.

***Attuning to Noise:******Nonrepresentational Approaches to Mobilities, Atmospheres and Aesthetics***

Interdisciplinary researchers are now drawing on nonrepresentational approaches to study the background of our daily lives. That is by addressing actors’ practices, instead of solely re-presenting what actors think, perceive, and articulate (Vannini, 2015). Attending to the shared background conditions of our lives, means to attend to the varied practices that constitute both the back and front, sensed and articulated, the tacit and represented. An important development in the study of affective atmospheres is the focus on sound and noise (Doughty et al., 2016; Goodman, 2012; Hemsworth, 2016; Peterson, 2017).

Noise holds together an important complexity; as much as it is an accessible and a well-known phenomenon, it is also unresolved, consisting of singular and plural, subjective and objective, big and small, proximate and remote attentiveness. Noise constructs socio-spatial relations and reflects social differences as it engages with multiple aspects of mobility; social, physical, environmental, and political as both mobile and *mobilizing*. Noise is the product of material mobilities such as the drone of an aircraft engine, or the roar of take-off. Noise is a mobile material object that moves social relations, emotions and bodily affects. Noise may even displace communities and populations. And noise certainly mobilises individuals and communities into political action.

For J-P Thibaud (2011), the sounds of place beckon particular bodily and non-human attunements, such as in practices of hearing, listening in, and tuning into the ambience of a place. Sound, as with notions of ambiance and affective atmospheres (see Bissell (2010b) on vibratory attunements), comes alive with its capacity to resonate. To sum up: there is no sensation without vibration and resonance, whether it be sound, light or texture (Thibaud, 2011). Thibaud goes on to elaborate how sounds are shared, public things, ‘expressions’ of what he calls, quoting at length from Gernot Böhme (1998), a particular way of living together. Approaching noise from an affective perspective, should include attending to its multiplicities as sensual, social, subjective, representational, inscribed, consensual, evolatory, and material – what Peter Merriman (2018) has highlighted as molecular, material mobilities.

Innovative inquiries examine sound and noise as integral to atmospheric conditions of urban places, to place-making and to mobilities in the city (Berrens, 2016; Doughty & Lagerqvist, 2016; Duffy et al., 2016; Gandy, 2017; Peterson, 2017; Pink, 2008; Shilon & Eizenberg, 2021; Simpson, 2011). For example, Duffy et al. (2016) suggest that we consider how our bodies interact with sound and particularly the movement of sound. They focus on visceral or gut reactions to investigate the lived experience of sound on-the-move. Moreover, following Thibaud’s (2011) engagement with Böhme, as an expressive and active constituent in ways of living together, it should come as no surprise that sound mediates social relations and mobilities. It can bring them together – people honking their horns in shared expression or protest at something, just as it can pull them apart – people honking their horns at each other. Efforts to regulate or curtail sound may mean aestheticising particular ways of life, privileging some while denigrating others.

 A wider and perhaps more mobile address of air and the technologies that meteorological scientists, engineers, and societies have developed to measure and navigate noise, have been offered by other researchers as methods or modes of listening, which may even displace the agentive practice of listening to the technology and its assemblages itself. This, we think, might help us differently pattern the concern of each mode of encountering sound, from positivist, policy-relevant metrics of sound, to the phenomenal, ethical listening subject who encounters it as nuisance.

Several bodies of scholarship can help us here. Sasha Engelmann suggests of the MIR balloon that technologies can listen to, sound-out, and translate received signals into representational forms (Engelmann, 2015, p. 78). In this sense, both machine and people ‘listen’ actively. For Engelmann, and with her collaborations with Derek McCormack, there may not be such a dissonance between what we have previously seen as incommensurable apprehensions of noise. As McCormack has written on remote sensing, we could see technologies that try to sense sound not necessarily as objective, ‘elevated’ forms of ‘capture’, but rather as ‘a set of mobile and modest techniques through which affective materials are sensed without direct contact or touch” (McCormack, 2010, p. 641). Engelmann and McCormack identify not simply listening technologies, but rather apparatus performing, ‘a heterogeneous, distributed field of sensing and feeling (Rànciere, 2004)’ that occurs ‘across bodies and devices and the lines, tethers, and relations that hold them together’ (Engelmann & McCormack, 2018). They share concern for the technological construction of noise as a thing to be concerned with, as Bröer explored earlier in relation to airport noise, but in ways that combine macro and micro political concerns and that aligns embodied subjects to each other in collaborative networks. Thus they connect, social constructions of meaning, technical performances of materials and technologies, and the micro-geographical embodied and collective sensations of noise and concern.

In analysing how music is produced rather than listened, Paine (2015) similarly puposes the techno-somatic dimension as a concept with which to reconsider the engagements between humans and technology in the case of music performances. Recentering technology as a significant participant in music production, Paine suggests that the dynamic relationship between the musical instrument/interface and the human body is of a reciprocal extension that produces the performative act. Finally, Egan et al. (2020) refer to the ways in which more-than-humans, and particularly birds react to noise made by drones. Instead of focusing on humans and their ecologics alone, the authors attend to the atmospheres, registers and capacities of sound and noise as they are being experienced by animals.

Just as much as noise may make sound palpable among irritated, vibrating, resonant bodies of those who occupy a home under a flight route, we should not discount more technocentric practices of listening and sensing from the same concerns. For not only do they become parts in the social construction of noise, but they too, suggest Engelman and McCormack, provide ‘the conditions in which different forms and entities emerge as potentially palpable matters of ethical and political concern’ (Engelmann & Mccormack, 2018, p. 4). Rather than pitting them against each another, there is a possibility to re-connect the phenomenological apprehensions of aeromobile sound with the technocratic practices and constructions of measuring, listening and sounding. As Peterson (2021) writes recently about the metrics of aviation noise monitoring in her genealogy of airport noise and noise monitoring in the United States from the 1950s, in much the same ethos, she suggests that we might see such technologies of abstraction and representation as much more than ‘their aspiration as representation’, but rather riven through with feelings that somehow:

‘hang on the side of graphs; pushes into sentences, explanations, and definitions; and lurks under floorboards or in disrupted radio and television signals. Fixed in a rather nebulous field of affect, sound level, and time, inscribed in measurement systems that are more of less opaque, objective, and predictive but perhaps further from experience’.

Feelings such as annoyance, Petersen argues, ‘resonates across perception and inscription’ (2021, p. 53).

**C Making Noise: People, Senses, Metrics, Technologies**

In this section we investigate multiple ways of getting to know noise while considering the complexity of noise and mobility as research subjects, and the different ways people, machines, tools, technology, and data can relate. Altogether, deconstructing the concept of noise to attend to its affectivity could illuminate its development and participation in producing mobile socio-spatial environments.

***Annoyance: measures of noise***

In Israel, the awareness of noise as a potential environmental and political issue seems to have followed a similar genealogy to that explored by Bröer in the Netherlands and Peterson in the United States. Particular technological, representational and legal processes of measuring and acknowledging sound would produce aircraft and airport sounds as a political issue. The first Annual Report on the Quality of the Environment in Israel under the Environmental Protection Service, in 1973, recognised that noise was only just becoming understood as a problem, stating that, ‘The essence of noise in Israel as a social problem has not yet been made known to the public and quiet has not yet been acknowledged to be a human and cultural value’ (quoted in Kretzmer 1978). Wider sound and nuisance law and regulations would modulate the apparent role of ‘objective’ and ‘subjective’ determinants of whether sound or noise had occurred, and in ways which troubled the apparent distinctions between objective measure and social scientific understandings of qualitative experiences.

In a legal discussion of Nuisance Abatement Regulations which were introduced in 1977, one commentator sees these divisions *fogging* up through poorly defined legal arguments, one of which set conditions for how subjective experiences could be drawn on as evidence, in relation to apparently neutral measurements. While ‘unreasonable’ noise was prohibited by using contextually specific standards, interpretations of the necessary burden of proof shifted from citizens being ‘obliged to move about with measuring devices about in their pockets’ according to one scathing judgment. For some the law divided tests for ‘unreasonable’ noise, and what noises could be deemed a disturbance by being ‘disturbing’. The ‘unreasonable’ noise was meant to require an objective test against a prescribed limit, and what was disturbing a subjective one, albeit with a mechanistic, objectifying provision that the disturbance test, ‘needs to be checked according to the standard of the reasonable man and not the specific sensitive one and in so doing there is an objectivization of the disturbance test’. For Rosenthal, ‘The inclusion of a “reasonable man” standard into the so-called subjective test’, was particularly problematic bringing a manner of atmospheric confusion for it ‘*clouds* what would have otherwise been a clear and logical division’ (Rosenthal 1985, p. 85, our emphasis). It was, he explained, ‘chimerical judicial creation which is simply not consonant with any modem nation’s variegated population and needs’ (92), and performs what Petersen identified as ‘folding in the subjective nature of noise’ in order to appear objective (Peterson, 2017, p. 77), hence producing a general listener - a ‘public ear’ (2017, p. 77) albeit with some caveats.

The application of the legal framework into litigation between the residents of Bnei Atarot who were affected by a new runway at Ben Gurion in 1977 (State of Israel vs Benei Atarot) became an early test case of the regulations, even if the provisions were not intended to be used for aircraft noise. The case of Ben Gurion International Airport further exemplifies that annoyance relates to different communities’ awareness to noise, their statutory rights to complain, their access to data, and their capacities to fight for their rights.[[3]](#endnote-3)

As the regulation of aviation noise evolved in Israel, the state borrowed specific policies and practices from the Federal Aviation Authority (FAA) of the United States, which regulates aviation sound drawing on instrumental discourse, to take noise as an objective phenomenon that under certain conditions needs to be regulated. The Day Night Level (DNL) is the FAA’s primary noise metric, that is: ‘…the cumulative noise energy exposure of individuals to noise resulting from aviation activities’ (11-2). DNL is a logarithm that averages aircraft sound levels at specific locations over a complete 24-hour period, with a 10-decibel (dB) adjustment that is added to noise events between 10:00 p.m. and 7:00 a.m. the following morning.[[4]](#endnote-4) The reason for adding 10 dB to night noise events is that at night – when we are perhaps less mobile, and more attuned to unwanted sounds – the general noise from the environment is lower by about 10 dB. Therefore, every noise disturbance at night becomes more of a problem for individuals as it can be ‘heard more’. The DNL metric goes someway to understanding that sounds are sensed, felt and made sense of at different times of the day, and in so doing, is a minor gesture towards the difficulty of attending to noise, to its in-betweeness as both subjective and objective. DNL, in quite blunt ways, relates sound to individual perceptions and experience, as well as to different spatial contexts in a broader ecology of movement and noise.

The 1992 Federal Interagency Committee on Noise (FICON) report recommended DNL as the preferred metric for measuring aircraft noise exposure (11-11).[[5]](#endnote-5) In 2001, ICAO adopted a derived formula of DNL, which replaces all the historical noise metrics of the EU.[[6]](#endnote-6) DNL is used in many airports around the world and in Israel it is the leading metric to draw on to abate noise. That is to say that DNL, often regardless of context and location, determines the level from which aircraft sound becomes a ‘nuisance’ for people hearing it. In the US a 65db threshold is used, but this is often criticized because the measure is an average which smooths out small numbers of very noisy aircraft sounds, or what could be very large numbers of less noisy aircraft (Schmidt, 2005).

In the Israeli National Planning and Building Council meeting protocol from 21.10.96, Prof. Joseph Ribak, a professional specialising in environmental and occupational health who participated in the meeting, defines noise as ‘An unwanted sound that has a different meaning for different people at different times’ (p. 3). Further, Prof. Ribak explains that:

Being *annoyed* by noise is not the result of the actual noise alone but of several factors. It is also *the fear* of aviation, that is, the fear of aircraft crash, or the *feelings* towards the value of the noise (p. 9, our emphasis). [[7]](#endnote-7)

In this sense the propagation of the sound wave and its perception by human subjects is a far too abstract notion of movement and noise. Similar to common dynamic sensations surfaced in aeromobility by varied weather conditions which can be regarded as accepted and expected phenomena or not (Barry, 2020), sound and noise are registered through a multitude of feelings and experiences that when they are held together they create a certain atmosphere than can be regarded as annoyance. Rather than in NATBAG alone, the affective registers of noise are also seen in the wider contexts of other international airports as well, especially within public protest and political activism. The Stop Heathrow Expansion (SHE), for example, outlines affective tones which airport and aircraft noise produce, with potential long-term impacts on well-being and even educational attainment.[[8]](#endnote-8) Publics are called to sympathise with the ‘misery’ of a young family’s life between ‘oppressive’ flight tracks. A resident is quoted ‘How can I be sane? . . I'm on the edge of breaking. . . it is so bad’.[[9]](#endnote-9)

Both official metric and public complainants thus sense and produce different measures of sound. If the DNL might be seen as a way of abstracting sound to ‘noise’ volume averages, to see this as perhaps outside an emotional or affective space would be too simplistic. Publics mobilise sounds, sometimes through metrics like the DNL which may be contested as the airport’s own DNL – ‘their *DNL*’ – explained one former representative of a community within the vicinity of NATBAG (also cited in Shilon & Kallus 2018). Thus, atmospheres of noise polluted areas are regularly elevated through words that excite emotional reactions. Attending to noise with an affective discourse produces empathy and the proximity of different people to the multiple and disturbing outcomes of noise.

 In opposition to the attempts to standardize noise, in practice people’s bodies dynamically respond to noise, especially to indefinite noise nuisance, like the case of mobile aircraft which dynamically make noise at different times and in different locations. In this sense, the perception of sound becomes not only a sensation of noise, nor is it an admission of vibrations being thrust through the body – to invert Bissell’s (2010b) discussion of the vibrations of train travel. It is rather a generative apprehension of mobile objects – a literal tuning in to movement in both an embodied but also technical attunement to the mechanical processes of the aircraft, as one participant responded: ‘We can clearly differentiate between takeoffs and landings. When an aircraft lands, it makes noise really towards the end when it brakes, while during takeoff the engines are in full power all along the takeoff’ (Lod Valley Regional Council CEO, 02.11.14).

And yet, it is not enough that people sense it. Noise regulators and airport operators task themselves to sense noise by more ‘objective’ means such as monitoring machines that track noise and can provide representations of it – as if to validate that sound as noise, and therefore, as a potential unreasonable disturbance. The responsibility for providing evidence for noise is divided between policy bodies on different levels (e.g., national and local authorities), technology, and people’s sensing bodies. However, both forms of sensing are surprisingly involved in one another. Both are ways of attuning to sound, to registering it and inscribing it, even if the blurring of sensor – bodily or technological – is still perhaps outweighed by the technical preponderance of airport authorities who use networks of air sensors and increasingly maps to discipline and regulate their production of noise, and the way air crew navigate their aircraft’s movements over and around monitoring sites. One map that co-constitutes noise is the Noise Abatement Procedure Map that directs pilots flying from and to Israel (see Figure 1). The black and white circles mark the location of noise monitors, while the pilot knows the exact degrees of the flight route to be taken to avoid alerting the monitors. Although they cannot sense the noise in the way it is sensed by people or monitors on the ground, noise can be generated physically by the pilot’s own actions.

**FIGURE 1 HERE**

***More-than Representing Noise and ‘Vernacular Mappings’***

While DNL metrics might work between or as more-than subjective and objective apprehensions of sound, noise also takes on other atmospheric qualities as ‘pollution’ which makes it in some ways harder to pin down. The Israeli Ministry of Environmental Protection both categorizes noise as a ‘unique’ and different type of pollution. Peterson sees the material-imagination of noise pollution as drawing on other ‘fundamentally atmospheric’ registers of which sound may in-fact have little physical comparison – not ‘of air, is not air’ and ‘hardly a thing’ (2021, p. 79) – but which renders its stubborn, immersing, insidious qualities by an indeterminate materiality or energy. Noise does not stay in the same way chemical or contaminants might, but it nonetheless leaves its trace on bodies. As the Israeli Ministry of Environmental Protection suggests: ‘there is a significant gap between the public expectations of noise mitigation and the priority that is accorded to noise by the authorities’, and that gap, they purport, might be explained by noise pollution’s unique status as originating from multiple sources: being subjective and objective, very local, and produces effects, both for humans and the environment, which are not immediate.[[10]](#endnote-10) While this indeterminate status might undermine the claims of noise’s presence, it also implies that noise pollution is unique because of its complexity resulting in the incompetency of regulative authorities to abate it. Because of such indeterminacies in the spatiality and location of noise, other forms of ‘inscription’ have been used to show and visualise aeromobile sound.

The Integrated Noise Model (INM) of the FAA produces DNL noise contours: INM is a computer model used to develop aircraft noise exposure maps. INM uses a database of aircraft noise characteristics to predict DNL based on user input on the types and number of aircraft operations, annual average airport operating conditions, average aircraft performance, and aircraft flight patterns.[[11]](#endnote-11) Since their introduction in the 1970s noise contours have become a ubiquitious approach to representing actual and projected noise levels produced in the vicinity of airports, and on the flight ‘tracks’ the aircraft take.

 According to *FAA Desk Reference 1050.1F*, inscriptions of existing aviation noise conditions for land use and zoning should include, inter alia, noise contours of 65, 70, and 75 dB (see Figure 2).

**FIGURE 2 HERE**

Following these standards, the NATBAG contour map is a powerful representational tool. This noise contour map binds together the presence and absence of noise; the aircraft and the surveyor are only present to mark the contours at particular times, and in specific (yet, changing) locations. Despite their apparent stasis and abstraction, the contour maps are, perhaps, mutable and mobile in a different way (Presti, 2020). The map is provisional. While it seems to hold together past, present and (possible) future communications of aircraft in the sky with human and more-than-human bodies on the ground all at once, in practice the relations between aircraft, engines, air, atmosphere, monitors, and human bodies, or ultimately ‘noise’ constantly change. Rather than reify the pretensions to objectivity, and let the lines ‘do the work of holding apart abstraction and experience’, we see other ways that noise contours might work and be mobilised, or ‘taken for a walk’ (Gerlach, 2014, p. 26).

 Without reading the legend or the text accompanying the contours and colors, it seems that these representations can evoke an intense feeling especially through what Beyes (2017) has called their chromatography, ‘theorizing colour’s efficacy without enacting a clear-cut split between perceiver and perceived’ (1468). While perhaps not an ‘atmospheric whirl’, the colour lines of the noise contour impress and provoke bodies and communities but the affective intensities of colour are also ‘as pivotal to the organization of lives and bodies’ (Beyes & De Cock, 2017, p. 69). When transforming from green to red as noise levels rise, and through different sets of actors, even if the contour line is static, it is not felt to be still but moving and vibrating. The Director of the Environmental Protection Division at Ben Gurion International Airport emphasizes a particular color that is an important representational tool for her work: ‘… we are obliged to create an updated noise conditions map. What’s important about this map is the blue line of 65 DNL, because it determines whether new buildings are entitled to acoustic shielding. Every year I must check if there were any changes’ (21.05.15). The blue color is a reference point for her responsibility as it serves as an organizational and regulatory tool for the built environment around the airport.

Residents fighting against aircraft noise and its distribution seem to underline colours by aligning them with how they experience noise on their daily lives. In the 11/05/15 meeting of the Public Committee for NATBAG, the 2014 noise contour map was presented by Dr. Anat Rosen, Chairman of the Professional Committee for NATBAG (see Figure 2). One resident responded to the map, comparing how she feels aircraft noise with the coloured map: ‘…the area within the green line [denoting the areas of 60 DNL] on the map should be much wider to all sides’. As Erin Manning suggests, colour ‘is never a representation of movement, nor is it a projection of movement. It is a moving-with of perception in the making’, perhaps a ‘feltness of seeing' (Manning cited in Beyes, 2017, p. 64) that the resident could accord with and make suggestions to. In this sense, the green contour was not simply inadequate to her experience, but in its very disjuncture from experience it also moved her. Yielding its own ‘vitality and vibrancy’ (Peterson 2021, p. 71), the disconnect is *moving*, ‘a gap opened between a feeling of annoyance and the visualization of metrics’ (74), the gap itself becomes pulsing and annoying. Airport sound maps mobilise communities to the extent that Peterson suggests the noise contour maps, in their lines and forms, and thermoception of colours, ‘are zones of intensity that flicker and buzz as active objects of engagement for engineers and others concerned with noise and its control’ (2021, p. 52).

Live maps supplied by websites such as Flightradar24[[12]](#endnote-12) are more recent apparatuses that serve as mechanisms for representing real-time aircraft movements to citizens or communicating data, sometimes as means for transparency. In these maps, one can see aircraft moving around the world, or aircraft flying directly above them, explore altitudes, speeds and atmospheric conditions such as wind and temperature, and locate and compare flight routes and number of aircraft per hour. In this sense, the community’s engagement with aircraft sound and flight tracing maps performs an additional assembly of knowledges and technical information than that we might have assumed (Cidell, 2008), but neither are they really a kind of ‘counter map’. Rather, in their provisionality and gestures towards movement, we might consider them in the terms Joe Gerlach calls ‘vernacular mapping’, for their ‘convivial performances of mapping into knowledge’. The noise maps ‘put at risk the divide between scientific and lay knowledges (2014, p. 32).

While in Israel, aircraft noise is only represented to citizens in a monthly report provided by the Israel Airports Authority,[[13]](#endnote-13) many airports now deploy aircraft flight tracking and noise monitoring mapping software which allows residents to compare sounds they have heard with recorded locations and movements of aircraft, and the noises recorded by the monitoring sensors.[[14]](#endnote-14) These systems enroll human bodies by their remote engagements with aircraft: first, instead of engaging policy makers, they target inhabitants and investigate if their senses comply with monitoring and tracking systems and act upon these explorations – what Peterson sees as a confusion of aerial attunements, a ‘somatic shifts into another mode of inscription that is trusted for its reliability and objectivity’ (2021, pp. 43-44). Second, and resulting from the first, citizens are called upon to use their capacities to observe, analyze, comment and take action. Third, by means of representation, authorities do appear to be making efforts to be transparent and taking positive actions to provide solutions to communities’ ‘misery’ by being attuned to how inhabitants sense noise and in turn enable them to be heard.

On the other hand, these tracking systems can also be understood as mediating the sky to the public under the control of western policy bodies and agencies (Lin, 2017) through the enrollment of people as sensors, but the consequences may not go beyond tokenism. Even as people become technologies of sensing they may still have little option for redress, or to meaningfully re-shape the geographies and mobilities of aircraft. Instead, noise maps might appear, as Peterson suggests, to be rather resonating in a ‘viscerality of abstraction’ (2021, p. 47). The maps perform a sharp disjuncture or dissonance between very differently somaticized forms of listening, and this may constitute some of the most contested aspects of these policies. For Peterson ‘the metric begins to become the world, an expansive and capacious representation that becomes, itself, an intensity’ (2021, p. 53).

Within Israel’s context, different communities have uneven power to accept or reject such inscriptions. The head of the NATBAG expansion planning team explained that Kfar Chabad, an ultra-orthodox community of less than 7000 people located in the airport’s vicinity, has demonstrated the biggest opposition to the airport’s expansion plan, despite their attempts to model – and thereby anticipate – the infrastructural sounds and sights of the airport. Instead of building an interchange that would bring passengers directly into the Departure’s terminal, everyone who wishes to enter the terminal must take a 11km bypass in order not to be seen or heard by Kfar Chabad residents on holy days:

The rabbi said: ‘They shall not ride this holy ground’… [we made] a model that shows how Chabad’s residents won’t see or hear anything… there was supposed to be a tunnel for the airport train, and six meters above the cars’ road a rampart with a park on top of it. Finally, the plan was approved, but the interchange was never built (22/10/14).

While the remote sounds of a tunneled train would not be likely to bother people, some communities have been highly concerned by this noise and despite their size, have been successful in defending their community from the airport’s expansion.

**D Conclusion**

Noise is a complex phenomenom. Getting to know noise can significantly vary between different bodies, machines, tools, perceptions and experiences that move and flow together as material mobilities and in the course of producing and constituting aeromobilities.

By reviewing different approaches to airports and aeromobility, known to have major negative environmental consequences for urban conditions due to what has become known as ‘noise pollution’, the paper demonstrates how interdisciplinary studies differently engage with policy debates around noise production, its experience and regulation, and communication. By providing empirical accounts of ways to get to know aircraft and airport noise by regulations, different tracings and representations of noise within technologies of mapping, affective experiences, and sensing machines and bodies, we demonstrated that noise is known or ‘attuned’ (Peterson, 2021) to through a variety of registers, senses, machines, metrics and representations. Each makes noise and movement palpable, either to our body or to an instrument depicting a number, wave form or contour line.

But while these sensing bodies register, attend to, and know noise, they know it differently and rarely link up. They have been treated as incommensurable ways of knowing, apparently divided between the objective and subjective, but also meaning, representation and practice, body-knowledges, perceptions and the somatic, and this may in part help explain the disconnect between the authoritative, instrumental and policy bound ways of knowing with the more fleshy, lived, and other distributed and aggregated sensors that know noise at a distance. Across these assemblages of sensing and measuring and recording, affect flows in the form of annoyance, interest, excitement: ‘As metrics are made and refined, rejected and reproduced’, these feelings, writes Petersen, percolate ‘as intrinsic to noise and as an effect of its perception, as an axis of quantification and an overall framework for interpretation’ (Peterson, 2021, p. 52).

The ever-growing mobilities in and between cities and urban areas and the complementary development of infrastructural lives (McFarlane & Graham, 2015), bring about complexities in terms of planning, developments, and outputs of current urban forms (Flyvjberg, 2014). Drawing on the case of airport, aeromobilty and aircraft sounds and the myriad ways to address these, this paper suggests that what seems to be incommensurable could actually be closely associated. A common ground with which to approach noise and its multiple attributions is to attend to the background conditions of our daily living; the nonrepresentational, affective, and atmospheric relations that constitute the more symbolic, perceived, articulated and represented attributes of noise. That is to trace the more immediate, somatic, and affective experience of sound alongside the representational, objective and documented noise that produces other attunements to sound which are almost always ‘clouded’ by affective and atmospheric relations. Rather than differentiating between the technical, personal, symbolic and nonrepresentational attendances to noise and mobility, a nonrepresentational approach enables us to address these different practices of knowing noise productively together. With this approach we hope that researchers, practitioners and policymakers will provide more encompassing understanding of a phenomena that has a major influence over contemporary urban environments. The multiple considerations of noise and the different ways it is possible to know or attune to it can bring multiple apprehensions of aeromobile noise together, and as a result more encompassing, pertinent, and sustainable solutions.

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**Notes**

1. Although NATBAG and its planning are also immersed in a geopolitical context, this paper focuses on NATBAG as a case study of a long and cumbersome planning process that closely ties together aeromobility, noise, and planning procedures and considerations. [↑](#endnote-ref-1)
2. The study was approved by The Technion Research Ethics Committee for Behavioral Sciences (approval No. 103). All informants signed a letter of consent. Usually, informants agreed to be referred to by their real names. Otherwise, we have used pseudonyms. When interviewees are cited, the date of the interview appears next to the citation. [↑](#endnote-ref-2)
3. Natbag’s noise is distributed among Arab and Jewish communities and cities adjacent to the airport vicinity, and yet, the harms of aeromobile sounds, noise disputes and complaints in the context of the airport have not so-far been well understood in the context of Arab marginality or exclusion. Our comments extend mostly to the experience of Jewish communities. Of course, it is documented that Arab communities are marginalised in other ways by Natbag’s daily security operations (see e.g. Hasisi et al., 2012), and by one of the airport’s objectives in serving the Israel Defence Forces’ air force in any time of need, emergencies, and wars (Berger, 2006).  [↑](#endnote-ref-3)
4. *FAA Desk Reference 1050.1F*: 11-2. [↑](#endnote-ref-4)
5. Although it has also stated that supplement tools for measuring noise exposure ‘…should remain at the discretion of individual agencies’ (*FAA Desk Reference 1050.1F*: 11-11, 11-12). [↑](#endnote-ref-5)
6. Israeli Ministry of Interior Central District Committee for Appeals (Appeals Number: 218/01, 146, 147, 150-157, 168-171, 176, 178), date: 31.10.2007. [↑](#endnote-ref-6)
7. All data gathered in Hebrew (e.g. newspapers articles, interviews, and reports) was translated into English by the authors. Minor variances may occur due to linguistic differences. [↑](#endnote-ref-7)
8. <http://stopheathrowexpansion.co.uk/news/2016/8/15/aircraft-noise-damages-lives?rq=noise> [↑](#endnote-ref-8)
9. <http://nextgennoise.org/> [↑](#endnote-ref-9)
10. http://www.sviva.gov.il/English/env\_topics/Noise/Pages/default.aspx [↑](#endnote-ref-10)
11. <https://www.faa.gov/airports/airport_development/omp/FAQ/Noise_Monitoring/> [↑](#endnote-ref-11)
12. [↑](#endnote-ref-12)
13. See <https://www.iaa.gov.il/he-IL/natureandenvironment/Pages/NoiseMonitoringMonthlyReport.aspx> [↑](#endnote-ref-13)
14. [↑](#endnote-ref-14)