

An Apple a day: Listening to data centre site selection through a sonospheric investigation

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Introduction

As other authors in this special issue have noted, the rapid expansion of digital technologies rests on the rapid building of data centres. Data centres must be built somewhere. We can understand the cultural force of data centres by looking at their situatedness, by attending to the somewheres they occupy. This essay encounters Derrydonnell Forest in Galway, the possible somewhere of Apple's newest data centre in Europe. What happens when one of the world's richest companies applies for planning permission to build a data centre in a forest on the west coast of Ireland? Broken into three sections, this essay begins with an introduction to the sonospheric investigation; a research methodology I deploy as a sound arts practitioner that offers a generative approach towards engaging with multisensory vibratory and temporal encounters. I then discuss several examples where community and activist groups have objected, appealed and resisted the emergence of data centre complexes across North America and Western Europe. Lastly, I introduce the artwork *Fields of Athenry* (Parker, 2016), a multimedia installation developed as part of an ongoing sonospheric investigation into Derrydonnell Forest. The work interrogates how the medium of YouTube is a way of connecting what Athenry is, to what it might become, as the town prepares for the arrival of one of the largest data centre complexes in the world. This essay aims to highlight the affective and cultural complexity of data centre site selection through the reflection of an artist's practice-based research project and asks what a practice of listening can offer media infrastructure ontologies.

Sonospheric investigation

In 2011, the composer Pauline Oliveros introduced the concept of the ‘sonosphere’ to define what she described as the ‘sonic envelope of the earth created by all vibrations set in motion’ (2011: 167). The sonosphere, she argues, functions in alignment with Earth’s resonating energy and beyond as waves and phonons. This resonating energy is both consciously and unconsciously processed by all creatures of perception ‘using earth bio and technological systems’ (Oliveros, 2011: 167). The human body consciously perceives only a subsection of these vibrational frequencies occurring in the world. For Oliveros, connections can be made between the broader vibratory continuum of the Earth’s energies and our own, by studying the relationship between the body and its position as a vibrating material assemblage. When thinking about the propagation of sound, the sonic, and the waveforms of sound, the longitudinal, mechanical soundwave created by the cyclical movement of a body in space creating the compression and release of air pressure is the most typically considered source. The sonosphere acknowledges a broader understanding of material waves that exist across the expanded realm of hertzian space (including electromagnetic and acoustical waves). As a ‘polymodal’ (Lipari, 2014: 51) listening methodology, the sonospheric investigation can potentially create affective bonds between listener and other vibrational forces be they human, nonhuman, organic, inorganic. The expanded potential of listening sonospherically offers a multimodal sensory awareness both of and within space as lived in, experienced in, and mediated through. For sound scholar Paul Jasen, such vibration ‘opens onto the acoustics of bodies and buildings, inadvertent encounters with ambient waves, the unheard vibrations of infrasound and still more liminal events that can only be called sound-like’ (2016: 3). It is not always the soundwave that forms perception but a sonospheric wave, a connective wave, a vibrant wave.

Philosopher Jane Bennett refers to the ‘*Thing-Power*’ of objects and ‘the curious ability of inanimate things to animate, to act, to produce effects dramatic and subtle’ (2010: 6). *Things* in the world for Bennett are connected through vibration. The sonospheric investigation explores what she refers to as the ‘cognitive dissonance’ (2010: 115) between the everyday comingling of microbes, bacteria, humans and nonhumans within complex material assemblages to form a sense of what we might call an ecology (the interrelations of things to one another). If we are to find a way to listen to the emergence and flow of such material assemblages, we must do so by making meaningful connections which require ascribing to a form of symbolic cues. Whilst this doesn’t have to manifest as

language, ascribing voices to things which can be listened to can be a generative form of meaning making between agential beings. Jasen argues that the body itself is a ‘sensate actor’, or ‘two-way interface’ (2016: 6) between nature and culture, making direct connection to that which lies beyond the body, but he also recognises that the body must simultaneously be understood as a ‘cultural vector’ (2016: 6): racialised, gendered and performative. Bennett and Jasen take an ‘ethico-affective’ (Thompson, 2017: 35) approach towards the body and perception, nature and culture, and Bennett, challenges us to think ‘transversally’ on the ‘interlacing of the mechanosphere, the social sphere, and the inwardness of subjectivity’ (Bennett, 2010: 114). If we are to acknowledge the vibrancy of matter and our bodies themselves as material assemblages operating across the vibratory mass of Earth, we must acknowledge the affect of this upon our bodies, and how these vibrations are subsequently enacted through voices and actions within culture. The sonospheric investigation, importantly transverses across a material study of vibration from objects in physical space and embraces the subjective, cognitive and social.

The discourse of ‘new materialism’ which has been generated by philosophers interested in vitality and hybridity (Bennett, 2010; Haraway, 1991; Ingold, 2011, 2000; Latour, 2005) and those concerned with assemblages and affect (Barad, 2007; De Landa, 2006, 1997; Goodman, 2012; Grosz, 2008; Deleuze & Guattari, 1987; Massumi, 2002) share the position that objects—human, nonhuman, organic and nonorganic—express a form of agency through being. Human beings are enmeshed within these existing assemblages, networks and becomings. The destabilisation of globalisation and the experience of being superconnected (Chayko, 2016), is intimately tied to the increasingly problematic effects of the growing ecological crisis of climate in the age of The Anthropocene. As we understand the interconnectivity of ‘things’, as agential, vibrant materials within the world, we can begin listening to the cracks and fissures ruptured by anthropogenic endeavour both by, and through, our interrelationships with digital media technologies. Benjamin Bratton, describing the multiple layers of planetary scale digital media infrastructure as ‘The Stack’ (2016), observes that it is ‘only through the medium of The Stack itself that we know so precisely how the carbon appetite of The Stack is contributing so decisively to our Anthropocenic predicament in the first place’ (2016: 303). Our understanding of this catastrophic climate crisis is formed, measured, understood, and the direct result of, the mass production and consumption of digital technologies, signals and data. The sonospheric investigation offers an opportunity to listen to organic,

nonorganic, human, and nonhuman systems of ‘reactive mutual inter-dependence’ (Braidotti, 2013: 49) whilst maintaining awareness of the multiple cultural vectors also at play. In the next section, I consider examples of how data centres, as central nodes of media infrastructure, can be both listened to, and understood as generators of sonospheric vibrations that consume and affect individuals in their proximity; situating global network infrastructure on a local and affectively charged scale.

Rejecting dirty data

Hyperscale data centre site selection is often predicated on access to cheap power and utilities, often made available in locations with substantial energy infrastructures already in place, following a period of industrial decline (Hogan, 2015: 4; Rosenwald, 2011). It relies on local councils willing to accept business opportunities—in turn offering significant tax incentives—that offer a short-term boost to the local economy through construction, or that create associations for their region with a globally recognised brand (Anderson, 2016; Sverdlik, 2015). These conditions are paralleled by a lack of long-term direct investment into the region through permanent employment prospects due to the low number of permanent staff required to operate a data centre compared to their industrial predecessors, and the specific technical training required for such roles (Blodget, 2011). Once constructed, data centres can potentially make their presence felt through material vibrations and through the rupturing of local communities. In Forest City, North Carolina, home to a hyperscale Facebook data centre, appeals were made by a group of residents citing noise disturbances that affected their home life (Schiering, 2013, 2015). In the Parisian suburb of Seine-Saint-Denis a local action group called The Urbaxion’93 Association filed to have planning permission withdrawn for a data centre in 2015 owned by colocation provider Interxion. Member of Urbaxion’93, Matilda Mijajlovic, reported that the site ‘makes a constant noise, and is in a residential area with some people living only 10m away’, and had failed to deliver ‘on a promise to create local jobs’ (Judge, 2015). In October 2015, Interxion’s licence to operate was withdrawn based ‘on the noise pollution the refrigeration and backup generator systems produce’ (Boyle, 2015a). By November 2015 Interxion had the ruling overturned by taking the case to a higher level commercial court (Boyle, 2015b). For Ryan Barron and Lynne Foster, residents of Labrador City in Newfoundland, Canada, the vibration from a Bitcoin mine across the road from them

affected their health and mental well-being (Foster in Barker, 2016). In this case, a power substation had been installed in the middle of a residential district to facilitate the energy needs of the private cryptocurrency operation. The effect on public health and subsequent quantification, measurement and legislation of industrial noise has been historically traced and is not a new phenomenon (Schwartz, 2011; Thompson, 2004). However, whilst the above examples are of industrial noise on local populations, the politics surrounding the arrival of data centres within rural, suburban and urban contexts uniquely situate them as a concern for how—particularly major tech companies—justify localised trauma upon individuals for the production and service of a global network operator that offers little direct benefit to the individual residents of that area. Whilst the technical media and infrastructural design of data centres are constantly improving, the volume of new developments and particularly developments in proximity of residential areas or non-industrial zoned land suggest that concern around data centre projects and their potential influence (or lack of influence) on largely marginalised, local communities will likely increase in the coming years.

Fields of Atherny

In April 2015, Apple Distribution International submitted planning applications to Galway County Council for permission to build a 24,505m² data centre, a 220Kv power substation and all associated facilities. The architectural visualisations submitted for the build included a further seven data centres within a complex totalling 196,040m² making it one of the largest data centre schemes anywhere in the world (Weckler, 2016). The proposed site, Derrydonnell Forest, is a greenfield area maintained by Ireland's forest and land custodian Coillte near the small town of Atherny. The site is also enjoyed by locals as a place to go for walks and take in fresh air. In response to the application, a total of 23 letters from appellants (individuals and groups) were submitted, formally stating concerns, objections and appeals. My sonospheric investigation begins here.

I read the letters of appeal alongside the planning application and listened to the arguments presented. Within the appellant's letters existed many concerns in response to the plans including: increased noise pollution and traffic during the construction phase; the preservation of wildlife (particularly bat and badger habitations, and a protected plant species *Vicia orobus*); alarm at the proximity of an industrial site of its scale

to a local primary school and residential area; lack of industrial zoning for the land in the regional development scheme; the risk of flooding to the area; and the forecasted energy demand to power the facility.¹ My initial plan was to visit the forest, produce sound recordings in locations cited in the environmental impact survey (EIS), then return, monitor and eventually demonstrate the altering soundscape ecology of the forest pre and post data centre construction. This method was influenced by the work of soundscape ecologists who deploy passive recording techniques to measure the direct result of anthropogenic activity, through deforestation and urban development, that dramatically alters the biophony (sonic presence of nonhuman organisms) of an environment (Krause *et al.*, 2011).² This work would be complemented by interviews with local appellants, whom I had contacted via the details available from their appeal letters, to form the initial data for a multi-sited sonospheric investigation. During my first research visit, I stayed in the nearby town of Athenry. The town's name had been attributed to the data centre project by Apple. In Derrydonnell Forest, I conducted phonographic recordings across three locations that had been marked as sites for noise measurement for the EIS in the East, Southwest and Northwest corners (Figure 1). I took recordings at 05:30, 13:00, 16:00 and 19:00 using a stereo microphone, stereo transducer 'contact' microphone pair, a geophone (low frequency vibration sensor) and video footage.³ Walking around the forest perimeter, I encountered several anti-appellants, protest placards. I realised that as passionate as the appellants were against the proposal, there may also be many residents strongly in favour for the arrival of Apple to their region (Figures 2 and 3).

21:20 GMT, Thursday 14 June 2012. PGE Arena Gdańsk, Poland

During the Euro 2012 football tournament in Poland and Ukraine, Ireland were on the receiving end of a comprehensive 4-0 thrashing by the World and European champions Spain which would see them knocked out of the tournament. Supporters decked out in green, orange and white took over the stadium as the game drew to a close, breaking out in a heartrending rendition of *The Fields of Athenry* (St. John & Doyle, 1980), an Irish song about the struggle of a man to feed his family. Supporters reached for their phones and recorded the moment from around the stadium and uploaded their footage to the Internet, to be stored in a giant data centre. Somewhere unknown. Somewhere like Athenry itself.

In producing *Fields of Athenry*, my aim was to make connections between the potential environmental and ecological impacts of a substantial data centre site in a rural forest, with the cultural practices of digital media consumption, and Irish patriotism. On YouTube, I located a total of 40 unique videos uploaded with first person phone recorded video footage from the six-minute period at the end of the match where fans sang, and I began to synchronise the clips together. The relationship between locality, space and community is rich within football heritage and the culture of chants is actively pursued both on the terraces and in the protests against multinational owners (Tidoni, 2015; Whitley, 2017). The passion of the Irish fans is channelled through the digital medium of YouTube and in the context of the Apple and Athenry campaign, could be understood as a sonic lament for the loss of agency of people in Athenry against the direct foreign investment of Apple. Collective singing is viewed as an important component of social movements and protests (Bensimon, 2012) and phonographer Christopher DeLaurenti, who listened to the sounds of the occupy movement in New York in 2011, states that ‘every echoing group of voices has its own timbre, spatial location, and variably passionate presence’ (DeLaurenti, 2014). *Fields of Athenry* finds echoing voices and spatial locations across the networks of digital social media platforms and the nonhuman community platforms of Derrydonnell Forest. The recordings made in the forest zones are combined and layered to make a ‘forest-floor supporters group’, chanting in juxtaposition to the human supporters singing in the archived digital recordings produced in Gdańsk. The work plays across relationships between space, place and ecology of the data centre, imagining a place that is already data driven and distributed through the existing ecological habitat but simultaneously is in opposition to a multinational media infrastructural threat.

Fields of Athenry is the culmination of a sonospheric investigation enacted through documentary analysis of industry trade magazines, local, national and international news vendors (mostly online), and planning procedure documentation. The investigation drew into regional and national sentiment of Athenry through metaphor, interlinking national pride (Irish sport fans) to the algorithmic data processes that occur within data centre nodes. A process of interviews, phonography, low frequency recording and walking situated the investigation to the region itself. I found the birdsong of the forest to be a powerful analogue to the tweeting energies of football fans and the sense of irony, melancholy, naivety and potential loss these two mediums brought to each other, resonated within my

studio-based exploration, which comprised 18x obsolete Apple devices playing back the synchronised media clips on loop. There were and continue to be many strong feelings explored both for and against the development in Derrydonnell Forest, and whilst Apple officially now own the land, the company decided to withdraw from the project in May 2018 following the delays created by the appeal process in Ireland (Goodbody, 2018). Meanwhile, three years after planning permission was requested, a twin site located in Viborg, Denmark, is constructed and operational, and Apple are focussing their attention on the development for a second site in Denmark to replace their Irish plan.

Closing remarks

The major data centre providers, particularly Apple, have been praised by Greenpeace since their initial criticisms in 2011 for aiming to improve the way they power their facilities, through green energy solutions (Cook *et al.*, 2017) and some of the early hyperscale sites have since begun to receive positive feedback from local politicians (Schneider, 2018). However, little has been done to consider the affective capacity of a growing data centre industry that demands closer proximity to residential areas to service metropolitan user's needs. The same stories from North Carolina, where 50 jobs were created by Apple, carry over to Athenry, where only 150 jobs were to be created for a project costing €850m. Combined with the significant tax incentives received in Ireland, the lack of long-term employment has created significant controversy within European Courts (State Aid, 2017; State Aid, 2016). The sonospheric investigation is a multimodal approach towards attending to the questionable commitment of sustainability for communities that is prior to and imbricated in the building of new data centres; it offers listening as a mode of perceiving these complex, networked and political environments.

Notes

1. EirGrid, the country's main grid operator has predicted data centres will consume 20% of Ireland's entire power generation capacity by 2025 (EirGrid & SONI, 2016: 19).
2. Passive sound recording practices require the sound recordist to position recording equipment statically in a specific location and then move away to a point where their presence is no longer registered by the microphone/recorder.

3. Stereo microphones, stereo transducers, geophones and digital video cameras are some of the tools and methods of sensing available to the sonospheric investigation in what I call the ‘sonopalette’. For more detailed descriptions about these recording devices and practical instruction on how to use them, see (Bartlett and Bartlett, 2017; Eargle, 2004; Nelson, 2014; Riley French, 2014; Wheeler, 2009).

4. *Fields of Athenry* was commissioned by The Brighton Digital Festival (2016) and funded by Arts Council England. In addition to the Brighton Digital Festival, it has been exhibited at ASC Gallery, London, UK (2016) and Birmingham Museum and Gallery, Birmingham, UK (2018).

Figures



Fig. 1- Overhead plan of Derrydonnell forest with three sound assessment stations (Source: Arup 2015, modified by Parker 2016)



Fig. 2 - Fields of Athenry (objecting the objectors #1). (Source: Matt Parker 2016)



Fig. 3 - Fields of Athenry (objecting the objectors #2). (Source: Matt Parker 2016)

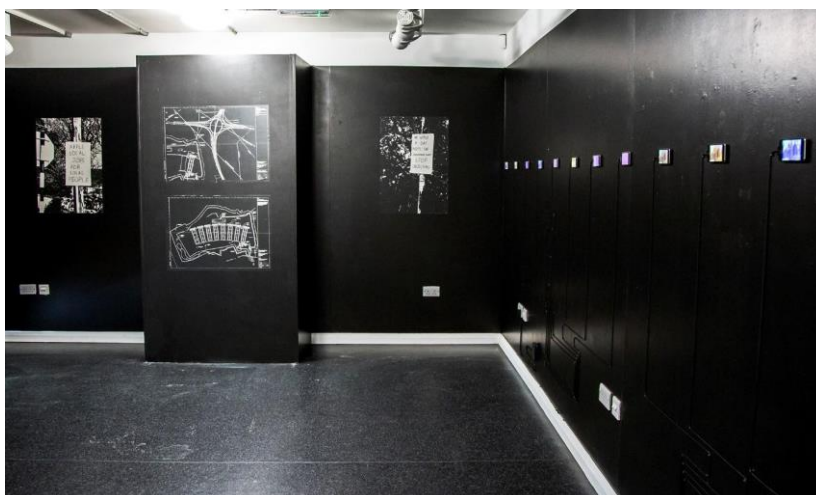


Fig. 4 - Fields of Athenry, Brighton Digital Festival, Brighton UK (Source: Matt Parker 2016)

References

All-island generation capacity statement 2016-2025 (2016) Dublin, Ireland: EirGrid & SONI. pp.1–76. Available at: http://www.eirgridgroup.com/sitefiles/library/EirGrid/Generation_Capacity_Statement_20162025_FINAL.pdf (accessed 10 April 2018).

Anderson, M. (2016) *Tax breaks bring Facebook data centre to New Mexico*. Available at: <https://thestack.com/data-centre/2016/09/15/new-mexico-town-woos-facebook-data-centre-with-generous-tax-breaks/> (accessed 14 March 2018).

Barad, K. (2007) *Meeting the universe halfway: quantum physics and the entanglement of matter and meaning*. Durham, NC and London: Duke University Press.

Barker, J. (2016) 'Data centre noise causing headaches for neighbours in Labrador City.' Available at: <http://www.cbc.ca/news/canada/newfoundland-labrador/data-centre-testing-noise-complaints-labrador-city-1.3884847> (accessed 15 March 2018).

Bartlett, B. and Bartlett, J. (2017) *Practical Recording Techniques: The Step-by-Step Approach to Professional Audio Recording*. New York and London: Routledge.

Bennett, J. (2010) *Vibrant Matter: A Political Ecology of Things*. Durham, NC and London: Duke University Press.

Bensimon, M. (2012) 'The sociological role of collective singing during intense moments of protest: the disengagement from the Gaza Strip', *Sociology* 46 (2): 241–257.

Blodget, H. (2011) 'The country's problem in a nutshell: Apple's huge new data center in North Carolina created only 50 jobs.' Available at: <http://www.businessinsider.com/apple-new-data-center-north-carolina-created-50-jobs-2011-11> (accessed 21 June 2016).

Boyle, B. (2015a) *Court orders Interxion to close Paris data center*. Available at: <http://www.datacenterdynamics.com/content-tracks/power-cooling/court-orders-interxion-to-close-paris-data-center/95059.fullarticle> (accessed 14 March 2018).

Boyle, B. (2015b) *Closure threat lifted from Interxion Paris site*. Available at: <http://www.datacenterdynamics.com/content-tracks/design-build/closure-threat-lifted-from-interxion-paris-site/95165.fullarticle> (accessed 14 March 2018).

Braidotti, R. (2013) *The Posthuman*. Cambridge and Malden, MA: Polity Press.

Bratton, B. (2016) *The Stack*. Cambridge, MA: MIT Press.

Chayko, M. (2016) *Superconnected: The Internet, Digital Media, and Techno-Social Life*. Thousand Oaks: Sage Publications.

Cook, G. *et al.* (2017) *Clicking Clean: Who is Winning the Race to Build a Green Internet?*. Washington: Greenpeace.

De Landa, M. (1997) *A Thousand Years of Nonlinear History*. New York: Zone Books.

De Landa, M. (2006) *A New Philosophy of Society: Assemblage Theory and Social Complexity*. London: Continuum.

DeLaurenti, C. (2014) *Christopher DeLaurenti: towards activist sound*. Available at: http://www.thewire.co.uk/in-writing/columns/christopher-delaurenti_towards-activist-sound (accessed 7 October 2016).

Deleuze, G. and Guattari, F. (1987) *A Thousand Plateaus*. Minneapolis: University of Minnesota Press.

Eargle, J. (2004) *The Microphone Book*. Amsterdam and London: Elsevier/Focal Press.

Facebook Noise Complaints. (2013) Directed by Schiering, M. Asheville, NC: WLOS News 13. Available at: <https://www.youtube.com/watch?v=ZYJzxJSsKfw> (accessed 13 March 2018).

Goodbody, W. (2018) 'Apple scraps plans for Athenry data centre'. Available at: <https://www.rte.ie/news/ireland/2018/0510/961460-apple-athenry/> (accessed 2 July 2018).

Goodman, S. (2012) *Sonic Warfare: Sound, Affect, and the Ecology of Fear*. Cambridge, MA: MIT Press.

Grosz, E. (2008) *Chaos, Territory, Art: Deleuze and the Framing of the Earth*. New York: Columbia University Press.

Haraway, D. (1991) *Simians, Cyborgs, and Women: The Reinvention of Nature*. New York: Routledge.

Hogan, M. (2015) 'Data flows and water woes: the Utah data center', *Big Data & Society* 2 (2): 1–2.

Ingold, T. (2000) *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill*. Abingdon: Routledge.

Ingold, T. (2011) *Being Alive: Essays on Movement, Knowledge and Description*. London: Routledge.

Jasen, P.C. (2016) *Low End Theory: Bass, Bodies and the Materiality of Sonic Experience*. New York and London: Bloomsbury Academic.

Judge, P. (2015) *Interxion Paris in court over fuel risk*. Available at: <http://www.datacenterdynamics.com/content-tracks/design-build/interxion-paris-in-court-over-fuel-risk/94927.fullarticle> (accessed 14 March 2018).

Krause, B. *et al.* (2011) 'Measuring and interpreting the temporal variability in the soundscape at four places in Sequoia National Park', *Landscape Ecology* 26 (9): 1247-1256.

Latour, B. (2005) *Reassembling the Social: An Introduction to Actor-Network-Theory*. New York and Oxford: Oxford University Press.

Lipari, L. (2014) *Listening, Thinking, Being: Towards an Ethics of Attunement*. University Park, PA: Pennsylvania State University Press.

Massumi, B. (2002) *Parables for the Virtual: Movement, Affect, Sensation*. Durham, NC and London: Duke University Press.

Nelson, D. (2014) *My Seismic Station*. Available at: http://www.sydneystormcity.com/g_phones.htm (accessed 2 July 2018).

Oliveros, P. (2011) 'Auralizing in the Sonosphere: A Vocabulary for Inner Sound and Sounding', *Journal of Visual Culture* 10 (2): 162-168.

Parker, M. (2016) *Fields of Athenry*. [Multimedia installation: 16x Apple iPod Touch 4th Generation (obsolete), 1x Apple iPhone 4 (obsolete), 1x Apple AirPort Extreme A1408 (obsolete), 4x large format newsroll prints, 16x consumer fan videos (source: YouTube), 16x videos and sound recordings (source: Derrydonnell Forest, Athenry)] 12mins 00secs. Available at: <https://www.earthkeptwarm.com/fields-of-athenry/>.

Residents Still Concerned About Noise From Faceb. (2015) Directed by Schiering, M. Ashville: WLOS News 13. Available at: <https://www.youtube.com/watch?v=KsxX7peUfoo> (accessed 13 March 2018).

Riley French, J. (2014) *leigh woods geophone*. Self Published.
Rosenwald, M., S. (2011) *Cloud centers bring high-tech flash but not many jobs to beaten-down towns*. Available at: https://www.washingtonpost.com/business/economy/cloud-centers-bring-high-tech-flash-but-not-many-jobs-to-beaten-down-towns/2011/11/08/gIQAccTQtN_print.html (accessed 13 March 2018).

Schneider, K. (2018) 'An Oregon mill town learns to love Facebook and Apple'. Available at: <https://www.nytimes.com/2018/03/06/business/apple-facebook-data-center.html> (accessed 7 March 2017).

Schwartz, H. (2011) *Making Noise: From Babel to the Big Bang & Beyond*. New York: Zone Books.

St. John, P. and Doyle, D. (1980) *The fields of Athenry*. Vol. RAISED ON SONGS AND STORIES. In: Raised on songs and stories. [Vinyl, LP Album] Dublin, Ireland: Release records. Available at: <https://www.discogs.com/Danny-Doyle-Raised-On-Songs-And-Stories/release/3538377> (accessed 19 March 2018).

State aid: Commission refers Ireland to Court for failure to recover illegal tax benefits from Apple worth up to €13 billion (2017) Available at: http://europa.eu/rapid/press-release_IP-17-3702_en.htm (accessed 21 March 2018).

State aid: Ireland gave illegal tax benefits to Apple worth up to €13 billion (2016) Available at: http://europa.eu/rapid/press-release_IP-16-2923_en.htm (accessed 21 March 2018).

Sverdlik, Y. (2015) *North Carolina makes data center tax breaks easier to get*. Available at: <http://www.datacenterknowledge.com/archives/2015/10/01/north-carolina-makes-data-center-tax-breaks-easier-to-get> (accessed 9 April 2018).

Things fall apart. (2017) Directed by Whitley, D. [HD video with 5.1 surround sound] (s.l.): Duncan Whitley.

Thompson, E. (2004) *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933*. Cambridge, MA: MIT Press.

Thompson, M. (2017) *Beyond Unwanted Sound: Noise, Affect and Aesthetic Moralism*. New York: Bloomsbury Academic.

Tidoni, D. (2015) *The Sound of Normalization*. (s.l.): Self-published.

Weckler, A. (2016) 'Apple's €850m data centre in Galway faces new Bord Pleanala hearing'. Available at: <http://www.independent.ie/business/technology/apples-850m-data-centre-in-galway-faces-new-bord-pleanala-hearing-34657888.html> (Accessed 17 May 2016).

Wheeler, P. (2009) *High Definition Cinematography*. London: Focal.