

Speaker Park: An Intersection of Loudspeaker Design and Post-Acoustic Composition

Jon Pigott and Antti Sakari Saario

jpigott@cardiffmet.ac.uk
antti.saario@falmouth.ac.uk

ABSTRACT

Speaker Park was an internationally curated project which brought together a custom installation of 24 hand built, sculptural loudspeakers made by Roar Sletteland and Jon Pigott, with two composers, Antti Sakari Saario and Mari Kvien Brunvoll, who took up residencies working with the system. The project was conceived as a critique of standardised commercial high-end loudspeaker systems of the type typically used for the electronic production and reproduction of sound. Setting up a conversation between composer and speaker designer / maker the project served as an investigation into unusual resonant and diverse approaches to loudspeaker design and how they affect the compositional and production processes. This paper is a first-hand reflection and exposition of *Speaker Park* by composer Antti Saario and speaker designer / maker Jon Pigott. It will detail the individual approach of each author in developing their part of the project (composition and speaker design) as well as the collaborative insights from the overall process through themes of assemblage and post acoustic composition.

1. INTRODUCTION

Speaker Park was a project which brought together a custom, 24 channel installation of hand built, sculptural loudspeakers made by Roar Sletteland and Jon Pigott, with two composers, Antti Sakari Saario and Mari Kvien Brunvoll, who took up residencies working with the system. The project, curated by Norwegian producers Leo Preston and Veronica Thorseth, founders of WRAP Kunsthøst, was funded by the city of Bergen and the Norwegian Arts Council (among others) and premiered at the *Borealis International Festival of Sound Art and Experimental Music* in Bergen in 2019. Preston and Thorseth describe *Speaker Park* as ‘a new concert installation that makes us rethink our relationship to musical technology. Bringing together speaker makers, artists, composers and musicians the project tries to get away from the commercially motivated Hi-Fi market, and challenge the criteria by which traditional sound systems and listening experiences are evaluated’

This paper will explore the technical and creative opportunities and challenges of *Speaker Park* by two participants, Saario and Pigott, through themes of creative collaboration, the physicality of sound, space and materials and the idea of the *assemblage*. For the project, composer Saario developed the 24-channel fixed media composition *Above the Blackened Skies. Beneath the Remains. (A†BSB†R)* (2019) [duration: 18’]. Pigott’s contribution to the speakers of *Speaker Park* were twelve rectangular forms (circa 500mm high) with a sculptural arrangement of internal forms and materials that reflected elements

of industrial speaker design (see fig 1) and which appropriated ‘cone-less’ speaker transducers. This coming together of the sonic, the compositional, the spatial and the material, formed the creative ground for the project and this was reflected in comments by critics:

What can one actually expect when one mixes something temporal with a more permanent and physically rooted expression?

With drone-like bass sounds and a more rhythmic drive, he [Saario] emphasised the feeling of the sound waves. I say feeling, because it really was a physical experience.

(Synnes Handal 2019, Bergen Times)

2. A CONTEXT OF CREATIVE LOUDSPEAKERS

The conscious use and misuse of the loudspeaker in compositional and sound art practice as well as in musical instrument and technology design has a rich heritage that has become increasingly well documented in recent years (Van Eck 2017). Perhaps unsurprisingly, from the very early days of electrical and electronic music technologies loudspeakers were incorporated into the sound processing techniques of instruments. Early electronic keyboard instrument, the Ondes Martenot, for example, featured a series of bespoke diffusers – custom loudspeakers which included the appropriation of metal gongs and tuned strings to add characteristic timbre and resonance to the electronically produced sound. A little after the Ondes Martenot, Donald Leslie’s rotating baffle speaker cabinet (the ‘Leslie Speaker’) appeared for use with electric organs such as the Hammond. It was also around this time that electromechanical processing devices such as plate and spring reverbs became available which, though not technically loudspeakers, used the same moving coil technology of loudspeakers to acoustically excite materials for sonic effect.

As recording technology and production techniques developed and the space of the recording studio became an increasingly important location for not only the capture but also the creation of music, loudspeakers became a vital component in delivering a reliable, accurate and, where possible, transparent window into a sonic universe. This situation can be linked to a general development of sound recording technologies but also, as Ethan Rose explains, to the ‘distillation of listening’ (Rose, 2013) which he identifies as a modernist project, seeking to rationalise and separate the senses, allowing for an ‘absolute’ music and an objective understanding of sound. It is partly from this context of an ideal loudspeaker listening situation that music composition was able to fully embrace electronic sound synthesis and the manipulation of ‘concrete’ sounds on tape, with works by Varese, Schaeffer, Stockhausen, Cage among others from the 1940s onwards.

This tradition of idealised listening and studio-based composition and production has been spurred on over the years by easily accessible and affordable studio technologies. This is especially the case with more recent availability of digital tools where seemingly

limitless sonic possibilities are afforded by ever more powerful computers and an ever more competitive market place of available digital tools for use by the creative. As such, studio based and studio quality listening that assumes and requires transparent loudspeaker interaction is now deeply embedded across both popular and experimental music composition and production activities.

Beyond this tendency towards transparency and standardisation in stereo loudspeaker listening there also exists a tradition of listening within multi-loudspeaker arrays, the emergence of which can be linked to a concern with the creative spatialisation of sound in composition. Barrett (2007: 242) identifies early examples of this in the activities of Pierre Schaeffer and Pierre Henry in 1950, in Cage's *Imaginary Landscape No 4* (1951) for twelve radios and in Varese's *Poeme Electronique* (1958) for a 425-speaker array installed in the Phillips pavilion at the Brussels World's Fair. Barret claims, however, that the first 'true' spatial composition, conceived prior to the act of performance was Stockhausen's *Kontakte* (1960). Emmerson, (2007: 151) identifies that the 'rise of multi-loudspeaker diffusion within the 'French tradition' of Schaeffer's *Musique Concrete* is not well documented' with the first 'controlled sound environments' emerging in the mid 1960s. It was not until the early 1970s however, that such systems became formalised and established with Christian Clozier's *Gmebaphone* and Francois Bayle's *Acousmonium*. These were followed a few years later by systems in other countries such as the Birmingham Electroacoustic Sound Theatre (BEAST) in Britain.

Despite the initial drive for such multi loudspeaker sound spatialisation techniques seemingly emerging from creative compositional concerns, Barrett claims that the 'influence of the loudspeaker orchestra on compositional aesthetics is somewhat tenuous'. Certainly, the listening experience of the audience appears as a key emphasis with such systems through considerations such as an audience's three-dimensional immersion in pure sound, and the accurate distribution of stereo fields across large auditoria for example. This audience impact factor of multi speaker listening environments is also at play in the more commercial end of the spectrum with surround sound for cinema and multimedia experiences for example.

It is tempting to categorise some of this technical and creative activity into the loudspeaker-as-instrument on the one hand and bespoke listening environments on the other but there are examples that challenge this simple attempt at categorisation. Most notably, David Tudor's *Rainforest* (1968, see Driscoll and Rogalsky 2004) is an installation of sculptural loudspeakers which appropriates found objects (bed springs, cart wheels etc.) as resonant materials attached to cone-less loudspeaker drivers to create highly resonant and colourful timbral responses. Tudor had a particular interest in the individual and unique voice of loudspeakers which certainly can be understood as loudspeaker-as-instrument. But *Rainforest* is also a listening environment, an installation space of prepared and spatially arranged loudspeakers through which an audience is able to explore and interact. Gordon Monahan has also made work that conflates the instrumental / environmental categorisation of loudspeakers including *Speaker Swinging*

(1982) a performance piece where loudspeakers are swung by performers creating a kind of human-powered Leslie speaker cabinet listening experience, and *Kinetic Audio Transmissions* (2016) where motors are used as loudspeakers through resonant objects in a system not dissimilar to Tudor's *Rainforest*. Also, Andrea Valle's *Rumentarium Project* takes a similar approach of using customised loudspeaker-type arrangements to create an 'acoustic computer music' (Valle 2013). Questions relating to whether or not, and when a loudspeaker may be considered an instrument have also been explored in a range of literature (Sharma and Schultz: 2017, Mulder 2010, Emmerson 2007: 149, Van Eck 2017).

3. POST ACOUSMATIC COMPOSITIONAL APPROACH

For Saario, this territory of the creative foregrounding of loudspeakers within *Speaker Park* maps to a post-acousmatic sensibility (Riikonen & Saario, 2011b). The composition of *A†BSB†R* was approached through a primary focus on the corporeality of sound, its physical visceral sensations and ability to affect bodies. Such an approach suggests no hierarchical value between live and mediated experiences, and places an emphasis on *tactile listening* and the materiality of sound (Riikonen & Saario, 2011a and 2011b). Through this post-acousmatic frame, the dynamic potential and interaction of all elements of compositional praxis in a given context is more important than their control. As such, listening as sensing and awareness of sound- and other compositional-bodies become key operational modes. To develop the necessary tactile awareness, the composer must seek to understand the ever-shifting relationship associated between the sound-, sounding- and other-bodies of a given work.

Ida Rolf, the creator of the 'structural integration' approach to health and physical wellbeing, states that 'structure is behavior', and that 'in any energy system, however complicated, structure (relationship of units of any size in space) is experienced as behavior' (Rolf, 1977). The *Speaker Park* project prompted considering such possibilities alongside -for example- Smalley's (1986; 1997) concept of *spectromorphology* which is 'concerned with perceiving and thinking in terms of spectral energies and shapes of space' along with behaviors, motion and growth processes within a musical context. With an awareness of such positions, Saario's *A†BSB†R* sought to articulate and portray the unique physical qualities of *Speaker Park* through an affective and embodied approach as opposed to simply a representative one bringing about an experience of multiple levels of sound, sounding structures and materials.

In this sense, the post-acousmatic composition is a political enterprise, one that navigates the interconnected energy systems of human and non-human bodies, with all aspects of the compositional praxis being productive factors in a political *machine* (Deleuze & Guattari). In *A†BSB†R*, Saario is developing a body practice for and applying 'body work' (Rolf, 1977, Schultz & Feitis, 1996) and 'tissue flow' (Hudis, 2006) principles to sound based fixed media composition. Just as connective tissue defines the body contour and is

the organ of structure and movement in the body (Rolf, 1977), sound shapes the ‘space contour’ and produces a tactile space, albeit temporary and continually unfolding.

This produces a transition from the ‘primacy of the ear’ (Harrison, 1992) to the primacy of bodies in a context where the bodies, space and technologies of *Speaker Park* are ‘inextricable of each other’ (Riikonen & Saario, 2011a), from the odd geometric ports and divided space of sculptural loudspeakers through to the multi-loudspeaker arrangement in the room and to the body of the listener. In this web, sound affects and touches in ‘reciprocal activity unfolding alongside with other diverse socio-material layers of fleshly signification’ (Riikonen & Saario, 2011b). From this perspective, fixed media listening is an interactive and sensual practice of being in intense and immediate contact with the recorded past-present-future sound flow and associated ‘multiple tactile-aural forms.’(Riikonen & Saario, 2011b)

The compositional intent of *A7BSB7R* became focused on affect production and production of differences of tone, intensity and space, over musical ‘content’ (Colebrook, 2002). Micro-perceptions and micro-differences produced by the inherent ‘voice’ of each unique loudspeaker were an integral part of the compositional process of this tone production. As such *Speaker Park* as a compositional medium, context and value proposition, affords the post-acousmatic composer with an excellent platform and a creative matrix to explore sound-based fixed media composition, body work, and affective space production.

4. SOUND, SPACE AND OBJECTS: DESIGN IN SPEAKER PARK

The speakers designed for *Speaker Park* by Pigott combined the technique of using cone-less drivers coupled to resonant materials found in the examples from Tudor and Monahan, with a sculptural approach which took inspiration from the formal characteristics and materials from the world of standard and industrial loudspeaker design. As can be seen in figure 1 these characteristics include truncated prisms, exponential curves, driver ports, grilles and the standardised rectangular ‘box’ of industrial loudspeakers. In the context the sculptural speakers of *Speaker Park*, these various tropes from the worlds of public address systems, sound systems and domestic hi-fi took on a new visual identity which somehow also echoes the minimalist sculptures of Robert Morris, Sol Lewitt and Donald Judd from the mid-sixties and later. The choice of simple industrial materials (predominantly wood, metal, plastic) with sharp geometries and repetition across the forms, contributes to this visual connection.

Though there are visual references to standard loudspeaker construction, the sonic voice of each of Pigott’s speaker forms is far from standard. Utilizing the type of moving coil driver shown in figure 2 each speaker produces a unique and characteristic sound created in part by the materials that these drivers are coupled to - materials which effectively become the speaker cone. These type of cone-less speaker drivers which in the 1960s Tudor appropriated from the world of hobby electronics and engineering are now

produced commercially for use in home cinema (for invisible sound propagation through internal drywall interiors) and underwater listening (through the skin of a hot tub for example) among other uses including vending machines and video gaming chairs. In Pigott's speaker designs for *Speaker Park* the drivers excite a range of materials selected for their ability to acoustically broadcast sound in a characteristic way including plywood, plastics and metal, all of which are thin, relatively light and quite stiff.



Figure 1: A selection of Pigott's sculptural speakers for *Speaker Park*

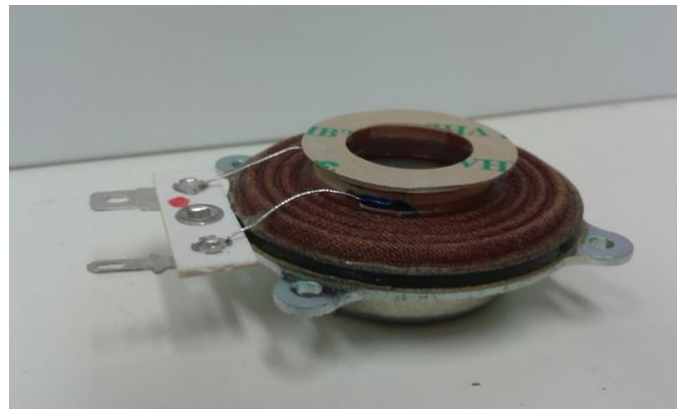


Figure 2: Cone-less speaker driver used in the above speakers.

This choice of materials and acoustic behaviours was informed by one of the collaborative requirements of the *Speaker Park* project which was to create a series of sonically unique and unusual speakers but that were not too extreme in their resonant distortion. Techniques such as those used by Tudor, Vale and Monahan of attaching large springs

and percussion instruments to speakers and electromechanical drivers resulting in highly coloured and distorted audio was carefully avoided in favour of a slightly more conservative approach of selecting materials that would broadly work as a traditional diaphragm though still add a characteristic tone of -for example- being ‘tinny’, ‘muffled’, ‘boxy’ or ‘wooden’ sounding or perhaps of having a very limited dynamic range. Further to these speaker diaphragm characteristics the boxes themselves also introduced resonances according to the various ways in which their internal voids were divided and subdivided, any ports that existed between the different chambers and the materials used. This is of course exactly as would be the case in standard speaker design except with Pigott’s *Speaker Park* speakers the various acoustic chambers and ports were created for visual effect rather than to create a flat frequency response and a transparent listening experience.

In the paper *Objects as Temporary Autonomous Zones*, Timothy Morton (2011) presents an objected oriented ontology whereby there are ‘no environment distinct objects’ - objects do not exist *in* time and space but that ‘they “time” (a verb) and “space”’. They produce time and space. With the *Speaker Park* composition, *A†BSB†R*, Saario had the sonic-affective intent to produce a *zone* that enables and empowers ‘space’ for autonomy of experience and subjectivity to emerge, in relation to the presence and experience of the custom loudspeakers. The *Speaker Park* and *A†BSB†R*, as a literal and material ‘composite’ of sound and sounding objects, “space”, “time” and “affect”, with sonic-space and time emanating from this (sound object) assemblage. Here a zone is produced where the standardized production and presentation of fixed media sonic space has been disrupted by the anti-configuration of *Speaker Park* and the anti-spatialisation and non-diffusion of *A†BSB†R*.

The *Speaker Park* <> *A†BSB†R* experience, and the associated spatial effect and affect production resists both the ‘downward’ and ‘upwards’ reduction described by Morton (2011). We do not consider the experience is usefully reducible to either its comprising parts nor to a holistic ‘one’. The installation and composition are, for us, better understood as a rhizomatic, connected and open network of spatial and sonic affect and potential, with the concert installation design bringing a different, and a difference, in the sonic-value-economy at play.

The *Speaker Park* presents the composer with an anti-configuration of loudspeakers, in terms of comprising loudspeaker types, numbers, layout, and format (see figure 3). The anti-configuration of the *Speaker Park* loudspeakers, effectively resists the production of stable (‘solid’) phantom images in a stereo or surround soundfield, and as such challenges (‘invites’) the composer to seek and produce different spatial *intensities* and relationships than those of the standardised stereo or multichannel loudspeaker systems and formats.

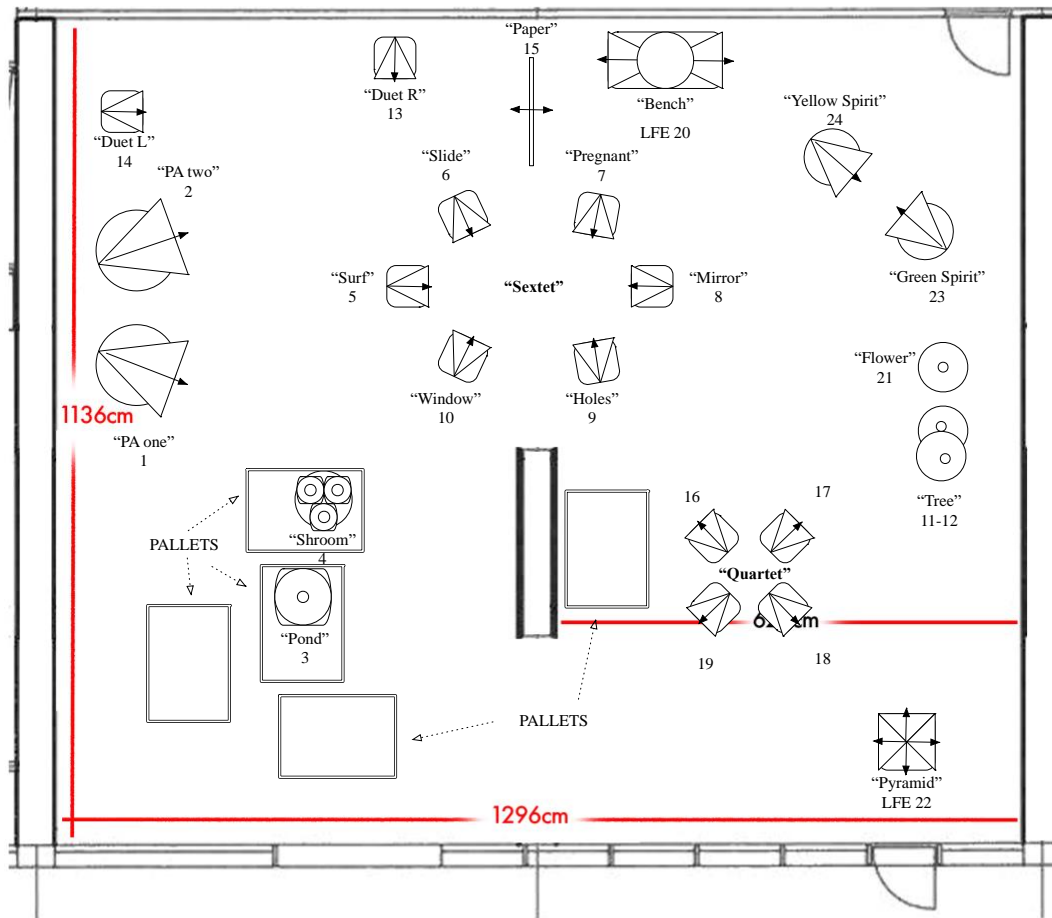


Figure 3: WRAP Large Project Room (Speaker Park venue, Borealis 2019). Floor plan. NB speakers 5-10, 13, 14 and 16-19 were made by Pigott.

As the *Speaker Park* loudspeaker system has no inherent sense of fixed front, back and sides and thus does not striate the available soundfield by default, it opens up the potential for the production of a smooth space of pure spatial strategy.

The sound objects associated with Saario's composition practice are typically predicated on the notion of a stereo space, either by the production of stereo space, being in a stereo space, and/or containing a stereo space. This extends to his work in and with surround sound formats and typical NSML diffusion systems, which he typically approaches from the perspective of multiple stereo planes combined with spatialised mono elements and native B-Format surround recordings. Working with *Speaker Park* necessitated a different perception and approach in relation to space production and thus the composition at large.

Harrison (Deruty, 2012) raises concerns about isotropy in relation to the associated impossibility of intimacy due to 'random' distances between speakers and a listening audience, the general audio quality, and the distortion of composers original intent. These

imply an assumption of a static audience and/or set seating in relation to the loudspeaker system. The effective anisotropy and omni-directional asymmetry of the *Speaker Park* anti-configuration, without any inherent hierarchy or reference to front-back-side(s), and with no fixed zone for audience, was found to produce an environment with high level of potential for intimacy, all on the listener's terms.

With *A†BSB†R* Saario decided to shape *Speaker Park* installation space so that one's position in the physical space ('room) did not matter or produce a hierarchy of positions in relation to the work. To paraphrase, the design brief for the sonic-space-body experience was one of 'disappearing' sweetspot (Deruty, 2012) with the spatial focus being one of continual immersion, irrespective of listener position. The approach empowers the participants to stay static or move in the 'park' and explore the space-continuum as desired, thus creating the potential for a moment of subjective 'autonomy' in a shared relational space, by producing and highlighting the difference and interconnectedness, in and of each spatial perspective in *Speaker Park*. A spatial assemblage of co-existing singularities and reality perspectives. In this seamless, continuous, and literal 'acoustic space' (McLuhan, 1967) of *A†BSB†R*, everywhere and nowhere is a sweetspot and the experience is one of 'all-at-oneness' (Bey, 1991; McLuhan, 1967).

Saario composed *A†BSB†R* into and in, as well as with and for, the *Speaker Park* speaker-space assemblage. There was no sound projection, spatialisation or sound diffusion of a finished composition *per se*. Composition and sound diffusion were coupled into a single production workflow stage and the compositional and spatial considerations and associated actions, were effectively inseparable from each other. The composition was production of space and the work emerged through this process of becoming-composition becoming diffused, or rather becoming-sound becoming-space.

This approach maps to a compositional approach for producing organic, emerging and nomadic structures and developing unfolding musical and sonic discourse which follows the basic listening premise outlined by Harrison (1992):

The starting point is always the sound – the individual sound in all its uniqueness. The details of its internal structure, of its spectral and temporal evolution reveal its potential and hint at what might be. The sensitive ear draws in and evolves other sounds with related potential – unleashed, from micro-structure through to whole pieces (Harrison, 1992).

In light of the above, the composer is effectively listening to the perceivable *spectromorphological* qualities (Smalley 1997). With *Speaker Park* it becomes important to extend the notion of a 'sound object' (Schaeffer, 2017) to include all elements of the loudspeaker-space-fixed-media-playback assemblage, with the listening focusing on specific, particular, unique features of each 'sound event', as enabled by the sound recording-playback assemblage. The uniqueness of each sound, the speakers, the

anti-configuration, and individual subjective experience (whether of composer or audience) produce and facilitate a new corporeal ('concrete') interaction with sound: subjective shaping of the sound-space continuum and production of a smooth space.

Also, with the composition of *A†BSB†R*, there was also no 'colouring' of the 'original musical content' (Deruty, 2012), as the musical content and the system were of each other. Instead of trying to minimise colouration, loudspeaker colouration was a fundamental feature, process and a medium, of collaborative composition practice between the composer and the 'park'. There was no enhancement, only 'colour'.

Finally, with this spatial strategy of negation of active sound diffusion, there is no spatial or spectral performance (Deruty, 2012) to 'view'. The 'park' and its participants are the only active agents of performance during the concert installation.

5. SPEAKER PARK AS AN ASSEMBLAGE

We understand *Speaker Park* neither as an instrument nor a listening environment or loudspeaker orchestra. *Speaker Park* is a collective of sonic collaborators and co-creators both human and non-human, where the ontological category of something 'being' an instrument or an orchestra, with their associated implied notions of authenticity or validation, hold no currency. The nature of the project was to bring together speaker designers and makers with composers and users into a single creative undertaking with view to uncovering new and creative possibilities through a critique of standardised and industrialised tools and workflow. From this perspective we see the project as an *assemblage*.

Typically credited as emerging from the work of Deleuze and Guattari (1998) from the French word *agencement*, an assemblage refers to both an ensemble of parts and the action required to bring those parts together simultaneously highlighting both materials and processes. The term implies an emphasis on heterogeneous components coming together through ad-hoc arrangements that are open to the possibility of change. From a perspective of vital materialism Bennett (2010) highlights the affective nature of components of an assemblage which have the power both to act and be acted upon, with the potential for these actions to be located in either human or non-human centres. The result here being that agency is distributed across a heterogeneously rich field rather than being localised in human efforts (Bennett 2010: 23). Assemblages are therefore not governed by a single head or single type of material, rather they are a collective, a coming together of different things yet with power distributed across them in uneven and unexpected ways (Bennett 2010: 24).

Law (2004) follows Watson-Verran and Turnbull (1995) in aligning the idea of the assemblage to the notion of the technological 'black box' - a term often used to describe

the way in which technologies are made singular, robust, transportable and closed. Reconsidering the black box through a lens of the assemblage highlights the way in which black boxes are more ad-hoc than they may seem, more open to interpretation and change and less closed.

Speaker Park maps onto these themes relating to the assemblage in a number of ways. Firstly, the collaborative and heterogenous nature of the project spans a range of materials, processes and modes of practice. Composition, electronic production technologies and techniques, formal design considerations and material construction techniques are really only the headlines of this heterogeneity in quite general terms. Inside each of these areas the *Speaker Park* assemblage reaches out making unexpected connections, possibilities and constraints in a myriad of ways. It is the unexpected nature of these crossings that allow for the characteristic ad-hoc nature of the assemblage to prompt the creative process to find new solutions.

The *Speaker Park* assemblage lent itself ‘naturally’ to the exploration and development of its intrinsic and emergent qualities, potentials, affordances and constraints, as compositional vehicles. Thus, the design of *A†BSB†R* emerged organically ‘as a product of the various forces in play in the milieu’ of *Speaker Park* and was ‘not be imposed from outside as specified form, but would work with the *grain* of its matter, from within, but also seamlessly with the milieu and networks extending to its horizons’. (Ballantyne, 2007). *A†BSB†R* is therefore all but one of many potential sonic designs emerging from the immanent properties of the *Speaker Park* assemblage of agents, materials and processes.

Bennett’s emphasis of affect within assemblages maps well onto a loudspeaker project such as *Speaker Park* where it might seem that the material constraints and associated resonances of the speakers draw up some hard lines around what is sonically possible and achievable. But without any audio to voice the characteristic sound of the individual speakers these resonances are not brought into being. In this sense the composed audio and the sculptural speakers are co-constructive of each other. There is no single power base of composer, instrument designer, or audio source, rather an unexpected and uneven web of possibilities and constraints. An audio ‘source’ in *Speaker Park* is located across both digital audio workstation and loudspeaker, its nature is negotiated between composer / producer and speaker designer / maker.

The undoing of the technological black box through an understanding of assemblage also helps to unpack the *Speaker Park* project. Some of the initial discussions relating to the project emerged as much from questions relating to commercial, high end studio technology and speaker specification as from the use of loudspeakers in experimental music. The project curators and participants were keen to test the paradigm of the ‘transparent’ loudspeaker within a context of composition, production and audience reception. For these reasons it was important that the project moved between different practitioners focussed on the different fields – speaker design, composition and curation

of the installed *Speaker Park* environment. It was with this broader, collaborative nature of the project in mind that the decision was taken not to make the speakers too extreme in their mechanical distortion and colouration of audio as described earlier. Future iterations of the project could explore this balance further, testing the balance of power and nodes of resonance distributed within the assemblage.

6. CONCLUSION

Speaker Park as a *milieu* was produced by and at the intersection of loudspeaker design and, in the case of *A†BSB†R*, post-acousmatic composition process. *Speaker Park* as a compositional collaboration effectively re-imagined the relationship matrix of a creator/designer-materials-work-medium-space as an ecology of collaboration, with composition as collaboration with all subjects including materials, media, agents, stakeholders, concepts, space and value propositions among others.

This productive assemblage built on Harrison's (1999) notion of composition as collaboration with sound materials as well as on traditions of exploring the sonic potentials of the loudspeaker within musical instruments and musical composition and listening environments. This produced increased complexity in terms of a network of dynamic interaction, connections, immanent potentials and emergent properties, and opened up new mediums of and for both creation and creative collaboration between human and non-human agents. Amongst other modes of interaction and collaboration, *Speaker Park* enabled (or called forth) the forming of an 'aesthetic-causal alliance' (Morton, 2011) with the non-human loudspeakers, thus innovating speaker design and post-acousmatic composition in tandem.

7. REFERENCES

Barrett, N. 2007. Trends in Electroacoustic Music. In Collins, N. and d'Esquivan, J. eds. 2007. *The Cambridge Companion to Electronic Music*. Cambridge: Cambridge University Press, pp38-54.

Bey, H. (1991). *The Temporary Autonomous Zone*. Autonomedia.

Deleuze, G. & Guattari, F. 1988. *A Thousand Plateaus: Capitalism & Schizophrenia*. Athlone.

Deruty, E. (2012). *Loudspeaker Orchestras: Non-standard Multi-Loudspeaker Diffusion Systems*. Sound on Sound. January 2012 Magazine. Available online: <https://www.soundonsound.com/techniques/loudspeaker-orchestras>

Driscoll, J. and Rogalsky, M. 2004. David Tudor's Rainforest: An Evolving Exploration of Resonance. *Leonardo Music Journal* 14, pp 25-30.

- Emmerson, S. 2007. *Living Electronic Music*. Aldershot: Ashgate.
- Harrison, J. (1992) 'The Primacy of the Ear' from liner notes to Smalley, D. *Impact interieurs*. Empreintes DIGITALes, Montreal. IMED 0409.
- Harrison, J. (1999). *Diffusion: theories and practices, with particular reference to the BEAST system*.
- Hudis, N. (2006). Tissue Flow Institute. Newcastle.
- Law, J. 2004. *After Method: Mess in Social Science Research*. New York: Routledge.
- Massumi, B. (2015). *After the Affective Turn: Reassessing Affect*. [Keynote]. ISEA 2015: *Disruption* conference, Vancouver, Canada
- McLuhan, M. (1967). *The Medium is the Massage*.
- Morton, T. (2011). *Objects as Temporary Autonomous Zones*.
- Preston, L. and Robles Thorseth, M.V.L. (2019). BOREALIS 2019 Programme Book.
- Riikonen, T. & Saario, A. 2011. *Listening to the Recorded Touch: A Strata-Aural Manifesto*.
- Riikonen, T. & Saario, A. 2011. Listening to the Recorded Touch: Towards Visceral Methodologies of Mixed Media Sound Making. [Paper presentation] *sforzando!*, EMS/EMF Conference, NYC, USA, June 2011.
- Rolf, I. (1992). *Re-establishing the Natural Alignment and Structural Integration of the Human Body for Vitality and Well-Being*. Healing Arts Press.
- Rose, E. 2013. Translating Transformations: Object Based Sound Installations. *Leonardo Music Journal* 23 pp65-69
- Schultz, R.L., Feitis. R. 1996. *The Endless Web: Fascial Anatomy and Physical Reality*. Berkley, North Atlantic Books.
- Sharma, K.,Schultz, F. 2017. Are Loudspeaker Arrays Musical Instruments? 4th international Conference on Spatial Audio (ICSA), Graz.
- Smalley D. (1986). *Spectro-morphology and structuring processes*.

Smalley D. (1997). *Spectro-morphology*

Synnes Handal, R. (2019). *Candy for your ears and eyes*. Translated by Preston, L.

Van Eck, C. 2017. *Between Air and Electricity: microphones and loudspeakers as musical instruments*. London, Bloomsbury.

8. DISCOGRAPHY

Saario, A. (2001), [digital release] *Portrait Concrete: Jo Hamilton in fixed media* [21'36" x 44.1kHz x 16bit]

Saario, A. (2001), [CD] *Viewpoint England: G&T Swimmers*. Sargasso Records.

Saario, A. (2004), [digital release] *Frames for One*.

Saario, A. (2007), [digital release] *Making Space: When the Curtain Falls*.

Saario, A. (2008), [digital release] *Aboriginal Terraformations*.

Saario, A. (2008), [digital release] *Nomadische Luftspiegelung für Eva*.