

<b>Institution:</b>	Goldsmiths, University of London
<b>Unit of Assessment:</b>	<b>35: Music, Drama, Dance and Performing Arts [MUSIC]</b>
<b>Title of case study:</b>	Sanitary Soundscapes: listener-centred approach to the noise effects of ultra-rapid hand dryers on vulnerable subgroups
<b>1. Summary of the impact</b> (indicative maximum 100 words)	

In research that challenges the dichotomy of music/ noise, Drever has investigated the properties and subjective effects of the high volumes produced by ultrafast hand dryers, finding that it is highly aversive for vulnerable groups including people with dementia, sensory impairments, and autistic spectrum disorders, in some cases exacerbating their social avoidance. These effects have been communicated to the public, industry professionals, and policymakers through a combination of creative art works and presentations of the research findings in varied public settings. They have been widely reported in the international media, via both general interest and specialist publications and programmes. He has worked closely with the UK's Noise Abatement Society and with industrial designers, who have welcomed his input to helping them improve hand dryer design.

<b>2. Underpinning research</b> (indicative maximum 500 words)
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John Drever has worked at Goldsmiths continuously since 2003 as Lecturer (and now Senior Lecturer) in Composition. In 2008 he co-founded and became Director of the Music Department's Unit for Sound Practice Research. The USPR fuses creative practice with music computing, audio technologies and unorthodox field studies to explore interactions between the body, ambisonics and wave field synthesis. In its mission to interrogate the social impact of sonic environments, it combines the application of field and studio-based artistic techniques with accredited methods of acoustic measurement to investigate the auditory experiences both of audiences for sound installation and creative performance and of *de facto* 'users' of products or activities which intrinsically entail exposure to sound and noise.

The present case study, exemplifying this mission, derives from Drever's investigation of the sonic properties and sensory/affective consequences of a ubiquitous societal experience: the noise made by the ultrafast hand dryers which are now found in most public conveniences. Expelling air at tremendous speeds to strip moisture off hands, their marketing draws on notions of muscularity: "blade", "blast", "hurricane", "jet", "turbo" and "typhoon". Whilst they represent an industrial engineering success story which chimes with the contemporary sustainability agenda, the 'sonic footprint' of these machines and their effects on individuals who are particularly sensitive to loud noise had not previously been investigated.

The study originated from Drever's participation in a national 9-week project which brought together sound artists, acousticians, designers, policy-makers and researchers to explore the relationship between sound and built environment. Entitled "*Ways of Hearing: a Proto-Academy in Listening, Sound and City Futures*", it was organised by Sound and Music in cooperation with MAAP, MUSARC and Arup, and enabled individual practitioners to develop new design approaches, processes and innovations. In this context Drever connected with the architect Fred Manson, who had recently designed state-of-the-art toilet facilities in Hong Kong, and Hugh Huddy, a partially sighted sound artist then leading the development of corporate policy on accessibility for the Royal National Institute for the Blind. The resulting focus on hand dryer noise was of interest to Drever and the USPR not only in its own right but because it served as a methodological paradigm for understanding the impact of noise and soundscapes at individual and societal levels, and for deploying the findings to inform debate, public policy, and product design.

In essence, the study investigated the auditory characteristics and effects of a selection of popular brands of hand dryer installed in public washrooms. Given Drever's interest in whether certain subgroups of the population find the noise particularly aversive, he sought advice from Anya Ustaszewski, a composer who is herself on the autistic spectrum and works as a disability equality trainer, and from Jo-Anne Bichard, a design anthropologist who has expertise in ethnographic studies of public sanitation environments. He also consulted with diverse professionals including acoustic engineers, urban designers, architects, product designers, and environmental health specialists. The resultant multi-dimensional methodology involved acoustic testing at the BRE [Building Research Establishment] laboratories; *in situ* environmental acoustics and noise assessment; field recording; and a social survey.

He found that a single hand dryer, when located in a small public washroom with highly reflective

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surfaces, created as much noise as the aggregate effect of nineteen of the same machines in a free field environment (as measured in the BRE anechoic chamber); furthermore, a high proportion of the energy was compacted in the high-frequency range.<sup>[1][2]</sup> The survey identified several subgroups for whom loud hand dryer noise led to elevated anxiety, fear, and confusion: these included infants; the elderly; partially sighted people; hearing aid users; and people with dementia, cerebral palsy, Ménière's disease, phonophobia, hyperacusis, or hyperacute hearing in the context of autism and Asperger's syndrome. Some even reported having to avoid use of public or workplace toilet facilities, exacerbating their social exclusion.<sup>[3]</sup>

Drever has complemented these empirical findings with practice-based research exploring the subjective effects of hand dryer noise through two sonic art works, both of which have attracted considerable public interest and media attention (see section 4 for details):

- *sanitary tones: ayre #1* [Airblade] (60mins; 2012)<sup>[4]</sup> The first étude in a suite of hand dryer sound energy studies, this features a Dyson Airblade™ which was recorded in BRE's large anechoic chamber. *Ex-situ* recording captured the inherent sound energy of the device. The work slowly unfolds shards of frequency band extracted from the densely compacted, turbulent white noise generated from the 10-second cycle of interfering parallel air sheets traveling at 400 mph.
- *Litany of the Hand Dryers* (20 mins; 2013)<sup>[5]</sup> features a 5 year old child with sensitive hearing introducing recordings of different brands of hand dryers and singing their names.

He has also presented this research at a workshop<sup>[6]</sup> organised by the European Cooperation in Science and Technology [COST] network to facilitate exchange between international soundscape experts on the impact of the environment on health and quality of life. This workshop focused on the exploration of practical methods for assessing and improving soundscapes in Brighton, and was open to the general public, stakeholders and those involved in policy.

### 3. References to the research (indicative maximum of six references)

**Evidence of the quality of the research:** The originality, significance, and rigour of this research, uniquely investigating not just the sound itself but its interaction with the physical context and qualitative aspects of the auditory experience, is evidenced by its acceptance for presentation at, and reporting in the formal proceedings of, prestigious international academic conferences including [1] and [3] below. Hard/electronic copies are available on request from Goldsmiths Research Office.

1. Drever JL (2011) '[Sanitary Ambiance](#): a study of current auditory ambiances of public toilets in England'. *Urban Design and Urban Society*. The Ludwig Maximilian University of Munich, 3<sup>rd</sup> International Ambiance Network Conference.
2. Drever JL (2013) 'Sanitary Ambiance: the noise effects of high speed hand dryers', *Sound Diaries Symposium: How are we using field recordings to change the world?* Sonic Arts Research Unit, Oxford Brookes University, Oxford.
3. Drever JL (2013) 'Sanitary Soundscapes: the noise effects from ultra-rapid 'ecological' hand dryers on vulnerable subgroups in publicly accessible toilets', Proceedings on CD-Rom of the *AIA-DAGA 2013*, the joint Conference on Acoustics, European Acoustics Association Euroregio, 39th Annual Congress of the Deutsche Gesellschaft für Akustik and the 40th Annual Congress of the Associazione Italiana di Acustica, Merano. <http://eprints.gold.ac.uk/8653/> and [programme](#).
4. Drever JL (2012) *Sanitary Tones: ayre #1* [Airblade]. Details [here](#) and recording [here](#).
5. Drever JL (2013) *Litany of the Hand Dryers* (20 mins). Recording [here](#).
6. Drever, JL (2012) 'Sanitary Soundscapes: the noise effects from ultra-rapid 'ecological' hand dryers on vulnerable subgroups in publicly accessible toilets'. In [Sounding Brighton - Exploring practical methods for assessing and improving soundscapes](#). EU COST Action TD0804 workshop, Brighton & Hove City Council and the Noise Abatement Society, Brighton.

### 4. Details of the impact (indicative maximum 750 words)

Drever and colleagues have worked intensively to bring their findings to the attention of the public, policy-makers, and industry professionals. This has entailed public performances of his sonic art works; giving talks at numerous public events; and dissemination via a range of media channels. He has worked closely with the UK's long-established Noise Abatement Society [NAS],<sup>[1]</sup> participating with them in networking events at the Palace of Westminster, giving public talks, and

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publishing in their journal SoundScape. Since 2011 he has also been an advisor to its international eco-award programme, [Quiet Mark](#), which is run jointly with the Association of Noise Consultants and recognises excellence in quiet product design.

**Sonic Art works:**<sup>[2]</sup> Drever's innovative and accessible interpretative sound art compositions and installations sought to convey to healthy adults, who are generally fairly tolerant of short-lived loud or unpleasant noise, the striking levels of discomfort experienced by others. Thus *Sanitary Tones* has been broadcast in its entirety several times, including in the 'AV Festival: As Slow As Possible', curated by People Like Us (Tyneside, 2012) and 88view Co-LaboRadio (Berlin, 2013); and it has been released online by Nantes-based collective APO33's Fibrr Records (July 2013) and performed at the launch in the Musée Des Beaux-Arts De Nantes.

*Litany of the Hand Dryers* was presented as a surround sound installation at a Goldsmiths "Making a Difference" event in Feb 2013, attended by 200+ members of the public as well as academics, and an excerpt was broadcast on BBC Radio 4's Today programme on July 18<sup>th</sup> 2013.<sup>[2]</sup> This elicited responses from listeners which, amongst other positive comments, described their own children's aversion to hand dryer noise: for example one [tweet](#) shown on the BBC webpage reads "hand dryers terrify my 3 yr old so much he won't go in toilets ... He's not the only toddler to have that fear".

Both works were included in a touring showcase, "[Soundscapes for the Public Realm - Exploring Practical Applications of Soundscapes](#)", linked to the EU COST Action TD0804 in association with the NAS. It has been exhibited at events for policy makers in Brighton (2011, 2012), Vitoria-Gasteiz (2012), Merano, Italy (2013) and Naples, Italy (2013).

**Public talks:** Since 2011 these have included a talk about sonic experiments as part of Brighton & Hove's White Night (an annual participatory festival which attracts c. 25000 people);<sup>[4]</sup> a contribution to a 'Smart City Talks: Sound City' series; and a keynote at the "Sounding Space" symposium held at Chelsea College of Art & Design in June 2013 organised by BE OPEN, a creative thinktank which runs conferences, exhibitions, master classes and cultural events.

These talks have not only elicited much interest from attendees, but have enabled some to find solutions to longstanding problems. Thus for example a hyperacusis sufferer wrote to say that he had been triggered by hearing one of them to contact various organisations for help, with a successful outcome: "I now have Bose noise cancelling headphones paid for by Access Point."<sup>[5]</sup>

**Media exposure:**<sup>[6]</sup> On World Listening Day (18/07/13) Drever was interviewed on Radio 4's Today and BBC Newcastle. The research findings were also reported in many newspapers and blogs, including (in the UK) the Telegraph, Daily Mail, London Evening Standard, The Independent, and (internationally) the Huffington Post, Cyprustoday.net, and Miami Newsday. They were also picked up by numerous specialist publications produced by public or professional interest groups (e.g. Age UK Hearing Aids, Nursing Times, Tinnitus Support, Clearer Hearing, Learning Disability Today). It even featured in *BBC News Magazine Monitor: Quiz of the Week's News* (19/07/13).

**Dissemination to and interactions with industry and public sector policy-makers:**<sup>[7]</sup> The interest of professional organisations in this research has manifested in invitations to Drever to participate in events including, among others:

- a roundtable discussion at the Royal Institution of Chartered Surveyors, in preparation for the 2012 National Noise Summit organised by Rockwool [the world's largest stonewool insulation manufacturer] and NAS, at which over 100 experts from the architecture, construction, acoustic and property professions gathered to discuss new ways to combat noise pollution in the UK's built environment. It included contributions and debate from leading authorities from universities, local and national government and major companies discussing what needs to be done about the rising levels of noise in our towns and cities. This contributed to the development of a Noise Manifesto to present to Government and industry.
- the European COST workshop described in section 2 above: co-participants were members of Brighton & Hove City Council, NAS, and an International Standards Organisation Working Group [ISO 54] which is developing the first International standard on soundscape (due for completion in 2015). The Director of NAS has noted<sup>[1]</sup> that "[Drever's] work on the noise effects of high speed hand dryers and participation in the NAS-led COST Action TD0804 and ISO Working Group 54 projects has been invaluable for knowledge sharing amongst government and local government policy makers, industry stakeholders and local people who would otherwise not have been exposed to the subject."

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Drever has written articles for professionals and non-professionals in non-academic publications<sup>[8]</sup> including *Blueprint* (Nov 2011), a long-established magazine focusing on design, architecture and style; the Noise Abatement Society's ezine, *SoundScape* (2012, Issue 2); the *World Forum for Acoustic Ecology News Quarterly* (Vol 10:3); and the *Acoustics Bulletin* (2013, Vol 38) of the Institute of Acoustics, the UK's professional body for those working in acoustics, noise and vibration. His research has also been cited in the *AIA/Architectural Record Continuing Education Program* on "Hand Dryer Technology and Accessible Restroom Design" sponsored by Dyson.

Industry has welcomed his constructive contribution to informing design priorities. For example, Mitsubishi Electric Europe has said that "*Goldsmiths is to be congratulated on its work – identifying an issue before it becomes even more widespread and suggesting ways that it can be addressed,*" whilst hand dryer producers Airdri, Savortex and Mitsubishi, with distributor Intelligent Hand Dryers, have written that "*We hope that Mr Drever's study will lead to a new standard as hand dryers must be inclusive for all users.*"<sup>[9]</sup>

A consultant town planner with responsibility for preparing and implementing the Greater London Authority's citywide noise strategy, to which Drever was an advisor in 2004, commented in an email dated 7<sup>th</sup> May 2013:<sup>[10]</sup> "*Drever's work has had significant direct impacts, for example, in raising the profile of severe noise effects on certain vulnerable population sub-groups. It has also had wider impacts in demonstrating the need for improving the ways in which the noise of such equipment is measured, assessed and regulated.*"

### 5. Sources to corroborate the impact (indicative maximum of 10 references)

All materials listed below are available in hard or electronic copy from Goldsmiths Research Office.

1. [ISO/TC 43/SC 1/WG 54 "Perceptual assessment of soundscape quality"](#), of the International Organization for Standardization (ISO), preparing the first International Standard on soundscape, ISO 12913-1]  
Full comments of the Managing Director of the Noise Abatement Society are available on request from Goldsmiths Research Office, and he is willing to be contacted for corroboration.
2. Material (programmes, recordings) relating to the performances of these works is available on request from the Research Office. The BBC programme is available [here](#).
3. [COST TUD0804 Final Conference](#) (2013) *Exhibition Exploring Practical Applications of Soundscapes for the Public Realm*. Curated by Lavia and Dixon.
4. Details of these public talks are available on request from the Research Office. Examples can also be seen at: [White Night](#) talk; [Smart City](#) Talk; [BE OPEN](#) talk.
5. Copies of correspondence available on request from Goldsmiths Research Office
6. [Media exposure](#): Articles appeared in the publications listed within the text plus: *Boots WebMD, Before It's News, Thisismoney.co.uk, The Beer Justice, Daily Referendum Blogspot, Capital Bay (USA), MSN UK News, Metro Newsday, London 24, Cleaning Matters, The Times of Malta, The Inquisitor*. A set of these articles is available on request from Goldsmiths Research Office.
7. [Events with industry and policy-makers](#): Information on these events is available on request from the Research Office. For brief details, see [The Noise Summit](#), and the [COST event](#).
8. These articles are available on request from Goldsmiths Research Office [or for examples, see [Blueprint](#); [SoundScape](#) ezine, p.57; [AIA/Architectural Record](#)].
9. Industry reactions: Copies of correspondence are available on request from Goldsmiths Research Office. The UK product specialist at Mitsubishi Electric Europe is willing to be contacted for corroboration [*contact details provided separately*]
10. The consultant's full comments are available on request from Goldsmiths Research Office. He is willing to be contacted for corroboration [*contact details provided separately*]