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The sound of study: Student experiences of listening in the university soundscape

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The students from three universities (Groningen, Oldenburg and the University of Applied Sciences in Utrecht) were surveyed on the experience of hearing and listening in their studies. Included in the online survey were established questionnaires on hearing loss, tinnitus, hyperacusis, a subscale on psychosocial strain resulting from impaired hearing and a questionnaire about students' perceptions of listening ease in study environments. Results from the 10,466 students who completed the survey (13% response rate) are highlighted, with particular attention to listening ease and measures proposed by students for improving it. The number of students having problems with hearing and listening transpires to be substantially larger when research is not constrained to students with a recognised hearing impairment, suggesting that listening is primarily a sociocultural performance and achievement rather than an artefact of physical attributes. One finding from our survey is that classroom practices could be more effective if study soundscapes are improved, while universities might exercise greater inclusive responsibility for study as a high quality sensory experience for the benefit of all students.

Keywords: higher education; access and accessibility; functionally impaired students; hearing loss and deafness

Introduction

While academic research reflects an interest in the study of sound, very little is known about the sound of study, the combination of focused listening routines and study environments with their own particular acoustic qualities that mediate the quality and effectiveness of teaching and learning.[1]

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The primary concerns in the field of acoustic ecology with auditory competence have their origins in the 1970s (Wrightson 2000) and acknowledge the increasingly visually orientated nature of social and cultural life – a ‘turn to visual culture’ that is, however, easily overstated (Jay 1993, 2002). Nevertheless, the widespread privileging of any one particular type of sensory experience over another in any one historical period does appear to go hand in hand with collective experience and with culture (Alpers 1983; Chaney 1993; Debord 1967). The sensory culture of the modern era involves a distinctive and extreme visual acuity and awareness that is technologically mediated and has become an attribute of social organisation (Jenks 1995). The increasing use of technology in society has brought with it a steep rise in the incidence of noise-induced deafness and changed the nature of auditory competence among children. This set of conclusions invites sound to be understood as a cultural phenomenon, with characteristics that vary according to the social and technical conditions that prevail at any one time and in any one place. Some commentators have pointed to problems with seeing sound as mediated by culture and technology, noting that it obscures how the senses integrate with the material world (Ingold 2011). However, there is an important message contained in the recognition that listening and sound do have social and technical histories and that their character varies with context. That message is that skills and judgement are needed for the more or less successful involvement of listening in particular types of social performance, such as attending lectures. Equally, what is implied by the term ‘listening’ will vary in time and with changes in both sound and what it means to hear it. Wrightson’s conclusion does therefore help to make clear that listening is rather more than active sensory awareness: listening involves a type of auditory competence that varies with time, place and collective habits.

The individual and collective deterioration of sonological competence across generations has been linked to the rise of technological infrastructure as the main cause of both the loss of auditory competence and the privileging of visual perception. This includes most notably the ever-present ‘low-fi’ background noise of traffic and machinery, which has reduced the diversity of local and historically more natural soundscapes to a sonorous, homogenised and persistent acoustic ambience. The average volume level of urban acoustic sound is said to have doubled over the last 20 years, while the volume of police car sirens has risen by 40 dB since the last century (Ipsen 2002). Analyses of the ability to hear that often include little more than audiological and medical characteristics of private individuals barely scratch the surface of all that is involved in hearing and listening, since they fail to address sociocultural and environmental attributes of hearing and listening: studies that focus on the physiological properties of hearing typically lack the ecological awareness of acoustic studies. As with all human experience, hearing and listening are thoroughly social phenomena that are ever-more the product of material environment and culture, as cochlear-implanted individuals – but not only they – may attest (Chorost 2006, 2011). Description of the materiality of social systems and culture is a common feature of studies in the sociology of technology (e.g. Bauchspies, Croissant, and Restivo 2005; Bijker, Hughes, and Pinch 1987; Bijker and Law 1994; Gross, 2010; Pickering 1995) and, in particular, is characteristic of actor network theory (Latour 2005; Harman 2009), although the perspective is much less often applied to sensory experience or disablement (an exception is Blume 1999, 2010). Our own study loosely joins this broadly sociomaterial rather than medical or audiological research orientation.

Hearing as physical disorder

General hearing loss in adolescents

Analysis of survey data collected as part of the US National Health and Nutrition Examination Survey (NHANES) between 1999–2004 revealed that 8.5% of young people aged between 20–29 years had a hearing loss of 25 dB (better ear average) or greater in the speech frequencies (Agrawai, Platz, and Niparko 2008). In addition, the prevalence of hearing loss seemed to be growing among this age group. The authors note that hearing loss is not only a disabling condition – one that limits verbal language development and social connection – but also increasingly presents a social problem, since the costs of increased needs and diminished autonomy that are associated with hearing loss are shared by society (Mohr et al. 2000). Other studies have confirmed a rise in the prevalence of hearing loss in the adolescent population. Comparing 1988–1994 with 2005–2006 NHANES data, Shargorodsky et al. (2010) report a significant increase, from 14.9 to 19.5%, in the prevalence of noise-induced hearing loss among 12–19 year olds in the US. In the 1988–1994 data was evidence for the conclusion that noise-induced hearing loss accounted for 12.5% of the 14.9% total of children and adolescents with hearing loss. The very large proportion of adolescents with noise-induced hearing loss is confirmed by research carried out by the Institute of Hearing Research in the UK (Fortnum et al. 2001). Generally regarded as an authoritative source on prevalence figures in the field of deaf studies, the study found an incidence rate of early onset deafness ranging from 0.91% for three year olds to 1.65% for children aged 9–16 years, adjusted to 1.07% and 2.05%, respectively, to compensate for the possibility of under-reporting/diagnosis. Roughly in keeping with an earlier estimate of 1.1 per thousand among 3–10 year olds (Van Naarden, Decouflé, and Caldwell 1999), these rates suggest that early-onset hearing loss and hearing loss that is mainly associated with genetic factors, birth complications and viral infections early in life have a low incidence rate that is stable over time, while noise-induced hearing loss is very much more commonplace and on the increase.

Contemporary listening habits raise particular concerns about the rising number of young people suffering from loud music and noise-induced hearing impairments (e.g. Mostafapour, Laharogoue, and Gates 2009). Studies report increases in loud music-induced hearing loss among young people, with many adolescents that were surveyed experiencing tinnitus or hearing impairment (or both) after attending concerts and clubs. It has been proposed that the majority of today's young adults have at any one time in childhood or adolescence experienced noise-induced problems with their hearing (Chung et al. 2005; Daniel 2007).

The rise in prevalence rates of noise-induced hearing loss among young people is not purely a recent phenomenon, although the explosion of portable music players in combination with headphones has accelerated the trend (Lipscomb 1972). More recently, research has focused on preventive measures in relation to listening habits, finding for instance that when listening in silence, 17.8% of volunteers spontaneously selected a potentially damaging listening level of approximately 85 dB, and 40% selected a listening level of about 94 dB with 90 dB background noise (Breinbauer et al. 2012). Recent estimates put the number of young people at risk from noise-induced hearing loss in the EU at between 2.5 and 10 million, whereas in an Australian study a quarter of iPod users listened at volumes sufficient to cause hearing damage (Levey et al. 2011). In the UK, two out of three people using MP3 players turned up the volume to dangerous levels of about 85 dB or higher (Rabinowitz 2010). And finally, 2003–2004 data suggest that 15% of Americans between the ages of 20–69 have a hearing loss that corresponds with the particular characteristics of noise-induced hearing loss, with a further 29 million Americans, or 16% of the population, suffering ≥ 25 dB hearing loss in the speech frequency region (Le Prell and Henderson 2012). One in ten people worldwide are estimated to have some kind of hearing loss, with noise-induced hearing damage now being the single most preventable cause (Mahboudi et al. 2012).

Tinnitus and hyperacusis

The prevalence of tinnitus (the more or less constant perception of sound not physically present in the environment) in childhood and adolescence has been difficult to determine. Earlier studies suggest that up to 20% of the population may experience bothersome tinnitus, whereas a recent retrospective case study review conducted in three EU expert centres reports prevalence figures among under-18s that represent 3.8% of paediatric clinical workload (Baguley et al. 2013). The reporting of tinnitus tends to increase with more recent birth cohorts, suggesting that while late-onset deafness not induced by exposure to loud noise is in decline, the prevalence of tinnitus is on the rise (Nondahl et al. 2012). Here, too, a correlation has been established with loud music, with 89.5% of university students experiencing transient tinnitus after exposure to loud music (Gilles et al. 2012). The incidence of transient tinnitus was higher among female than male students, while 14.8% of students exposed to loud music experienced permanent onset of noise-induced tinnitus. The authors note that the onset of noise-induced tinnitus is therefore particularly common among young adults.

Hyperacusis is a condition associated with unusual intolerance for and discomfort from environmental sounds. Claims and findings about hyperacusis have so far engendered modest consensus among experts, so that estimations of its prevalence vary from 7 to 23% of the population (Andersson et al. 2002; Baguley 2003). The majority of people with a loudness perception disorder also have tinnitus, whereas just under half of individuals with tinnitus also report some degree of hyperacusis (Baguley and McFerran 2011). According to some experts hyperacusis can be induced by migraine, with co-occurrence rates estimated to fall between 70–80% during attacks (Eggermont and Zeng 2012). Striking about hyperacusis therefore is that, while comparatively little is formally known about the condition, it may well account for a significant proportion of people experiencing impaired hearing.

Access to higher education in the Netherlands and Germany

Like most Western countries, the Netherlands and Germany have signed up to the Salamanca Statement (UNESCO 1994). This statement recognises the 'necessity and urgency of providing education for children, youth and adults with special educational needs within the regular education system' (viii), calling for signatories among other things to 'establish decentralized and participatory mechanisms for planning, monitoring and evaluating educational provision for children and adults with special education needs', and for the academic community to 'strengthen research and networking and to establish regional centres of information and documentation; also, to serve as a clearinghouse for such activities and for disseminating the specific results and progress achieved at country level in pursuance of this Statement' (x–xi).

The Netherlands instructs the equal treatment of students with a functional impairment by law (Dutch Ministry of Health/VWS 2003). The principle of equal treatment in education is based on Article 1 of the constitution, which secures the general right to equal treatment and equal participation, as well as protection from discrimination on grounds of handicap or chronic illness. Article 2 of the same law imposes on universities the obligation to make efficient adjustments in order to make education accessible to all students. According to education law, adjustments that correct for impaired access must be both necessary and appropriate and not present an unreasonable challenge for the institution (Dutch Education Inspectorate 2012). Following a 2011 amendment to education law, higher education institutions are legally bound to self-assess the level of access and sufficiency of access arrangements for students with functional impairments (Dutch Ministry of Education/OCW 1992, §5a.8–13). Although a number of general survey reports (Broenink and Gorter 2001; Plemper 2005; Poels-Ribbering et al. 2011) and a general annual national monitor are available, little empirical research is being undertaken into the particularities of hearing and listening at university.

The annual monitor suggests that a variety of support measures are reported by universities, including providing information, hosting intake (diagnostic) conversations, providing a range of technical aids and adjustments to students and for coaching of students, and hosting awareness training for staff. According to the most recent monitor, 8–10% of the national population of 650,000 students report studying with a functional impairment (Steenkamp 2012, 2). The number of students with a functional impairment exiting their study early, around 2000 per year, is two to three times higher than for students generally (Handicap+Studie 2008). In an earlier national survey completed by 9772 first-year university students with a functional impairment, 60 students (0.6%) indicated a functional impairment in hearing (Severiens et al. 2009, 47).

In Germany education is decentralised and subject to the regional differences of its 16 *Länder*. Academic adjustment according to need is a right granted by the higher education Acts of the German federal states. The *Hochschulgesetz* of the state of Niedersachsen, for example (under which Oldenburg falls), states that the social participation of students needs to be ensured by institutions and detrimental effects on the quality of study avoided, if possible without the use of external help (Niedersächsisches Ministerium für Wissenschaft und Kultur 2010, §3). Further binding regulations ensure transparency and verifiability, much as is the case in the Netherlands. In 2006, 19% (327,000) of 1.76 million students in total had reported an impairment to their university, of which 4% (±13,080) reported a hearing loss (Isserstedt et al. 2007, 390–393). Based on these figures hearing loss has a prevalence rate of 0.7% among the general student body. The number of students with a hearing loss has risen 10% since 1997, which judging by other findings is most likely attributable to a combination of improved reporting and an increase in the rate of noise-induced hearing loss. Of the students with a hearing loss, 50% receive study support (Isserstedt et al. 2007, 395). The figure of 19% for the incidence of impairments generally is double the 8–10% figure reported for the Netherlands, while the incidence figure of hearing loss is strikingly similar. However, in a separate study, the Institute of Advanced Studies in Vienna reported that 8% of the German student population had a disability or chronic disease (Deutsches Studentenwerk 2013), so that differences in prevalence calculations between the Netherlands and Germany are likely attributable to the many variable features of data collection.

The study: 'Have you heard?'

In 2009 a collaborative research project on barriers to participation for students in relation to hearing, listening, sound and acoustics was initiated by Oldenburg University in Germany, and Groningen University and the Applied University of Utrecht in the Netherlands. Survey data were collected online from a joint pool of 79,158 students using Limesurvey software. The survey aimed to collect data on students' subjective judgement regarding hearing and listening. In order to avoid the introduction of selection bias with the presupposition of particular categories of hearing and also to include students who experienced no issues with hearing or listening, the survey was open to all students. A total of 10,466 students completed the survey, a response rate of 13%. The response rate varied by university (Oldenburg 29%, Groningen 12% and Utrecht 10%), but since there was no particular reason to include national legislation and policy as a variable (Dutch and German education law and practice being strikingly similar in both intentionality and generality on this point), we judged that there was no real cause to weight the data. It is likely that a relatively greater number of students with a hearing condition completed the survey in all three universities, since they are more likely to be alert to the interests being served by research on this topic. Therefore the data-set cannot meaningfully be used to derive general statements about the incidence rate of hearing impairments or disabling conditions among the population under study.

At the start of the survey participants were asked if, and if so how long, they had been suffering from a hearing condition. Only those students who indicated suffering from a hearing condition for at least one month or more prior to the survey date progressed to a further set of questions aimed at characterising that condition. This included items referring to the magnitude of the condition, its laterality (in one or both ears) and the use of hearing aids. Further questions then selectively pointed respondents to sub-questionnaires relating to tinnitus and hyperacusis where this became appropriate.

With respect to tinnitus, students were asked how often they hear noises in their head or ears (for example, ringing in the ears). Respondents who answered with 'often' or 'always' received the Mini-Tinnitus Questionnaire (Mini-TQ12) from Goebel et al. (2005), which consists of 12 items and helps establish the severity of the tinnitus according to four levels (mild, moderate, severe, most severe). In addition to the Mini-TQ12, respondents were asked further questions to characterise their tinnitus (for example, acuteness, pitch, volume and laterality).

With respect to hyperacusis, respondents were asked – in keeping with Meeus, Blaivie, and Van de Heyning (2010) – whether they find noises uncomfortably loud even when other individuals are not disturbed by them. Respondents who answered in the affirmative received the 14-item hyperacusis questionnaire from Khalfa et al. (2002). This questionnaire contained further questions from which the onset of noise sensitivity and its laterality could be ascertained.

All respondents with confirmed hearing loss, tinnitus and/or hyperacusis were furthermore presented with the Modes of Behaviour and Reaction and Interpersonal Relationships subscale from the Göteborger Profile (Ringdahl, Erikson-Mangold, and Andersson 1998), in order to collect data on the psychosocial strain that they experience while being a student.

All respondents (including respondents with normal hearing) were moreover asked to make judgements regarding hearing in three sub-categories of speech cognition – 'hearing in quiet', 'hearing in noise' and 'directional hearing' – so that their personal judgement regarding hearing could be assessed. The Oldenburg Inventory-R (Holube and Kollmeier 1994) served as the gauge.

The first exploratory statistical analyses we conducted on our data-set (Schulze et al. 2013) suggest that the hearing problems investigated with the sub-questionnaires – hearing loss, tinnitus and hyperacusis – are meaningful phenomena to the students surveyed at all three universities. In total, 28.8% (Oldenburg 27.2%, Groningen 27.7% and Utrecht 31.6%) of all respondents indicated that they suffered from either hearing loss (4%), chronic tinnitus (3.1%), noise sensitivity (15.8%) or a combination of these (5.9%), and gave answers that were internally consistent with the range of questions asked in the survey.

The greatest number of those students reporting a hearing condition reported hyperacusis (close to 55%). Hearing loss (14%) was the second most common condition indicated. The proportion of students who reported that they are affected by at least a moderate hearing problem (Oldenburg 2.2%, Groningen 4.3% and Utrecht 5.6%) is roughly in keeping with the international literature cited earlier but towards the higher rates reported, including notably a study by Sohn and Jörgenshaus (2001), who assume an average prevalence of 2% hearing loss in the general population aged 20–29. For Utrecht, the higher figure can probably be explained by the presence of Deaf Studies programmes in the university. With regard to the various possible permutations of combined hearing disabilities, our survey data show a particular association between tinnitus and hyperacusis, averaging 6.1% across students in the three institutions. Only 3.7% of the students with hearing conditions reported a combination of all three types of hearing impairment.

Tinnitus was reported by 7.1% of respondents (Oldenburg and Utrecht 8%, Groningen 6%). The relatively stable 4% prevalence rate of chronic tinnitus among adults indicated by Pilgramm et al. (1999) and other international studies therefore does not, at first sight, appear to be replicated in the data-set. However, 3.1% of the respondents in our data-set report only chronic tinnitus (Schulze et al. 2013, 97), while the other 4% report additional problems with hearing. In keeping with earlier studies by Schaaf, Eichenberg, and Hesse (2010) and Pilgramm et al. (1999), the overwhelming majority (between 85–90%) of respondents suffering from tinnitus can be categorised as the compensated type.[2]

With regard to the psychosocial stress of students reporting a hearing problem, the data-set shows that the stress experienced by students rises strongly in association with the increasing severity of the hearing condition. Nevertheless, the 21.8% average psychosocial stress experienced by students with hearing conditions in this study is 9% lower than the 30.8% reported by Ringdahl, Eriksson-Mangold, and Andersson (1998). This deviation can probably be explained by the fact that the latter study relied on two groups with a very narrow range of hearing loss for the measurement of average psychosocial stress. It is not unlikely that the average hearing loss among our respondents was lower, which in turn could have led to lower average psychosocial stress being reported. Our data also suggest that students with the decompensated type of tinnitus are exposed to a psychosocial stress that is twice as strong (33.2%) as that suffered by students with the compensated type of tinnitus.

Findings: listening ease and measures proposed by students to improve it

Now that the demographic particularities of our data-set have been clarified, we can move to detailing general features of the responses that were given by the Oldenburg and Groningen students to the Perception of Listening Ease (PLE) questionnaire that was also part of the survey.[3] The students completed the PLE and a final open question that invited them to indicate what measures in their view might be taken to alleviate the hearing and listening elements of studying, giving them space to write down three separate measures. In what follows we will first summarise students' general PLE responses – since doing so enumerates the most significant challenges students experience – and then focus on the measures they propose to alleviate the difficulties associated with listening during study.

The PLE (Kennedy et al. 2006) is a three-part questionnaire containing 21 closed questions in total. The aim of the questionnaire is to measure classroom listening qualities as these are perceived by students. In the study by Kennedy et al., it was administered to 5700 students in 30 classrooms at one single university, alongside physical acoustical measurements being taken in each classroom. In addition to measures related to listening ease, the questionnaire includes items relating to course- and instructor-specific measures (part two) and individual factors (part three). The 19 items in parts one (listening ease) and two (course specifics) generate a PLE score for each student. In the Kennedy study, reduced PLE was primarily associated with female students, students who have English as a second language, students with hearing impairments and students not interested in the course material (Kennedy et al. 2006, 307). Since our study was pitched differently and we had no means for taking acoustic measures over such a large and distributed population, we omitted parts two and three of the questionnaire and asked students to respond, not in relation to any one particular teaching room, but in general terms to the six items in part one of the PLE.

Figure 1 lists those sounds that most disturb listening during lectures according to the students included in our study. Responses are distributed on a five-point Likert scale that ran from 'almost always' (1) to 'rarely' (5); only the first two response categories ('very often' and 'almost always') are included in Figure 1 for the total of 7345 student responses.

Figure 2 lists what students judge to be the consequences of noise distractions during lectures, according to the students themselves. Again, only the first two response categories are included. Just to note the salience of what might seem minor disruptions, 49.7% of students report very often or almost always experiencing impaired concentration as a result of noise disruption, while 19.9% of students indicated that lack of understanding results. It also seems striking that 27.9% of students report needing to work harder as a consequence of noise disruption. Even the smaller responses of just over 14% needing to seek clarification from lecturers and 10.8% leaving lectures suggests that clear gains in educational effectiveness may result from improving the higher education soundscape.

And, finally, Figure 3 details which educational activities are most likely to lead to adverse performance when disturbing noise is experienced, as a count of the total number of responses given by the students per activity.

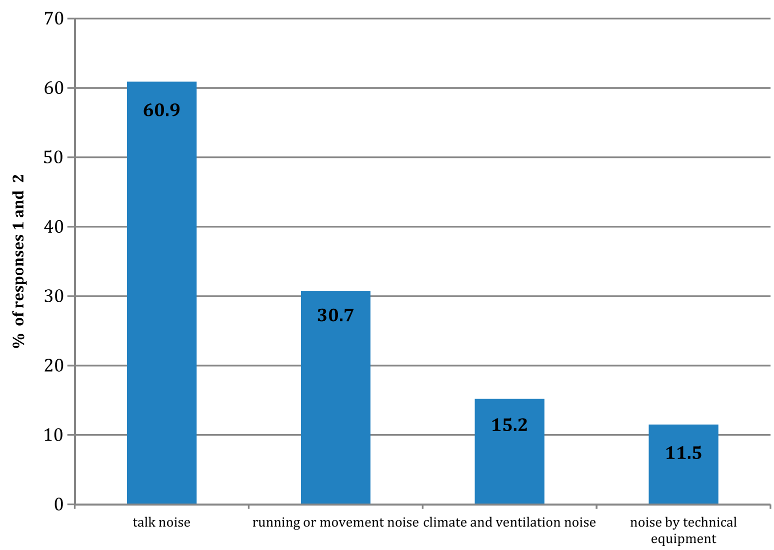

Figure 1. Sounds that most disturb hearing and listening during lectures ($N = 7345$).

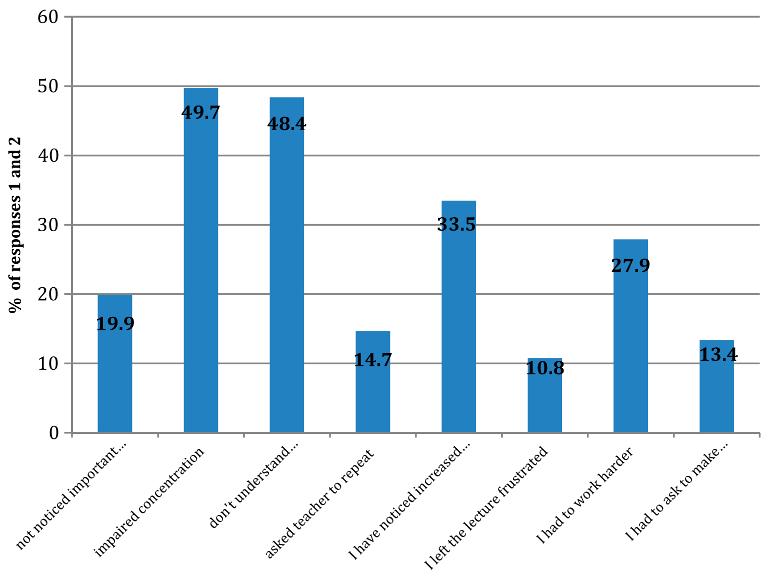

Figure 2. Consequences of noise distractions during lectures ($N = 7321$).

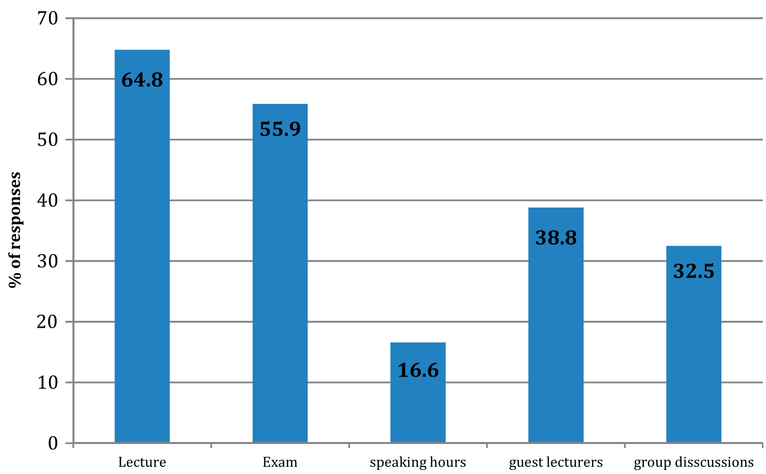

Figure 3. Educational activities in which performance is adversely affected by noise ($N = 7316$).

In summary, the ‘hi-fi’ noise of student talk and movement is evidently experienced as more disruptive during lectures than the ‘low-fi’ background din of climate control and technical equipment; this seems hardly surprising. The consequences of noise disruption centre most on the personal, including impaired concentration, increased fatigue and students feeling they need consequently to work harder to keep up with the course. Proactive interventions – asking for clarification, asking lecturers to repeat themselves or leaving the lecture altogether – are less often reported: on the whole, students are more likely to passively submit to sound conditions. A high percentage of students (48.4%) indicates very often or almost always failing to hear the questions posed by other students, which seems an issue straightforwardly related to the size and acoustics of lecture rooms. Striking is perhaps that the issue remains quite so predominant in spite of the well-circulated good practice of lecturers repeating out loud questions from students before they respond. And, lastly, adverse effects from noise disruption in lectures (including guest lectures) and examinations are much more commonly reported in this data-set than are adverse effects of noise disruption during consultation hours or group discussions. This may of course have something to do with the level of formality and listening focus that is needed (where it is assumed that reading exam questions and thinking of answers involves silent and introspective listening). Given this high level of reporting by students, a clear indication from the findings is that classroom practice would be more effective if the study soundscape could be improved. A second finding is that such improvements may depend more on people's hi-fi than technology's low-fi.

In our analysis of students' responses to the open question regarding what measures might be taken to ameliorate listening ease in their own view, we found smaller differences when responses were sorted by whether students had reported a hearing condition (having hearing loss, tinnitus and/or hyperacusis versus no hearing condition) than when we sorted the responses by institution (Groningen versus Oldenburg). First, the Groningen and Oldenburg sets of open responses were coded separately – because one data-set is in Dutch and the other in German – according to a pre-agreed shortlist of main themes that had been identified by a first scan through the data. After the open responses of both data sets (including *N*=6747 students) were scored by theme, coding differences were resolved by clarifying and further standardising the coding choices available to the respective coders until no differences remained. In what follows, the data are compared on two variables: institution – Groningen (*N*=3681 students) or Oldenburg (*N*=3066 students); and hearing condition – absent (*N*=5416 students) or present (*N*=1331 students). Table 1 lists the number of suggestions put forward by the students in each institution.

In summary form, the following findings emerge. In general terms, students with a hearing condition are predictably more likely to advise that measures in support of hearing and listening are taken. They are 4% more likely to support raising behavioural norms among students. They are 3% more likely to advise that lecturers' didactic skills be improved and 2% more likely to recommend technical solutions. Improving room acoustics and insulation (3% more likely) and reducing the number of participants in lectures and seminars (1.5% more likely) were also noted. Reducing

Table 1. Distribution of coded responses by institution and number of suggestions made per completed questionnaire.

University	Number of suggestions made by students				
	1	2	3	total	%
Groningen (NL)	1360	759	321	2440	43.3
Oldenburg (D)	1543	1084	572	3199	56.7

technical noise (2% more likely) and prohibitions (1.4% more likely) also confirmed this pattern. No differences between students with and without hearing condition were found in relation to providing more self-study cubicles (±3%), reducing noise outside the room (5.3%) or optimally matching room size to number of students (±1.5%). In both groups, the highest levels of support were found for improving didactic skills of lecturers (8.6%), various technical solutions (8.4%) and imposing norms on student behaviour (6.5%). The figures are listed in Table 2.

Table 2. Coded responses when contrasting Groningen and Oldenburg: 'List up to three examples of sound-related measures that would facilitate your study' (N=6747).

	Groningen		Oldenburg		Total	
Proposed measure	no.	%	no.	%	no.	%
Improving student norms of behaviour	206	5.6	363	11.8	569	8.4
Improving lecturers' didactic skills	264	7.2	479	15.6	743	11.0
Improving technology	368	10.0	323	10.5	691	10.2
Improving room acoustics and insulation	233	6.3	254	8.3	487	7.2
Reducing the number of students on courses	108	2.9	368	12.0	476	7.1
Matching room size to number of students	15	0.4	136	4.4	151	2.2
Conducting lectures online	72	2.0	18	0.6	90	1.3
Reducing noise in the room (moving, eating)	167	4.5	21	0.7	188	2.8
Reducing noise outside the room	177	4.8	198	6.5	375	5.6
Providing more self-study cubicles on campus	109	3.0	90	2.9	199	2.9
Instigating prohibitions (e.g. no mobile phones allowed)	98	2.7	54	1.8	152	2.3
Other measures	338	9.2	477	15.6	815	12.1

The greatest differences, however, found when the Groningen responses were compared with those of Oldenburg. Imposing norms on student behaviour, for example, was mentioned more than twice as often by Oldenburg students (11.8%) than by Groningen students (5.6%). Raising the didactic skills of lecturers was also mentioned twice as often by Oldenburg students (15.6%) than by Groningen students (7.2%). Other differences were also striking but less impressive because of the lower total number: Oldenburg students mentioned reducing the number of participants in lectures and seminars four times more often (12%) than Groningen students (2.9%). Matching room size to participants was noted 11 times more often by Oldenburg students (4.4%) than by Groningen students (0.4%). Oldenburg students also suggested improved room acoustics and insulation twice as often as Groningen students. In contrast, Groningen students suggested conducting lectures online over three times more often (2.0% versus 0.6%) than Oldenburg students and were six times more likely (4.5% versus 0.7%) to advise reducing noise in the room. We suppose that at least two factors likely contribute to these observed differences, namely, differences in study culture and differences in the physical built environment of study – the lecture rooms. The figures are listed in Table 3.

In summary, the students we surveyed are more likely to advise imposing changes in people's behaviour (stricter norms on student behaviour, improving the didactic skills of lecturers) than they are to seek technical improvements, which is entirely consistent with the issues they are most likely to report. Especially with respect to this distinction between changing

Table 3. Coded responses when contrasting students with and without a hearing condition: 'List up to three examples of sound-related measures that would facilitate your study' (*N*=6747).

	Hearing		Hearing impaired		Total	
Proposed measure	no.	%	no.	%	no.	%
Improving student norms of behaviour	394	7.3	175	13.1	569	8.4
Improving lecturers' didactic skills	549	10.1	194	14.6	743	11.0
Improving technology	521	9.6	170	12.8	691	10.2
Improving room acoustics and insulation	351	6.5	136	10.2	487	7.2
Reducing the number of students on courses	364	6.7	112	8.4	476	7.1
Matching room size to number of students	131	2.4	20	1.5	151	2.2
Conducting lectures online	59	1.1	31	2.3	90	1.3
Reducing noise in the room (moving, eating)	134	2.5	54	4.1	188	2.8
Reducing noise outside the room	283	5.2	92	6.9	375	5.6
Providing more self-study cubicles on campus	144	2.7	55	4.1	199	2.9
Initiating prohibitions (e.g. no mobile phones allowed)	98	1.8	54	4.1	152	2.3
Other measures	631	11.7	184	13.8	815	12.1

people versus changing technology, major differences were observed between the Oldenburg and Groningen students, with the former being much more likely to seek to change people's behaviour and skills and the latter just as likely to seek improvements in technology as improvements in people. Differences between students with and without hearing conditions are less pronounced than differences between students at different universities in our data-set, so that at least where student responses in our data-set are concerned local sociotechnical conditions and study culture appear to be more relevant for identifying soundscape issues than hearing status.

Conclusions: hearing as a sociocultural disorder

The prevalence of students experiencing problems with hearing and listening, we found rather self-evidently, transpires to be higher when research on hearing and listening is not constrained to include only students with a recognised hearing impairment. Their number is moreover on the rise. This rise is primarily the result of sociotechnical changes in the acoustic environment, which in turn call for ever more dedicated listening skills. With respect to the attentive listening that is needed for study, impaired performance does not in our view reduce to individual afflictions in the ability to hear, not even in those cases where hearing impairments are formally diagnosed and stated in clinical terms.

It seems to us that the persistent and commonly held belief that access to sound is in principle unfettered and provided by nature (thereby making listening a strictly personal responsibility), is itself one of the mechanisms involved in generating and perpetuating adverse listening conditions. We have proposed a more holistic and re-socialised understanding of the sound of study, following our attempt to escape from merely accounting for prevalence-related hearing impairment facts that we summarised earlier in this article. In our analysis we have treated listening as a collective performance based on continually evolving shared habits. This has the considerable advantage of providing a much more solid foundation for genuinely inclusive practice in further and higher education, more so than does the present focus on diagnosing and compensating for individual functional impairments as the sole consideration in providing equal access to learning.

We conclude with a more general consideration. Hearing disorder, we suggest, describes those persistently adverse social circumstances of hearing and listening that are collectively owned and result from social norms and material culture. Such a social understanding of disorder subsumes all physical and psychological traits that affect hearing. This consideration is intentionally more in keeping (than is a personal deficit view of disorder) with a commonplace sociological focus on those structures, institutions, relations, values and practices that tend to give unexceptional everyday interaction and behaviour their ordered, unremarkable appearance. This final consideration amounts to a radical departure from universities attending somewhat patronisingly to the supposed special needs (Florian 2008) of artificially construed groups of functionally impaired students. It instead proposes that universities – applying also in passim to further education colleges – exercise their responsibility for study as high quality sensory experience for the benefit of all students and with critical awareness of the personal impairment rhetorics of policy and practice (Brennan 2003; Brennan, Grimes, and Thoutenhoofd 2006), only thereby exercising their responsibility to ensure inclusion.

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Notes

1. We should also include in *listening* that concentrated quality of focusing on text that is done during silent reading. Why else should we wish for quiet study rooms and libraries?
2. In the compensated type, students register sounds but these cause little or no particular psychological strain so that the quality of life is not affected; this is in contrast to the decompensated type, in which the tinnitus has become uncontrollable and significant stress is experienced.
3. Responses from the Applied University of Utrecht were excluded because a technical error caused some of the data to become unsortable.

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