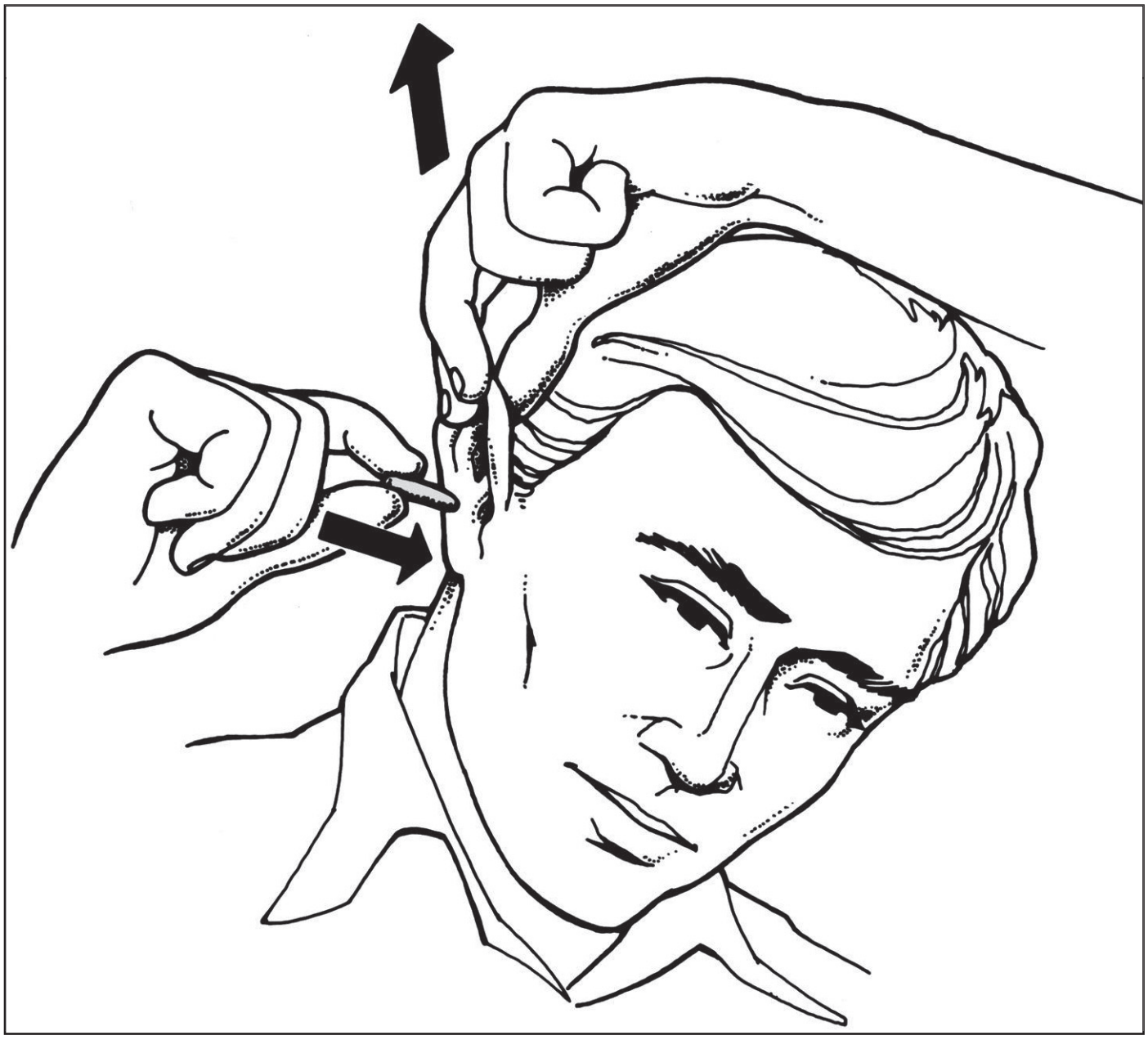
Soundscape

volume 6 number 1 | spring/summer 2005

Hearing Loss



The Journal of Acoustic Ecology

Soundscape
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Soundscape is a biannual English language publication of the World Forum for Acoustic Ecology (WFAE). It is conceived as a place of communication and discussion about interdisciplinary research and practice in the field of Acoustic Ecology, focussing on the inter-relationship between sound, nature, and society. The publication seeks to balance its content between scholarly writings, research, and an active engagement in current soundscape issues.

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WORLD FORUM FOR ACOUSTIC ECOLOGY (WFAE)

The World Forum for Acoustic Ecology, founded in 1993, is an international association of affiliated organizations and individuals, who share a common concern for the state of the world's soundscapes. Our members represent a multi-disciplinary spectrum of individuals engaged in the study of the social, cultural, and ecological aspects of the sonic environment.

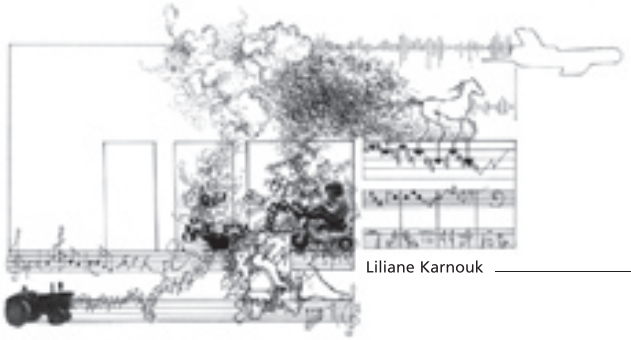
BOARD MEMBERS OF THE WFAE AND ITS AFFILIATES

CONTRIBUTIONS

Ideas for journal themes, proposals for new sections, as well as visual materials, are welcomed. You may submit either a proposal or a complete manuscript of a potential article to *Soundscape.* The Editorial Committee would generally prefer to communicate with you beforehand regarding your idea for an article, or receive a proposal, or an abstract (contact information below). Please also download our Guide to Contributors: Instructions for the Preparation of Materials for Submission to *Soundscape* (PDF) on the WFAE Website at: www.wfae.net

Submissions. Texts can be submitted for the following sections in the journal: *Feature Articles*; *Current Research*: a section devoted to a summary of current research within the field; *Dialogue*: an opportunity for editorial comment from readers; *Perspectives*: reports of events, conferences, installations etc.; *Sound Journals*: personal reflections on listening to the soundscape; *Soundwalks* from around the world; *Reviews*: of books, CDs, videos, websites, and other media; *Students' and/or Children's Writings*; *Quotes*: sound and listening-related quotations from literature, articles, correspondence, etc.: *Announcements*: of events organized/sponsored by the WFAE Affiliates.

Please send correspondence and submissions to: *Soundscape—The Journal of Acoustic Ecology*, School of Communications, Simon Fraser University, Burnaby, B.C., V5A 1S6 Canada.
Email contacts (please send your email submissions to the relevant address): soundscape-editor@wfae.net, soundscape-news@wfae.net, soundscape-reviews@wfae.net, soundscape-technology@wfae.net.



Liliane Karnouk

Soundscape

The Journal of Acoustic Ecology

VOLUME 6 NUMBER 1 | SPRING /SUMMER 2005

Contents

NOTE: *Announcements, Resources* and *Sound Bites* can now be found in our Online WFAE Newsletter: www.wfae.net/newsletter

Submissions should be sent to: secretary@wfae.net

Editorial

Soundscape journal often examines aesthetic, communication, and societal aspects of sound; in this issue we turn our emphasis more directly towards unwanted sound, that is noise, and examine the effects that its proliferation not only in the workplace, but in many people's daily lives, has on our hearing abilities. Excess noise has both social and economic costs, though the latter are not well studied. The European Union has estimated that financial damage it suffers due to environmental noise ranges from 10 to 40 billion Euros per year due to the reduced value of housing, increased medical costs, reduced possibilities of land use and cost of lost labor (European Commission, "The noise policy of the European Union. Year 2, 1999—2000," Luxembourg). These are only some of the affects of noise and for only a portion of the planet.

Not only does excess sound alter the quality of listening and of the soundscape, but a surfeit of it can damage the hearing organ—our ear. Acoustic ecology addresses interactions with our acoustic environment and how we can experience it, affect and sculpt it, preserve and enjoy it, and most of all deepen our knowledge of it. In large part our personal experience and enjoyment of sound is only possible if we have healthy natural hearing. Those with hearing losses can still perceive vibratory energy, but the sense is different, most would agree diminished, from the joys we derive with normal healthy ears, and the mere act of hearing becomes effortful and deliberate.

This issue explores features of the auditory system and tools for a lifetime of listening, or if hearing has become impaired, devices for hearing assistance. The feature articles discuss the use of hearing protection as a defense against noise-induced hearing loss and a means of reducing annoyance, the mechanics of audition and how sounds affect our ear, tinnitus (noise in our ears in the absence of actual sound) and its causes and treatment, and remediation of those effects via hearing aids for those who fail to protect themselves or who lose hearing from other causes. Additionally this issue includes personal experiences of hearing loss and sound excess in the *Perspectives* section, as well as reports of conferences with WFAE involvement, reviews of books and CDs, and other contributions that explore various aspects of the soundscape.

In preparing the feature articles questions arose that had not been considered in the planning stages. Those questions and the ensuing discussions were one of the enriching aspects of the editing process, as professionals from diverse backgrounds dissected and explored the meaning and implications of the contributions.

• What does hearing loss mean for the quality of life and what are its social implications with respect to altered perception, individual safety, longevity, and emotional status? [Kirkwood, D. H. (1999). "Major Survey Documents Negative Impact of Untreated Hearing Loss on Quality of Life," Hearing J. 52(7), 32—40.]

• How does society notice noise pollution and respond to it? What is its impact and what can be done about it? [Berglund, B. and Lindvall, T. (2005). "Community Noise," Arch. of Center for Sensory Research, Stockholm Univ., 2(1), Sweden]

• It is gratifying that today we have a wide array of effective hearing protection products that we can use, but should we have to use them at all? Would it be preferable or possible to reduce the noise to obviate the need and eliminate the risk of noise-induced hearing loss? [INCE Technical Study Group (2004). "Draft Report from Study Group 5: Global Noise Control Policy, Noise Control" Eng. J. 52(6), 251—298.] This is especially true when music is the source of potential hazard since indeed it is ironic that we create something that is intended for auditory enjoyment but do so at such levels that we frequently require protection from our own artistic creation.

• And finally, why is it that in spite of the marvelous hearing-aid technology avail-

able today, that many who need aids and could benefit from them, fail to purchase and use them? Are there losses that hearing aids can't ameliorate? Must society become more hearing-aid friendly? Do we need additional hearing-assistive technologies, besides hearing aids, in public and communal spaces? [Hearing Industries Assoc. (2004), "A White Paper Addressing the Societal Costs of Hearing Loss and Issues in Third Party Reimbursement," www.audiologyonline.com/articles/pf_arc_disp.asp?article_id=1204]

We leave you with these thoughts for contemplation and individual exploration; some will likely be further examined in subsequent issues of *Soundscape*, and others are addressed via inset question-and-answer boxes accompanying the feature articles.

Meanwhile, listen well, and protect those ears. It can be noisy out there.

Elliott H. Berger
Guest Editor

Report from the Chair

There is a sense of steady as she goes within the WFAE for the first half of the year. Our membership numbers are holding steady. A positive development is that, since the ASAE has been established, almost all members are now represented by local affiliates. All affiliates are reporting activity at a local level including the gradual emergence of a new organisation in Sweden. The WFAE enjoyed a successful presence at the *International Congress on Sound and Vibration in Lisbon* and is already preparing for a major conference in Japan next year.

The WFAE structured session on acoustic ecology at the Lisbon Congress featured a number of different elements, an all-day paper session; a soundwalk; and a one-hour open panel session. Twelve papers were presented by authors from around the world, including Brazil, Japan, Portugal, France and the UK. Immediately following the papers we conducted a one-hour panel session on a theme generally related to qualitative aspects of the sonic environment. The soundwalk on the previous day was attended by 22 people and was followed by a brief discussion. A very well received keynote address by Murray Schafer reached the largest audience at this international gathering of scientists and engineers.

Among the huge array of papers and themes within the Congress were sessions on Sound Quality and Hearing and Sound Architecture. Both of these included interesting papers and discussions on topics closely related to acoustic ecology. Proceedings of the event are available from the IIAV at www.iiav.org.

On behalf of the WFAE I would like to acknowledge the significant contribution made by Carlos Alberto Augusto in the planning of our presence at the event through many months of emails and meetings. In addition to thanking Carlos I would also like to extend our gratitude to the organising committee and especially to Luis Bento Coelho for the warmth of the welcome extended to us and the insightful decision to invite acoustic ecology into the programme.

I would also like to thank all our colleagues for making the journey to be with us in Lisbon. In particular I thank Keiko Torigoe and Kozo Hiramatsu with whom we met to discuss planning for our next major meeting in Japan in November 2006. We look forward to this event and hope to see you all there. Meantime, happy listening!

Nigel Frayne
Chair, WFAE Board
chair@wfae.net

Regional Activity Reports

Australian Forum for Acoustic Ecology (AFAE)

By Helen Dilkes

The AFAE has an enthusiastic but small core of members who are immersed in their work within the sound world, and two members in particular contribute time to the WFAE—John Campbell continues as membership secretary and Nigel Frayne continues as chair of the WFAE as well as the AFAE representative on the board.

There is new vigour in the AFAE with the added contribution of younger members. In May the AFAE conducted its first soundwalk, instigated and planned by Anthony Magen with assistance from other members and led by Helen Dilkes. Around 20 people attended the walk which explored the Abbotsford Convent grounds and places along the nearby Yarra River in Melbourne—listening sites along the way juxtaposed former contemplative and private spaces with more public and exterior places. Newcomers to the concept of soundwalk reported illumination, exhilaration and surprise during discussion at the end of the walk—preconceived notions of particular places and sounds were challenged or dispelled.

Mostly members will continue in the same committee positions as per last year. At the recent AGM Jim Barbour, the continuing president, proposed a timetable of meetings and it was agreed that regular soundwalks would keep up involvement and enthusiasm. Jim also committed support from his university department for establishing an AFAE website and discussion eList.

Contact: afae@wfae.net

United Kingdom and Ireland Soundscape Community (UKISC)

By John Levack Drever

Quite a brief report on UKISC activities this time. However, that is not to say there is not a lot of work going on in the background. Very soon we hope to be able to confirm a colloquium on the sounds of the city as well as an event for UKISC members to meet and share their work. There is also a major funding application in the system right now for soundscape studies in the UK. So, let's keep our fingers crossed!

Earshot 5, UKISC's journal, will be launched later this summer. This issue will present a wide range of projects that have been undertaken in the past couple of years, plus a CD of disappearing soundmarks.

A couple of events are worth commenting on that involved participation from UKISC members. Both coincided with major public sound installations by Bill Fontana.

Creative Lab in Birmingham, to coincide with Bill Fontana's performance and installation of *St Martin's Bells Sonic Mapping*, organised by MADE (Midlands Architecture and the Designed Environment) and MAAP (Medical Architecture and Arts Projects), and *Ways of Hearing in Leeds*, to coincide with Fontana's sound installation *Sound Lines*, in the Dark Arches, organised by Lumen and MAAP. Both days involved a sound walk by Fontana and John Levack Drever through regeneration sites. The days concluded with a discussion on how an approach to designing a human soundscape could be adopted within these sites.

Contact: ukisc@wfae.net
No website yet, but UKISC owns www.ukisc.org so watch this space.

Canadian Association for Sound Ecology (CASE) Association Canadienne pour l'Écologie Sonore (ACÉS)

By Andra McCartney and Nadene Thèriault Copeland

Several members of CASE took part in the conference *In and Out of the Sound Studio*, at Concordia University in July 2005, organised by Andra McCartney. Victoria Fenner presented on her sound art work, and Hildegard Westerkamp presented two sessions: one on designing a group listening soundwalk, and the other on soundscape composition. Ellen Waterman presented a paper on Canadian radio art. For further information about *In and Out of the Sound Studio*, please go to http://andrasound.org.

Next year, in conjunction with the Architecture-Music-Acoustics conference, hosted by the architecture department at Ryerson University in Toronto (June 8—10, 2006), Professor Waterman will be facilitating a two-day CASE sponsored session on Acoustic Ecology: "how can understanding the acoustic ecology of structured environments foster an auditive culture?" Submissions for this and the conference as a whole are due October 31, 2005. Further information about conference submissions will be posted shortly on the conference website, http://ryerson.ca/arch/conference.htm, or contact the conference organizers at amaconf@ryerson.ca.

This year's *Sound Travels* event on Toronto Island ran from July 24 to September 4 and was organised by CASE members Darren Copeland and Nadene Thèriault-Copeland of New Adventures in Sound Art. Events included a number of elements that would be of interest to the soundscape community:

• Two interactive computer pieces designed by Don Sinclair in collaboration with other artists ran as part of the *Sign Waves* exhibit at St. Andrew-by-the-Lake Church and are also available on-line at www.soundtravels.ca. *The Toronto Island Sound Map* is an interactive sound map profiling the sounds of Toronto Island with soundscapes recorded by Darren Copeland and Diego Phillips-Shea and photography by Nadene Thèriault-Copeland. The second computer piece, *around radio roadmovies*, was made in collaboration with Christian Calon and Chantal Dumas and draws from soundscape recordings, interviews and photographs made during Calon and Dumas' cross-Canada road trip from which they also created their double-CD *radio roadmovies*.

• Outdoor soundwalk performances of the piece *Sound Can Fly* by sound artist Steve Heimbecker and theatre/performance artist Neil Cadger took audiences through various sites on Toronto Island while they listened to Cadger's battery-powered amplified environmental sound on a swinging speaker and Heimbecker's Acoustic Field Intensifier. The constant Doppler Effect of the swinging speakers mesmerized listeners over the full 40-minute duration of the performance.

• The August 6 events included a concert that premiered new soundscape compositions by Toronto artists Parmela Attariwala, Lewis Kaye, Rose Bolton, and David Ogborn. All of the pieces used soundscapes of Toronto as material for their pieces.

In Vancouver a group of Soundwalkers, co-ordinated by Hildegard Westerkamp, is organising soundwalks for the third year now, as part of Vancouver New Music's regular concert season.

Contact: case@wfae.net
www.acousticecology.ca

Forum Klanglandschaft (FKL)

By Albert Mayr

FKL's main activities in the past months focused on the two conferences in April 2005, *Klänge, Macht und Landschaft* in Potsdam, Germany and *Ascolta Palermo / Palermo Ascolta* in Palermo, Italy, about which you can find more detailed reports on pages 25—27 of this Journal. An important aspect is that—more or less in connection with the preparation of the conferences—two regional groups were formed, *klangforum brandenburg* (Potsdam) and the *Sicilian Soundscape Research Group* (Catania, Palermo) that have joined FKL as organizations. As you can read in the reports, the conferences were made possible thanks to the co-operation of various institutions. Seeking out such co-operation requires ability of course, (and some luck), but appears to be essential. Perhaps it would be useful to dedicate some space in this Journal and/or the WFAE Online Newsletter to reports by the various affiliates describing their (more or less) successful search for such co-operating institutions. Obviously there are enormous differences in approach and experience at the international and regional level. But still, a sharing of strategies could be stimulating.

Member news: Elita Maule has published: *Per una didattica attiva del paesaggio sonoro. Sound antichi da scoprire e reinventare: suoni e musiche di mestieri scomparsi*. Brescia: Orff-Schulwerk Italiana, MTK, 2005. Tiziano Popoli received a commission from the Villa Ghighi Foundation for an extended solo work on the sounds of their park. Antonello Colimberti presented a paper on "The Ecology of Music" at the Pharos conference in San Leo, Italy, May 6—8. Antonio Arpini is co-organizing the seminar *Il paesaggio sonoro e il silenzio* (Soundscape and Silence), October 28—29, in Fonte Avellana in the Marche region. He will also give a paper on "The mountain lodge, the mountain and the soundscape", November 7, in Trento, Italy.

Upcoming event: Seminar Il *paesaggio sonoro e il silenzio* (Soundscape and Silence), October 28—29, in the Monastery of Fonte Avellana, I—61040 Serra Sant'Abbondio (PU), Italy. Info: www.fonteavellana.it

Contact: fkl@wfae.net
www.klanglandschaft.org

Swedish Affiliate Forming

The Swedish Forum for Soundscape (Svenskt forum för ljudlandskap), soon to be affiliated with the WFAE, is under construction as a provisional working group under the NGO *Science for Sustainable Development* (Vetenskap för hållbar utveckling; www.ieh.se/vhu ("Arbetsgrupper"). The aim of the Swedish Forum will be to promote research, training and information on sound environments, acting as a network for individuals representing social sciences, the humanities, arts and design, natural sciences, city and landscape planning, etc. The steering committee is headed by landscape architect Per Hedfors (email: per.hedfors@lpul.slu.se).

Finnish Society for Acoustic Ecology (FSAE)

By Simo Alitalo

One Hundred Finnish Soundscapes

In my previous reports I wrote about FSAE´s *One Hundred Finnish Soundscapes* project (www.100aanimaisemaa.fi). The first phase of the project is coming to an end. The time for sending proposals for your favourite Finnish soundscape ended June 30, 2005. So now is a good time to review the current situation of the project.

So far, we have received about 300 proposals from 176 people of soundscapes that they feel are significant in some way. Proposals have been sent in Finnish, Swedish and in English from Finland, Sweden, the Netherlands and the United States. The age scale of proponents runs from 9 to 88 years. The proposals for a significant Finnish soundsape vary. We have received many sound memories from the 1940´s and 50´s, descriptions of different silences and sounds of work and everyday life.

We are running a little behind in our recording schedule. So far about a dozen proposed soundscapes have been recorded, but we will continue the recording of proposed locations and sounds at least until February of 2006. Different ice sounds have proven to be most difficult to capture on tape because they are so dependant on weather conditions and light—which can be very tricky and unpredictable in a northern country like Finland. We are expecting to start uploading sounds to the website during late summer.

There are plans to produce a radio and television documentary on the subject during the fall. Some of the material was already put to use in a study that is in progress at Turku University.

Soundscape Studies on the Web

The previously mentioned web-based soundscape education project that FSAE is developing has also taken some major steps forward. The presentation of the first draft at *The Interactive Technology in Education* conference in Aulanko this spring was a great success. Next fall the first courses will be given, together with Tampere Polytechnic www.tpu.fi.

Books

Board members of FSAE have also been active on the publishing front.

Kaarina Kilpio´s dissertation *Kulutuksen savel* (Consumer Tunes) about music in Finnish advertising films from 1950´s to 1970´s came out this spring (ISBN 951-471-578-3). The Association of Finnish Advertisers gave Kilpio's dissertation their annual award of 2500. Kaarina Kilpio has also found time to edit another tome: *Kuultava menneisyys* (Audible/Transparent Past—see comments on title translation in *Soundscape*, Vol. 5 Number 2, p. 10) about the history of Finnish soundsapes (ISBN 951-95102-9-X). It contains articles by Helmi Järviluoma, Heikki Uimonen, Petri Kuljuntausta, Kaarina Kilpio and Noora Vikman among others.

Contact: fsae@wfae.net
www.akueko.com

Japanese Association for Sound Ecology (JASE)

by Keiko Torigoe

As usual, our regional activity report brings you the activities of the Soundscape Association of Japan (SAJ).

On May 28, 2005, the SAJ held its annual meeting and symposium at Osaka City University, with the title *Sound Archives*. Speakers were Shin Nakagawa, the chair of the symposium, Osaka City University; Kazuyuki Nakama, sound engineer, Mid Sound Pro; Yasuyuki Noshita, a director of NHK Osaka; Masafumi Matsui, biologist, Kyoto University; Hirohisa Mori, information scientist/International Research Center for Japanese Studies; and Kozo Hiramatsu, secretary general of SAJ, Kyoto University. They presented their own technologies and procedures of sound recordings in their professional activities, and discussed the objectives, thoughts and systems of the future Sound Archives, in which we all could participate on a nationwide scale.

A few days before the annual symposium, May 25—26, a soundscape tour combined with a small symposium entitled *Early Summer Soundscape of Ina Valley* was held in Iida City of Nagano prefecture. This was planned and co-ordinated by Koh Tanimira, the president of the SAJ, with the support of the Iida Art Museum. The members of the SAJ, including Teruyo Oba, natural sound ecologist of the Ecology Park of the Natural History Museum and Institute, Chiba, had a dicussion with the local scholars and artists, about the sounds of indigenous creatures such as frogs, birds and insects living in the valley.

Murray Schafer visited Hiroshima City, together with young musicians from Newfoundland, Canada, for the *Threnody Peace Education Project*. On July 30 Schafer gave his commemorative lecture at Elisabeth University of Music before the concert, which presented the Japanese premiere of *Threnody*—his anti-war protest work which included eyewitness accounts by children and young people who experienced the atomic bombing in Nagasaki.

The JASE is now preparing for the WFAE 2006 conference, to be held November 2—6, 2006 at Hirosaki University in Aomori prefecture (see announcement on page 5). The last few days of the event will be spent on a soundscape tour in Hirosaki City and its vicinities.

Finally we have to inform you in deep sorrow that Miho Yamagishi, an important member of JASE, passed away in January 2005 following a traffic accident in which she had been involved in November 2004. We also would like to inform you, that the retrospective exhibition of Hiroshi Yoshimura, a member of the SAJ and participant of *The First International Conference on Acoustic Ecology* (Banff, 1993), was held in the Museum of Modern Art, Hayama, July 9—August 28, 2005.

Contact: jase@wfae.net
Conference website: www.saj.gr.jp/en/hirosaki2006.html

American Society for Acoustic Ecology (ASAE)

By Jim Cummings

The ASAE is brewing a number of new projects that will, we hope, raise the profile of acoustic ecology here. By the end of 2005, we should have our website up and running at www.asaeonline.net; the site will serve as a primary outreach vehicle for our first two projects, an *Endangered Soundscapes* list (which will be open for nominations for several months), and a wide-open *favorite local soundscapes* forum, in which we'll encourage folks to share a sense of what soundscapes they appreciate, and why. Please check the website for the latest info on these projects, and send in your nominations and contributions!

The New York Society for Acoustic Ecology (ASAE's NY chapter) is co-sponsoring, with the Electronic Music Foundation and other organizations, *An Ear to the Earth*, a festival exploring the interaction of music, sound, the natural world, and human-made environments, scheduled for March 17–26, 2006 in and around New York city, with a pre-festival full-day symposium and concert on December 11, 2005. The festival, brainchild of Joel Chadabe of the Electronic Music Foundation, will include concerts by David Rothenberg, Steven Miller, Barry Truax, Hildegard Westerkamp, and others; installations by Annea Lockwood, Thomas Gerwin, and others; soundwalks, recordings featuring UNESCO Young Digital Artists from around the world, and a website. See www.emfproductions.org/upcoming/eartoearth/index.html for updates. Meanwhile, member projects continue to sprout from coast to coast.

• In Long Beach, California, Glenn Bach curated So.Cal.Sonic in the spring of 2005. Glenn has also launched two listening-based projects: a blog/wiki on pedestrian culture (www.pedestrianproject.blogspot.com), and a long-poem work-in-progress, *Atlas Peripatetic*, which is an extended sequence of poems inspired by the sounds of his morning walk (www.csulb.edu/~gbach/ap.html).

• The New York Society for AE is sponsoring a steady stream of local events including *Giant Ear* (a monthly radio show), Cellphone_scape/New York, and soundwalks (see www.nyacousticecology.org).

• In New Mexico, an 8-session Acoustic Ecology lecture series hosted by Steven Miller's College of Santa Fe Contemporary Music Program featured Steve Feld, David Dunn, Jack Loeffler, and Jim Cummings.

• Jim Cummings's Acoustic Ecology Institute (www.AcousticEcology.org) continues to feature news updates on sound-related issues, and has become a player in ocean noise research, regulation, and public education. AEI is a point organization on industrial seismic surveys for the Ocean Noise Coalition, and has been a lead advocate for attention to acoustic masking in the National Marine Fisheries Service's new ocean noise criteria; Jim is guest-editing a forthcoming special edition of the *Journal of International Wildlife Law* on the topic of ocean noise.

If you're a U.S. member of the WFAE but have not yet become a member of ASAE, we welcome you to join us. To subscribe to our online listserv, or to download a membership form, please visit the website. We need your ideas, enthusiasm, and support!

Contact: asae@wfae.net
www.AcousticEcology.org/asae
www.asaeonline.net

Dialogue

We invite your comments and criticism in response to anything you read in Soundscape, including other members' comments. Please send your reactions to: soundscape-editor@wfae.net, or to the mailing address at the bottom of the inside front cover page.

World Forum for Acoustic Ecology 2006 in Hirosaki, Aomori, Japan

November 2—6, 2006

Organized by the Japanese Association for Sound Ecology (JASE) together with Hirosaki University International Music Centre Co-hosted and co-supported by Soundscape Association Japan (SAJ)

Lectures—Paper presentations—Discussions—Soundwalks & Excursions ...

Within 1 to 2 hours drive from Hirosaki, in Northern Japan, one can visit villages and communities whose residents still keep traditional lives and habits.

For more information contact Professor Hiramatsu at Kyoto University

Email: hkozo@asafas.kyoto-u.ac.jp

August 2005: Vancouver Garden Listening

By Gary Ferrington

Lily pads in the pond

I've been staying at my friends' home in Vancouver, British Columbia, while attending a week long workshop in the city. My daylight basement room opens out into a wonderful garden with a bubbling fountain and pond. This backyard garden is rich in flowers, shrubs, and is abundantly green here in the middle of a Canadian summer. The garden is situated in a transitional zone between an urban and suburban environment about 20 blocks from downtown. The soundscape can be extremely quiet late at night and early in the morning. But it is increasingly full of energy as the day progresses.

As I sit by the fountain its patterned play of water captures my attention as a foreground sound against which all others play. The water gurgles as it shoots up a few inches into the air and then tumbles down a rocky pathway to the pond below. Various birds native to the westcoast of Canada fly around from one tree to the next filling the garden with song and chatter.

Surrounding the small garden are neighbors living in two and three story early 20th century homes. A small child and mother talk in the yard just on the other side of the bushy hedge. On the other side a neighbor pulls in the laundry from a rope line extending from the second floor of the house out over her yard. It squeaks with each tug on the line.

One can also hear conversations inside those homes that have windows open for the cooling afternoon air. Some amplified music drifts through the garden. My friends' cat pounces on an unsuspecting butterfly that has flown within stalking distance. The cat purrs with success at capturing and eating the insect.

Somewhere nearby a hired gardener trims a hedge in a cut and stop, cut and stop pattern. This annoying sound is diminished by that of an occasional delivery truck driving down the neighborhood's narrow tree shaded street, wide enough for only a single vehicle to make its way down the rows of parked cars on either side.

Beyond this immediate acoustic field I can hear a baseball game at a nearby park about one block away. I know it involves young kids by the timbre of their voices and the joyful nature of their shouts. I also hear the rapid hitting of a ball against a racket indicating an active tennis game apparently in the same recreational area of the park.

My friends' garden is, at times, in the flight path for Vancouver International Airport. Jets of various sizes apparently begin their descent above the garden with one particular type of aircraft throttling back its screaming engines, giving this startled visitor pause for thought. A more welcomed sound from above is a honking flock of Canadian geese flying in a V-shaped pattern across the sky—perhaps making an early retreat across the near-by border for winter grounds in the United States.

Although the garden is only three or four blocks from a very heavily traveled main thoroughfare, this listener cannot hear that street's frantic traffic sounds. However, the infamous Vancouver sea planes can be heard taking off from the harbor a mile or two away. Those are the same air planes so closely identified with the city on the classic 1970's recording of *The Vancouver Soundscape*.

From the immediate bubbling fountain to the distant sounds of the soundmarking seaplanes of Vancouver, this garden has been a special treat. I have left behind my use of phone, radio, and TV and have found here a place for listening and retreat.

GARY FERRINGTON is a Senior Instructor Emeritus at the University of Oregon, Eugene, Oregon, USA. He currently serves as Secretary of the WFAE, WFAE Web Coordinator, and Editor of the WFAE Online Newsletter.

Hearing Protection For The Critical Listener

By Elliott H. Berger, M.S.

Hearing is one of our most important senses; the one, it can be argued, without which our lives are most impacted (Gasaway, 1996). For critical listeners and acoustic ecologists, hearing has special significance. Since relatively modest changes may effect our aural perceptions and the enjoyment we derive from the aesthetic and professional aspects of audition we should exercise special care in the protection of our ears. It is truly regrettable that about 10 million Americans, and countless others worldwide, experience hearing loss that is at least partially attributable to noise exposure, since hearing loss due to noise (with the exception of unexpected explosive sounds) is virtually entirely preventable through the use of hearing protection devices (HPDs).

Hearing protection can sometimes be achieved through common-sense actions that will reduce our exposure to noise, either by decreasing the level or the duration of the exposure (i.e., our cumulative noise dose). For example, excessively loud sound from personal music systems is something we can control. At other times, either due to occupational exposures (noisy jobs), or recreational activities (shooting, woodworking, snowmobiling, flying light aircraft, attending concerts, public events, etc.), our only viable choice may be to purposely exclude sound from our ears. Though our fingers can do this quite effectively, functioning as the equivalent to a 25-dB HPD,[1] a preferred alternative is a bona fide personal hearing protection device, generally an earplug or earmuff, or as an alternative, a semi-insert (earplug or pod-like tips on a lightweight spring-loaded band).

Hearing conservationists normally recommend that HPDs be worn whenever sound levels regularly exceed 85 dBA for extended periods. Such levels are generally present if you feel the need to shout in order to be heard by a normal hearing person who is only about 3 feet away. To familiarize yourself with sound levels see the accompanying article in this issue on hearing loss, or visit www.e-a-r.com/pdf/hearingcons/T88_34NoiseLevels.xls to download a file with hundreds of representative sound levels.

Today, more than ever, there are a wide variety of hearing protectors available in both consumer and professional markets. Following are a few ideas that may help you choose and use those devices most effectively.

1. HEARING PROTECTORS MUST BE COMFORTABLE AND WELL FITTED. You should try different brands and types to find what is best for you. Be sure to carefully read the instructions and practice proper insertion. Two of the most common consumer complaints I receive about foam earplugs are "they don't block enough sound," and "they don't stay in." Nine times out of ten the reason is incorrect fitting. The goal is a proper, very tight and crease-free roll down (thinner than a pencil), accompanied by a pinna pull to facilitate full insertion well into the earcanal (see Figure 1). This takes practice. Without it, you will still get protection, but the fit is not as comfortable or secure, the noise attenuation not as great, and the occlusion effect more annoying (see Item 7 below). An in-depth brochure called *Tips and Tools for Fitting and Using E•A•R ® Foam Earplugs*, applicable to all brands and types of roll-down foam earplugs, is available at www.e-a-r.com/pdf/hearingcons/tipstools.pdf.

Figure 1—Illustration of the correct method of pulling the pinna (outer ear) by reaching over the head with the opposite hand to the ear being fitted.

Other types of HPDs also require correct use. See E•A•RLog 19 for numerous suggestions on fitting a broad range of products: http://e-a-r.com/hearingconservation/earlog_main.cfm.

2. DON'T GET HUNG UP ON THE NOISE REDUCTION RATING (NRR), the US. government-mandated noise protection factor that must appear on the packaging for all HPDs.[2] It is based on optimized laboratory-based tests that, in practice, represent what only a few of the most motivated and best-trained users can achieve. During the test the devices are worn for only brief periods, comfort is irrelevant, and, especially for earplugs, most users will rarely achieve the test results in practice. Unfortunately NRRs don't even necessarily rank order products in an appropriate manner. This means that small differences in NRRs, less than 4 or 5 dB, should definitely be ignored. The more rigorous you are about fitting, the closer your achieved protection will approach the

NRR, which is intended to indicate the approximate reduction in decibels (dB) of the overall sound level that the device can provide to those wearing the device in an optimal manner.

Your best bet is to simply use the NRR as an indicator that a product was designed for and tested for noise reduction. As a rough guide you can presume that devices with NRR of 29 and greater are among those providing the highest possible protection, and those with NRRs of 16 and lower provide modest protection. The lower values of protection are often quite sufficient (and even preferred) for common recreational exposures, other than shooting or the loudest of rock concerts.

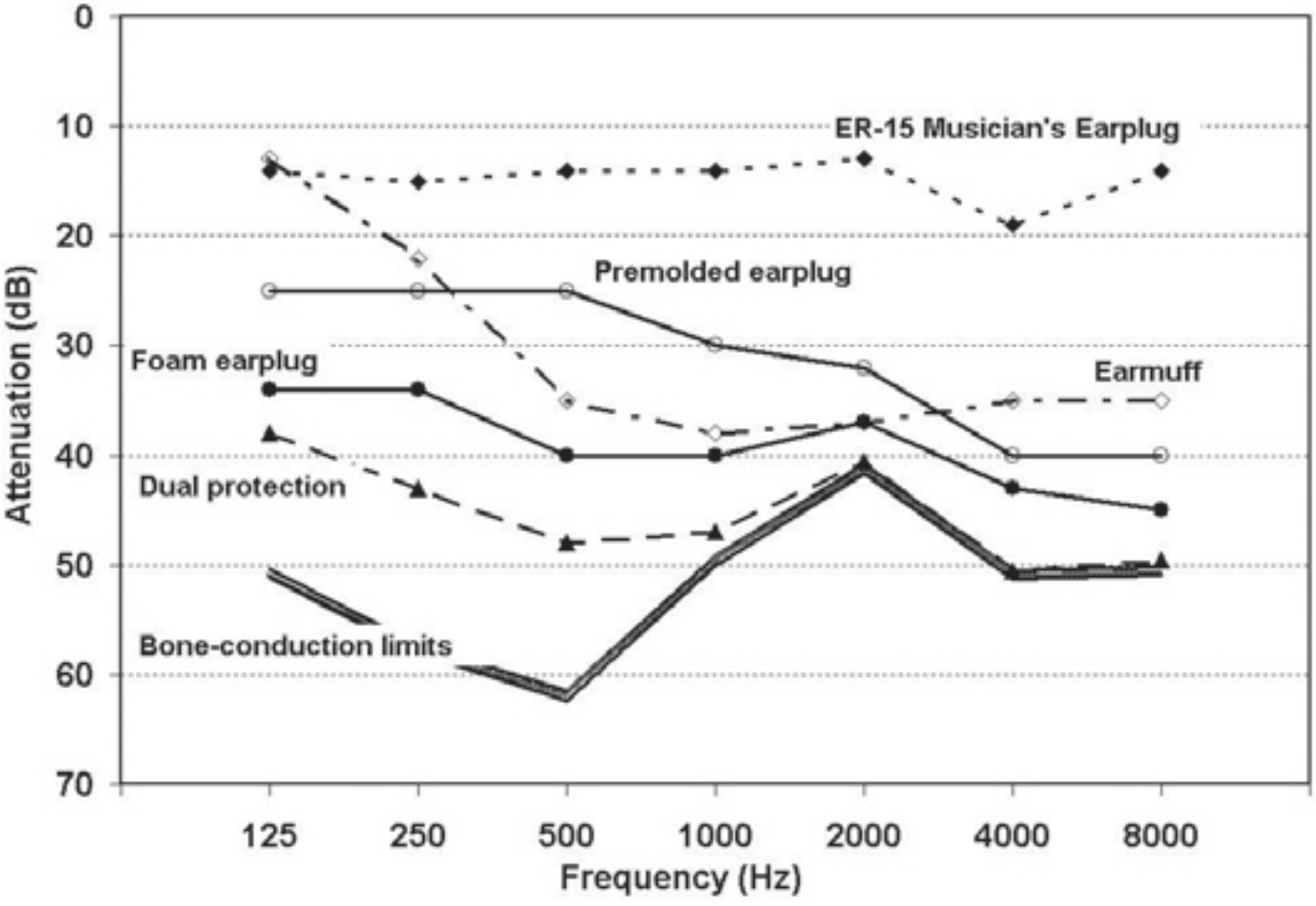
3. NO HEARING PROTECTOR WILL BLOCK ALL SOUND. Sometimes users are worried that they won't hear anything at all; other times they are worried that the device won't be protective enough. Figure 2 provides an indication of the amount of noise reduction (also called "attenuation"), on average, that well-fitted hearing protectors will provide. To achieve these values you *must* read the instructions for fitting and use and be sure the device is scrupulously inserted in the earcanal or placed over the ears to fully seal against sound. Devices providing the 30- to 40-dB of protection shown in the figure will make it sound as though you are in the room adjacent to the sound source, with a solid-core door tightly shut and sealed around its perimeter.

The bone-conduction limits, also illustrated in Figure 2, represent the noise reduction that can be achieved if the earcanal is perfectly sealed and blocked so that no sound can traverse that route to the inner ear. Even in this case, sound vibrates and to some extent (as indicated in Figure 2) passes through the bone and tissues of the skull, bypassing the hearing protector. Normally, HPDs are not worn well enough to provide noise reduction that approaches these limits; so much sound comes through the hearing protector that the small amount filtering through the bone-conduction paths is inconsequential. However, these limits are reached in the case of a deeply fitted earplug worn together with a well-positioned earmuff (dual protection), at which point the small amount of vibration transmitted by bone conduction becomes the most important contributor to what is heard.

When wearing well-fitted dual protection, a person with normal hearing will have difficulty even detecting the presence of speech delivered at a normal level from 3 feet away. Typically, dual protection is recommended for extreme noise levels in excess of 100 dBA where communication is not essential and is difficult regardless of whether or not hearing protection is worn.

4. THE CHOICE BETWEEN AN EARPLUG AND AN EARMUFF IS GENERALLY ONE OF PERSONAL PREFERENCE or ergonomics, as both types, when well fitted, can block sounds similarly. However, the better earplugs typically outperform the better earmuffs at the lower frequencies, which are those below approximately 250 Hz (see Figure 2), or in musical terms, middle C on the piano. Earplugs are of course more portable and less conspicuous to use in public places. Earmuffs are easier to put on and take off for short-term exposures, and for those who are averse to the idea of putting something in their ears, a more desirable solution. Semi-inserts are a compromise between the two, usually not as protective as plugs, but easier to don and doff, and convenient to store around the neck when not in use. The key is to use something that you like and fits your lifestyle. A variety of HPDs are shown in Figure 3.

Figure 2—Attenuation (noise reduction) for various hearing protectors as compared to the bone conduction limits (see text). Notice the tendency for most products to be more effective in blocking high-frequency sound, which makes them sound muffled.



5. THERE ARE MANY BASIC STYLES OF EARPLUGS. In the consumer market, those products that I am often asked about include roll-down foam (the foam is rolled into a tiny cylinder and inserted in the earcanal where it expands in place), premolded rubber-like plugs (usually with multiple flanges or sealing rings), formable wax or silicone slugs (the slug is pressed into the entrance of the earcanal), and custom-molded plugs (wherein a liquid with the consistency of thick honey is injected into the ear to make a custom-shaped device). Although all can work and block sound, there are a few things to keep in mind.

Figure 3—Representative hearing protectors (clockwise from lower left): foam earplugs, earmuffs, semi-insert device, premolded earplugs, (center) custom earmolds with ER-15 acoustic feature.

Foam plugs, as noted above, require some skill to insert properly. However, they are forgiving and even when not inserted optimally will provide a reasonable noise-blocking seal, though one that is not as secure or effective as otherwise could be achieved. Overall, they tend to be the most comfortable and effective style of earplug, providing protection equivalent to high-attenuation earmuffs. Premolded plugs can also seal well, but as a group tend to be somewhat less comfortable and protective. Unlike foam plugs that can be inserted very deeply with little discomfort, deeper and more protective fittings of premolded earplugs tend to be less acceptable. Formable plugs made of wax or silicone can only seal at the entrance of the canal. This limits the noise exclusion they can provide, primarily in the low frequencies, and also creates a large occlusion effect as discussed in Item 7, below. Custom earmolds, which can be among the most comfortable of earplugs, are more expensive, and contrary to intuition are not normally the most protective. Taking a good impression and making a well-fitting mold requires training, skill, and attention to detail. Even when well fitted, custom earmolds can easily break or lose their seal since they lack the dynamic accommodation of foam plugs or the flexible flanges of premolded earplugs.

6. WHEN WORN IN MODERATE NOISE HPDS WILL MAKE TINNITUS (A RINGING, BUZZING, OR HUMMING IN YOUR EARS) MORE APPARENT for those who already experience it, since the ambient noise that normally partially masks the tinnitus will be substantially eliminated by the noise reduction of the HPD. However, in higher noise levels enough sound will usually penetrate the hearing protector to provide a degree of masking or covering up of the tinnitus. Use of the HPD will help keep the noise from worsening the tinnitus, and once the protector is removed the masking provided by ambient sounds will immediately return.

7. WHENEVER YOU PROPERLY FIT AN EARPLUG OR EARMUFF YOU WILL EXPERIENCE THE OCCLUSION EFFECT (OE). This effect, which increases the efficiency with which body-conducted sounds are transmitted to the inner ear, causes a change in the perception of one's voice and body sounds. They become fuller, boomier, hollow-sounding, and muffled. The OE is easily demonstrated by sealing your earcanals with your thumbs while reading this sentence aloud. The OE is both a nuisance to HPD wearers, that can be minimized by proper selection and fitting (deeper-seated plugs reduce the OE), and an aid to wearers to use as a fit test; its presence indicates a proper seal. See E•A•RLog 19 for more information (http://e-a-r.com/hearingconservation/earlog_main.cfm).

8. MANY NOISE EXPOSURES ONLY REQUIRE 10 DB OF NOISE REDUCTION, SO DON'T OVERPROTECT with high-attenuation products unless you simply prefer the extra quieting they provide and won't be troubled by the greater degree of isolation they will create between you and the sounds around you. An excellent, but expensive, moderate-attenuation product I often wear is the ER-15 Musicians Earplug™ (cost in excess of US $120/pair, see www.etymotic.com/ for availability information for the US and worldwide). This custom molded earplug requires two trips to an audiologist to create and fit, but in return provides a comfortable, truly high-fidelity hearing protector that blocks sounds equally, regardless of their pitch, avoiding the muffling effect so common with conventional products (see Figure 2).

An alternative, much less costly one-sized product (from about US $12/pair), with nearly equivalent sound quality can be purchased off the shelf—Professional Musician E•A•R® Plugs www.aosafety.com/hbc/music.htm (and for international availability see www.e-a-r.info), also sold as ER-20 High Fidelity Earplugs (www.etymotic.com). Like the ER-15 these plugs avoid excessive protection and are ideal for music exposures and many public entertainment events.

9. MANY POTENTIAL HPD USERS ASK ABOUT "HIGH-TECHNOLOGY" SOLUTIONS SUCH AS EARMUFFS THAT INCORPORATE ACTIVE NOISE REDUCTION (ANR; sometimes also called noise cancellation). This method takes sound picked up underneath the earmuff cup and processes it so that it can be reintroduced via a small earphone to cancel the incoming sound. The applications are limited and only effective for low-frequency sound below about 400 Hz, such as the loud rumbling engine noise inside a light aircraft.

Another application for ANR is in earmuffs designed to provide an earphone-listening experience while reducing nuisance noise. Such devices are useful for travel applications such as in commercial aircraft when you want to listen to music or the movie soundtrack while at the same time reducing the perception of the noise in the cabin (see www.bose.com and www.peltoracoustics.com for representative products). However, for good noise protection, consumer ANR devices offer little that can't be achieved with a conventional and much less costly passive (non-electronic) device. So if you are comfortable wearing an earplug, an effective alternative is to use insert earphones (like the ER-6 Isolator™ earphones by www.etymotic.com) that passively block sound and, like their ANR counterparts, include the ability to accept an electronic input to reproduce music or other audio information.

10. LISTEN TO YOUR EARS TO MAKE SURE YOU ARE GETTING THE PROTECTION YOU NEED. If, immediately following a noise exposure you experience increased tinnitus, or for those blessed with normally quiet ears, you experience the onset of tinnitus, the noise was too loud for your ears. Regular exposures of that nature will likely lead to hearing loss and permanent or increased

tinnitus. Another, post-exposure effect that indicates inadequate protection is if your hearing seems dulled or your ears feel full after an exposure. Again, the indication is that the exposure was too great and there is potential for permanent effects. In such cases you should re-check how well you fitted your hearing protection, and/or consider using a more protective product, and if you still experience noise aftereffects, reduce the severity, duration, or repetition of your exposures.

11. NOT ONLY DO HPDs PROTECT YOUR EARS, BUT THEY CAN BE FUN AND USEFUL TOO. Want to hear a new sound? Take a shower while wearing earplugs. Not only will you keep your earcanals dry, but the impact of the water pouring upon your scalp will make interesting sounds in your ears due to the occlusion effect. Do you need to hear distortion in audio equipment at high sound levels? Listen through earplugs. If you audition at very high levels (over 100 dB) your inner ear sends a distorted signal to the brain. This should be no surprise. Those levels cause hearing damage so it makes sense that your ear is being overstressed when that is happening. Reducing the level with earplugs lessens the distortion in your hearing mechanism so that you can better hear the true performance of the sound system.

Or perhaps you want to "cleanse" your auditory palate to enjoy the next listening experience. Nature recordist, Gordon Hempton, who says earplugs should be as common as aspirin, shared with me the following. He occasionally takes an earplug-break during his field recording sessions even though he is often listening to extremely subtle and quiet sounds, in order to re-equilibrate his ears prior to his next listen, much as you would savor a taste of sorbet between courses at a fine meal.

Other types of artists may "need" hearing protection too. In 1981 Robert Hamon, a performance artist, created a video/sound installation entitled *Archangel, An Opera*, sponsored by the Western Front gallery in Vancouver. In this case there were no performers, only an audience full of participants; the subject being the personal experiences of those in attendance. The presentation was set in a four-court tennis bubble.

Guests arrived in soft-soled shoes and were handed yellow foam earplugs, a flashlight, and a glass of champagne. The installation included five video monitors displaying views of the constellations, hundreds of silver metal paper clips lying on a large felt-covered vibrating silver tray that was mounted on three red and white battery-powered electric toothbrushes, and 40 frogs with torsos wrapped in silver tinsel garlands distributed throughout the bubble. The audience was instructed to insert the plugs, and turn on their flashlights while sipping the champagne. The occlusion-effect enhanced sensation of bubbles popping within their mouths sounded like wild applause as their flashlight beams danced across the dome while they wandered about experiencing the space.

Concluding Remarks

Once you have selected a hearing protection device and learned to wear it properly, the key is to have it available when needed. Since you can't always predict when you will be exposed to noise, keep your HPDs handy, just like you might carry a pair of sunglasses. Obviously this type of application dictates earplugs instead of earmuffs due to their portability. I find foam plugs are small, lightweight, and easy to store in jacket or pants pockets or a travel bag, and if lost the cost for replacement is trivial. However, many times they are more protective than I require, so I like to also have available one of the low-attenuation "high-fidelity" protectors such as a Musicians earplug. My goal is to assure that I always have handy the protection I need, when I need it.

So there you have it—my best tips for selecting, using, and enjoying your hearing protection. Remember, life can be loud—be prepared.

Endnotes

1 Did you ever need immediate and brief hearing protection with only one hand free? Reach over your head with your free hand to use a finger to block the opposite ear while lifting the shoulder of that same arm to press against and seal the ear that it naturally contacts.

2 Other countries also specify noise reduction factors for hearing protection, numbers like the Single Number Rating (SNR) and Sound Level Conversion (SLC), but they are based on more realistic testing procedures. Though still optimistic, they better reflect what can be achieved in practice.

References

Gasaway, D. C. (1996). "To Prevent Noise-Induced Hearing Loss—Aim Between the Ears," Spectrum Suppl. 1(13) p. 28.

For additional information on noise and hearing protection visit www.e-a-r.com/hearingconservation for reprints, FAQs, audio presentations, current news, and links.

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The Nature Of Hearing And Hearing Loss

I wonder about the trees/Why do we wish to bear/Forever the noise of these/More than any other noise/So close to our dwelling place… From *The Sound of Trees* by Robert Frost

By Kathryn H. Arehart, Ph.D.

If a tree falls in a forest and no one is there to hear it, does it make a sound? The answer to this question depends on the way in which we define sound. An objective definition of sound relates to a physical characterization of pressure waves traveling through the air. A subjective definition relates to the human perception of the physical disturbance caused by the sound source.

Soundscapes may contain many different sounds: in addition to the sound of trees, there may be also be the sounds of distant thunder, a mountain quail and a running stream. As Plomp points out,

> When we say that we hear one or another "sound" we refer to our ability to identify the various percepts one to one with their sources. Implicitly, such usage also indicates that although the vibrations produced by the various sound sources are superimposed seemingly inextricably in the air, the ear is able to disentangle these vibrations so faithfully that we are not aware of the fact that they were ever mixed. [Plomp, 2002, *The Intelligent Ear*, page 1]

This disentanglement typically occurs without our awareness except when something interferes with the natural process. This interference can be competing vibrations (e.g., an airplane flying over a natural soundscape) or it can be due to a problem within the auditory system itself. The purpose of this article is to describe the nature of human hearing and how hearing loss can disrupt the ability to listen within a soundscape.

Nature of Hearing

Hearing involves a complex process in which the auditory system changes sound vibration from the environment into neural impulses that the brain perceives as sound. As shown in Figure 1, the ear has three major parts. The outer ear consists of the pinna (which is the part of the ear that is visible) and the outer ear canal. The eardrum separates the outer ear from the middle ear. The middle ear is an air-filled space that contains the ossicles, which are three small bones called the malleus, incus and stapes. The stapes interfaces with a membrane called the oval window, which forms a boundary between the middle ear and the inner ear. The inner

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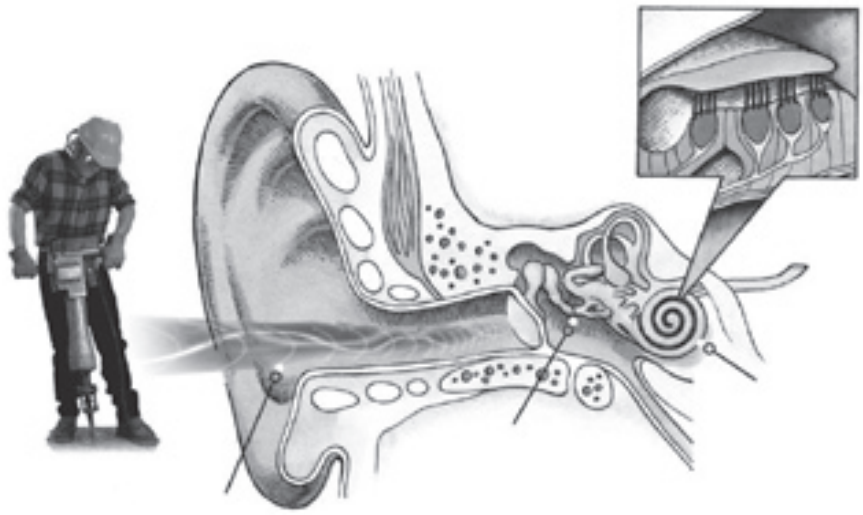
Figure 1—How We Hear

Healthy inner-ear nerves (hair cells) are the key to good hearing. Although some die off naturally as you age, many more are killed early if your ears aren't protected from harmful noise.

Courtesy, E. Berger, Aearo Co.



Hair cells within the cochlea of the inner ear respond to vibrations by generating nerve (electrical) impulses. The brain interprets these as sound.

The outer ear collects and funnels sound waves along the earcanal to the eardrum

The middle ear contains a chain of three tiny bones, called ossicles, which link the eardrum to the inner ear. When sound waves strike the eardrum, the ossicles conduct the vibrations to the cochlea in the inner ear.

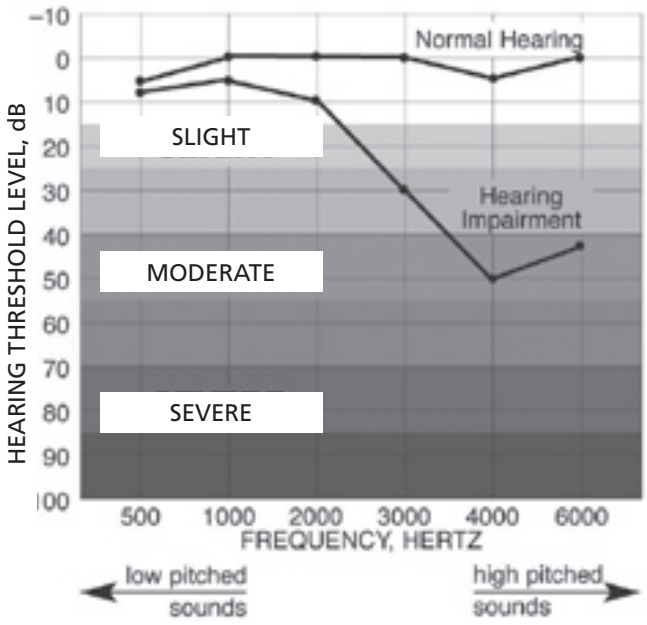


Fig 2—Degrees of hearing loss with audiometric profiles representative of normal and impaired hearing.

Courtesy, E. Berger, Aearo Co.

ear is fluid filled and consists of the sensory organs for hearing (the cochlea) and for balance (the semicircular canals). Within the cochlea are rows of hair cells. The hair cells communicate with nerve fibers in the hearing nerve, that in turn connect to the auditory cortex in the brain by way of the central auditory nervous system.

The outer and middle ears are the *conductive* part of hearing. The outer ear collects sounds from the environment. When sound waves travel through the ear canal and strike the eardrum, the sound waves cause the vibrations to be transmitted through the chain of ossicles and transferred to the fluids of the cochlea. The cochlea and hearing nerve are called the *sensorineural* part of hearing. The cochlea transduces sound vibrations into neural impulses that are sent along the hearing nerve up to the auditory cortex in the brain. The cochlear hair cells are an essential part of this transduction process. As the stapes pushes and pulls on the oval window, it causes the fluid within the cochlea to move. This fluid movement causes the hair cells to bend and release neurotransmitters, which in turn causes the hearing nerve fibers to fire. The cochlea is organized with a frequency map, such that higher frequencies are processed closest to the middle ear and lower frequencies are processed at the end furthest from the middle ear. This frequency-by-place organization plays an important role in the ear's ability to distinguish different frequencies. Finally, the brain uses the complex neural code coming from the auditory periphery to interpret the soundscape.

The interpretation of the soundscape involves several layers of complexity. The simplest layer is the *detection* of sound. That is, is sound present? A second layer of processing is *resolution*. That is, can specific characteristics of one sound source be perceptually separated from another sound source? When listening in a soundscape, spatial resolution allows us to discern that two sounds are coming from different locations. Frequency resolution refers to our ability to distinguish two or more frequencies in a complex sound. Temporal resolution refers to our ability to perceive changes that occur in sounds over time. A third layer of processing is the identification of sounds in the auditory environment (e.g., naming different instruments playing in an orchestra or identifying the several bird calls present in one scene).

Nature of Hearing Loss

Hearing loss can impact both the detection and resolution of sound. The effects of a particular hearing loss will depend on three characteristics, including the *degree* of the loss, the *configuration* of the loss and the *type* of the loss.

Figure 2 shows an audiogram, which is one way to quantify hearing loss in terms of a person's ability to detect sound. Along the horizontal axis is the frequency of the sound, which is described in terms of the number of cycles per second or Hertz. (Middle C on the piano corresponds to 256 Hz). While the human auditory system is sensitive to frequencies ranging from 20 Hz to 20,000 Hz, normally only the frequencies from 250 to 8000 Hz are tested in a hearing evaluation.

The vertical axis shows the volume or the level of the sound using a scale called the decibel (dB) Hearing Level scale. During a hearing test, an audiologist establishes the softest level at which someone can just detect a pure tone of a particular frequency. These levels are called the *threshold of hearing* and are plotted on the audiogram.

Question: Why do the test frequencies in the audiogram chart in Figure 2 only extend up to 6000 Hz?

Answer: Because of testing and calibration problems at higher frequencies, audiometric testing generally only extends to 6 or 8 kHz, even though young, normal-hearing adults can hear sounds out to 16 to 20 kHz. Today there are earphones and test systems that do extend hearing testing to 16 kHz, but there are no normative data or official standards against which one could make comparisons. When testing is done at those frequencies it often uses the individual as a baseline against which future comparisons are made, as in the case of monitoring hearing that might be changing in a patient who is being administered a cancer treatment that includes ototoxic drugs. One should also consider that few if any natural or musical sounds contain fundamental and important energy above 10 kHz, so that hearing losses at those high frequencies are not only difficult to measure but also difficult to detect by the person experiencing them.

Normal-hearing young adults can perceive sounds that extend across a wide range of levels ranging from sounds that are at threshold (0 dB HL) to sounds that are intolerably loud (120 dB HL). This range of levels is called the *dynamic range of hearing*. Thresholds less than 15 dB HL are considered normal hearing, so any thresholds that fall in the unshaded portion of the audiogram are considered normal. If a person has thresholds which are 15 dB HL or greater, they are considered to have a hearing loss. A hearing evaluation often includes determination of a listener's tolerance for loud sounds (level at which sounds become uncomfortably loud). For many people with hearing loss, this level will be similar to or even lower than the tolerance of someone with normal hearing (at or below 120 dB HL). Therefore, individuals with hearing loss often have a reduced dynamic range (e.g., from thresholds of 40 dB HL to intolerably loud at 110 dB HL).

The *degree* of hearing loss (see Figure 2) refers to the amount of hearing loss and is described in terms of being slight (15—25 dB HL), mild (25—40 dB HL), moderate (45—55 dB HL), moderately severe (55—70 dB HL), severe (70—85 dB HL) and profound (greater than 85 dB HL).

The *configuration* of hearing loss tells us how hearing loss changes across the frequency range. Hearing loss can occur at all frequencies or at just some frequencies. The "hearing impairment" line on the audiogram illustrates a configuration with

normal hearing in the low frequencies and sloping downward to a moderate hearing loss in the higher frequencies. A person with this configuration of hearing loss will not be able to detect any sounds that are at frequencies and levels in the region above the "hearing-impairment line." This hearing loss will impact a person's ability to hear some but not all speech sounds. Consider, for example, the word "Sue." Sounds like the /s/ are called fricatives and mostly consist of higher-frequency sounds that are low level (below about 40 dB HL). In contrast, vowel sounds have most of their energy in the lower frequencies and are often more moderate in level. Thus, the person with this configuration of hearing loss might be able to hear the vowel sound but not be able to detect the fricative. In contrast to the sloping configuration shown here, a hearing loss might also have a flat configuration, such that the thresholds are the same across the entire frequency range.

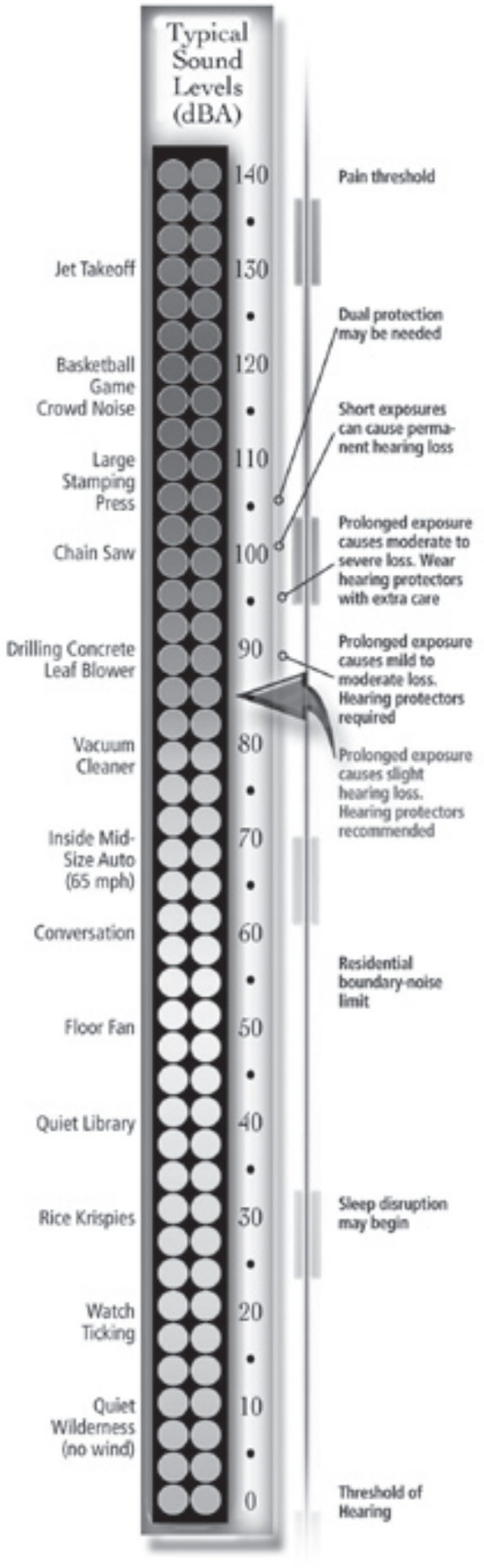
Question: What is the threshold of auditory pain and why is it variously shown as 120, 130 or 140 dBA?

Answer: Although some may think of auditory pain as an extreme discomfort in the hearing of a sound, which is certainly true of sounds above 110 dB and approaching 120 dB, auditory physiologists have defined it differently. It is the point at which a physical, i.e tactile sensation is felt in the middle ear, as opposed to a sound being sensed or heard in the inner ear. The definitive research on this topic was done in the US Air Force in the 1950s by von Gierke and his associates. It involved test signals such as speech, pure tones, and jet-engine noise. This painful and dangerous research is rare, especially today, because of human-subject review board concerns. The values found in that early work were 140 dB. For more information please see Von Gierke et al. (1953). "Aural Pain Produced by Sound," *Benox Report—An Exploratory Study of the Biological Effects of Noise*, ONR Project NR 144079, Univ. of Chicago, p. 29—36.

The *type* of hearing loss describes the place within the auditory system that the hearing problem occurs. There are three types of hearing loss: conductive, sensorineural and mixed. A *conductive* hearing loss affects the conduction of sound through the outer ear and/or through the middle ear. A conductive hearing loss causes an attenuation of the sound volume reaching the inner ear due to a problem in the effective transmission of the sound. Therefore, it will primarily affect a listener's ability to detect sounds. The degree of hearing loss resulting from a conductive loss will usually be in the slight to moderate range. Examples of conditions that cause a conductive hearing loss include the following: earwax (cerumen) that becomes impacted in the outer ear canal; a foreign object (e.g., a bead) trapped in the ear canal; an infection (such as "swimmer's ear") in the ear canal; a rupture (hole) in the eardrum; fluid in the middle ear due to an ear infection; and a break or discontinuity in the chain of ossicles. A conductive hearing loss is often successfully resolved with surgical or medical treatment. For example, antibiotics might help resolve a temporary hearing loss due to an ear infection in the middle ear or surgical repair of an ossicular break might restore efficient conduction of sound through the middle ear.

A *sensorineural* hearing loss is due to a problem in the cochlea and/or the hearing nerve. Whereas a conductive loss primarily affects the detection of sound, a sensorineural hearing loss will affect both the detection and the resolution of sound. The impact of the sensorineural hearing loss on detection will be evident on the audiogram. The degree of impairment resulting from sensorineural hearing loss can range from slight to profound. Such

Fig 3—Representative sound levels together with indications of safe vs. hazardous exposures. Courtesy, E. Berger, Aearo Co.



hearing loss can also introduce distortions that affect a person's ability to resolve sounds. This degraded resolution is not evident on the audiogram, but is evident in a person's ability to effectively hear in complex auditory environments. Often, someone with a sensorineural hearing loss will report greater difficulty hearing in noisy environments. The person's ability to resolve or perceptually separate different sounds (e.g., the speech from the competing background noise) becomes more difficult. Sensorineural hearing losses are usually permanent and not curable through medical treatment. Hearing aids are a common prescription for a person with a sensorineural hearing loss.

Question: I am surprised that the chart of sound levels indicates that a crowd at a basket ball game reaches nearly 120 dBA, which is more than 10-dB louder than a chain saw.

Answer: Surprising though it may be, values that high are easily (though not always) reached when over 10,000 screaming fans get pumped up in a large reverberant indoor arena. And though chain saws are loud indeed, and certainly require the use of hearing protection, they fall short of crowd noise when the fans are fanatically excited. Both crowd noise and chain saws are potentially hazardous sounds depending upon the duration and regularity of the exposures. For a listing of estimates of noise levels for about 1,000 different sources see www.e-a-r.com/pdf/hearingcons/T88_34NoiseLevels.xls

Examples of conditions that can cause a sensorineural hearing loss include hereditary hearing loss, medications that are toxic to the cochlea, viruses, head trauma, tumors, aging and most commonly, exposure to noise. The gradual hearing decline associated with aging is called presbycusis, mainly affecting higher-pitched sounds. Unlike the loss in Figure 2 that indicates a recovery at the highest test frequency, presbycusic losses are monotonic, showing increasing loss with increasing frequency. According to the National Institutes of Health, presbycusis affects approximately 35 percent of adults between 65 and 75 years of age and up to 50 percent of adults who are older than 75.

Sensorineural hearing loss is often due to damage to the cochlear hair cells. For example, exposure to intense noise can result in the death of hair cells in specific regions of the cochlea. As illustrated in Figure 3, the amount of noise that can cause hearing loss depends on both its level and duration. Damage to hair cells can occur due to repeated exposure to moderate-level sounds or due to a single exposure to a very intense sound. The damage may also be temporary (called a *temporary threshold shift,* or TTS) that will recover typically within minutes or hours, or permanent (called a *permanent threshold shift*, or PTS). One might notice for example, a dullness in the listening experience due to a TTS after a day of work in a noisy environment, or subsequent to a lengthy airplane ride or time spent in other loud forms of transport, or from a too-loud listening session to one's favorite music or at a concert, etc. Though this may well recover by the next morning, if one repeatedly experiences TTSs, it is likely that with time they will become permanent. One strategy for avoiding noise-induced hearing loss is to be sure to allow the ears time for recovery before the next hazardous exposure.

The National Institute of Health estimates that noise is a primary factor in the hearing loss of about one third of the 28 million Americans with hearing loss. Hearing loss due to noise can happen at any age and often is accompanied by tinnitus (see accompanying tinnitus article by Martin et al.). Except for exposures to unexpected blasts/explosions, hearing loss due to noise is almost completely avoidable. Education about hazardous sound levels is an important first step in its prevention. A helpful strategy is to monitor sound levels in your listening environment with an inexpensive sound level meter (e.g., Radio Shack sound level meter model 33—4050 costs about $40).

A *mixed* hearing loss occurs when a person has both a conductive and a sensorineural hearing loss at the same time. For example, a person with a noise-induced hearing loss may also have a chronic ear infection, resulting in a mixed hearing loss. Finally, a hearing loss can occur in one ear (unilateral) or in both ears (bilateral). In a bilateral hearing loss, the hearing loss can be similar in both ears (symmetrical) or different in each ear (asymmetrical).

Listening in the soundscape with a hearing loss can affect a person's ability to both detect faint sounds as well as to clearly resolve the frequencies, the location and/or the duration of the sounds in the auditory environment. The soft and subtle whisper of a light breeze through the trees may be one of the first sounds that we loose and with that—if we concur with Robert Frost's words at the beginning of this article—a profound sense of connectedness to nature. Persons who are concerned about their hearing might consult with a hearing health care professional. Otolaryngologists are physicians and surgeons who specialize in diseases of the ear, nose, throat, head and neck. Audiologists are trained to evaluate hearing loss and other disorders, including tinnitus and balance disorders. They also provide non-medical rehabilitation for persons with hearing loss, including the fitting of hearing aids and assistive listening devices.

Resources regarding hearing loss

The websites of the American Academy of Audiology (www.audiology.org) and the American Speech—Language—Hearing Association (www.asha.org) have helpful information regarding hearing and hearing loss, including screening questionnaires that can assist in determining if you might have a hearing loss or need a hearing test. The National Institutes of Health has helpful health information on many problems that cause hearing loss, www.nidcd.nih.gov.

Acknowledgements

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"A British study among 23 DJs indicated that many DJs, themselves, suffer from the loud music. Seventeen in 23 said they experienced some degree of tinnitus, and 16 reported that they had suffered from temporary hearing loss. Three DJs suffered from permanent noise induced hearing loss (NIHL) after years of excessive noise exposure at work. On average, the 23 DJs worked for 1 hour and 53 minutes without a break with noise levels of 103 dB." Read More: www.youth.hear-it.org/page.dsp?page=2978

Tinnitus and Sound

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Introduction

Sally woke up and looked at the clock on the nightstand. It read 3:05 AM, far too early for her alarm to be going off. She heard something, but it wasn't the sound of her alarm. It sounded like the teapot was whistling. Who could possibly be boiling water at this time? Husband Al was snoring next to her so it wasn't him. Perhaps one of them had bumped the stove knob before coming to bed and the water had slowly crept to a boil. She pulled herself from bed and went in the kitchen. The sound she heard was as clear as day, but the stovetop was cold and so was the kettle. She wandered through the house, trying to localize the sound, but it sounded like it was in the middle of her head. "Al," she said, shaking him from sleep. "What's that sound?" Al heard nothing, told her she was crazy and to go back to sleep. She figured it was coming from outside the house, a transformer or something that Al couldn't hear. She would solve the mystery in the morning. She tossed and turned until the alarm finally did go off. The shrill sound refused to let her sleep. Nor would it for more than moments during the next two years. In the morning, it was there again, crystal clear. Al denied hearing "anything" and gave her a strange look. He really didn't believe her. She must be losing her mind.

This account is not uncommon. Sometimes it is precipitated by a fun evening of dancing at a loud night club, or going to a rock concert with friends, or an unexpected explosive sound like a firecracker. A strange, new sound starts and no one else can hear it. Just you. And you can't hide from it no matter where you go. You never experience peace and quiet again.

Tinnitus, the experience of sound in one's head or ears in the absence of external sound, is an aberrant auditory phenomenon occurring in a significant number of people. Estimates of the number of people experiencing tinnitus range from 13 to 19% of the general population. Regardless, the number in the United States alone appears to be upwards of 40 million people. Of those, approximately 10 million experience it with such severity that they seek medical attention and 2.5 million are considered disabled by it. Figure 1 shows a graph of the ages and genders of patients at the time of their first clinical visit to the Oregon Health & Science University Tinnitus Clinic.

Tinnitus may be almost universally experienced in some form. It is most often reported as a ringing sound but can include a wide range of sounds such as hissing, roaring, buzzing, cricket sounds, popping or crackling. The vast majority of tinnitus events resolve spontaneously within a matter of seconds, hours or days. Most of those cases that persist are mild and not problematic to the individual. Some forms of objective tinnitus, related to mechanical factors, can be treated surgically or medically. Even subjective tinnitus, when related to tumors of the auditory nerve or disease processes of the middle ear, may be relieved by medical intervention. However, there are numerous cases of subjective tinnitus that do not dissipate. Clinical experience with such subjective tinnitus indicates that the likelihood of tinnitus resolving is extremely small if it has been present for six months to a year or longer. To date, there is no known cure for chronic tinnitus.

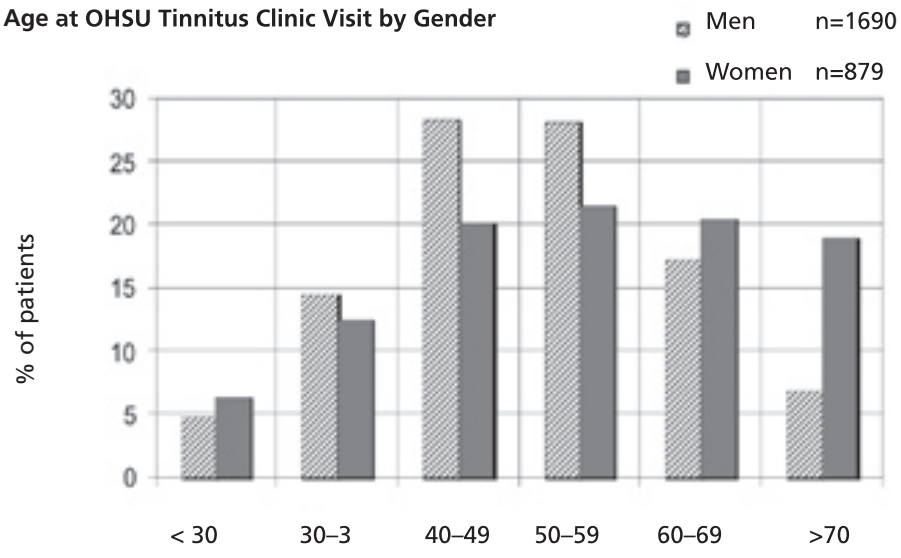

Figure 1. Age of patients at the time of their first visit to the OHSU Tinnitus Clinic.

Causes

Tinnitus can be divided into two categories; objective and subjective. Objective tinnitus is caused by some mechanical process in the head or neck and can often be heard by the clinician as well as the patient. In cases of constricted blood flow, patients will hear a pulsing or wooshing sound that corresponds to their heart rate. Other sounds such as clicking or popping arise from malfunctions of the Eustachian tube (connecting the middle ear to the airspace at the back of the nose and throat) or from spasms in the muscles attached to the tiny bones of the middle ear. Objective tinnitus can often be treated by medical or surgical intervention.

Subjective tinnitus can only be heard by the individual who has it. A wide range of events, diseases or disorders may trigger it. The most common triggers of tinnitus are inner-ear disease or noise damage. The Oregon Tinnitus Data Archive (www.tinnitusarchive.org) records of patients seen at the Oregon Health & Science University Tinnitus Clinic in Portland, Oregon indicates that 39% have no idea what triggered their tinnitus. About 20% attribute the tinnitus onset to significant noise-exposure, either over a long period of time or resulting from a short blast. Head and/or neck injuries were reported to have triggered tinnitus in 12% of patients followed by ear and sinus infections at 9%. Other illnesses, reactions to medications, stress, temporomandibular ("jaw") joint problems and other medical conditions accounted for the balance of the reports. In most cases, more than one factor was indicated as being associated with the onset of the tinnitus.

Tinnitus can be particularly bothersome to professional musicians who rely on their auditory acuity to perform complex, blended musical pieces, especially in concert with other musicians. The presence of an internally generated sound (tinnitus) over which the individual has no control, can be distracting, confusing and a source of frustration to the musician. Wearing earplugs can reduce the likelihood of further damage, but the exclusion of ambient noise increases the perception of the tinnitus and makes the tinnitus even more problematic.

Increasing evidence from brain research suggest that subjective tinnitus is due to abnormal brain activity triggered by a disruption of the delicate balance in nerve activity levels. It is considered to be analogous to phantom limb pain; experienced pain in a limb, hand or foot that has been traumatically amputated. The model is that the areas of the brain responsible for processing sound input are receiving erroneous information from a damaged end organ (e.g. a sound-damaged cochlea) or neural pathway (e.g. a tumor growing on the hearing nerve). The hearing section of the brain interprets the error signals in the only way it knows how . . . as sound.

Children infrequently report tinnitus but do experience it. If it is a chronic but non-problematic condition, children think that it is the normal state of affairs. Unless asked explicitly, they tend not to spontaneously complain about it. Acute cases, especially triggered by noise exposures or head and neck trauma or ear infections, are the most common events reported by children related to tinnitus onset.

Treatment And Management

The initial step in tinnitus care is to systematically identify and address any active disease processes that can be medically and/or surgically treated. Medical *treatment* of a disease provides a good probability that the tinnitus will resolve.

If either the disease or damage cannot be treated, as in the cases of age-related hearing loss, noise-induced hearing loss or chronic Meniere's disease, tinnitus *management* strategies can be employed to provide the patient with significant relief. Several tinnitus management tools have been developed over the years. The majority of patients with problematic tinnitus benefit from these strategies.

Acoustic Therapy

Acoustic therapies employ the use of sound to provide immediate relief and/or to facilitate long-term changes in the auditory-neural system's influence on the perception of tinnitus.

Masking has been used to provide immediate relief by presenting competing sound to either reduce or eliminate perception of the tinnitus. Masking may be accomplished from a number of sources. Ear-level maskers or sound generators provide continuous background sound that may be controlled by the user. Hearing aids (when warranted by the presence of a hearing loss) may amplify background environmental sounds to levels that provide adequate distraction for the patient. Some ear-level units combine amplification and sound generation capabilities to further meet the needs of those with hearing loss and tinnitus. External devices and recordings are available that generate environmental types of sounds or bands of noise that diminish the perception of tinnitus for many.

It has been postulated that exposure to continuous, low-level, broad-band sound might take advantage of neuronal plasticity (the ability of the brain to adapt to change by growing new neural connections) and facilitate habituation to the tinnitus signal. This is a long-term process that may take from three months to two years to complete. The strategy is based upon the idea that sub-cortical and cortical centers along the auditory pathway are critically involved in the detection and perception of tinnitus. It also postulates that non-auditory structures such as those found in the limbic system (those brain structures involved with emotions) are critically involved in the perpetuation and enhancement of tinnitus through linking of emotional significance to the tinnitus signal. Functional imaging studies of the brain have provided evidence for neural activities in the auditory cortex, limbic system and inferior colliculus that appear to be related to tinnitus. These results indicate that tinnitus activity is represented across several different levels and regions of the brain. Education and counseling regarding the nature of the individual's hearing health, tinnitus, and tinnitus mechanisms, as well as validation and reassurance are critical components of "retraining" strategies. Figure 2 presents a schematic of the neurophysiological model of tinnitus.

It is difficult to manage individuals with profound hearing loss using acoustic therapy since with such patients the auditory input is not available to either provide immediate relief or long-term stimulation. Reports contend that up to 93% of those whose hearing loss was ameliorated via cochlear-implants, found some relief from their tinnitus.

Medications

In parallel to acoustic therapy, several drugs have been used in attempts to provide tinnitus relief. Most reports using medications are either anecdotal or poorly controlled. However, there are some medications that have been reasonably evaluated and appear to be effective. Alprazolam (Xanax) is a benzodiazepine developed as an anti-anxiety treatment. In relatively high doses, it reduced both the objectively matched and subjectively scaled measures of tinnitus loudness. Nortriptyline is a tricylic medication developed to treat depression. It was shown to assist depression and reduce the matched tinnitus loudness. One reason that these specific medications have been helpful is because they address three of the most commonly reported factors that exacerbate and stem from tinnitus; anxiety, insomnia and depression. Patients in the Oregon Tinnitus Data Archive report a wide range of problems associated with their tinnitus (Table 1). It is essential to effectively treat parallel, tinnitus-exacerbating medical issues as part of a tinnitus management program.

Surgery

Surgical intervention, in the form of severing the hearing nerve to provide relief from tinnitus, has had mixed results. Patients often wake up with no hearing, and only tinnitus, and that often exacerbated compared to the pre-operative condition.

Summary

When appropriately applied, acoustic therapy, counseling/education, and medications in combinations specifically selected for an individual's personal needs can often provide tinnitus relief.

Table 1—Problems reported as a result of having tinnitus by patients in the Tinnitus Data Archive (www.tinnitusarchive.org) from the Oregon Health & Science University Tinnitus Clinic.

Concentration problems	85%
Anxiety	84%
Discomfort in a quiet room	83%
Difficulties in social interactions	74%
Sleep difficulties	73%
Feeling depressed	70%

Noise-related tinnitus can almost always be prevented through the appropriate application of simple safety measures (www.dangerousdecibels.org). When listening to a sound system that has volume control, it is best to turn down the volume to sound levels at which you can still carry on a conversation without having to raise your voice to be understood. If you are listening to a personal stereo system (e.g. CD player or MP3 player) and you cannot understand someone speaking to you 3 feet away without removing an earphone, the listening level is probably dangerous. Lowering the volume slightly will allow you to enjoy the music and avoid noise-induced hearing loss and tinnitus. Sound drops half of it's sound pressure level (6 dB) when you double the distance from the sound source. Moving away from a loud sound is another means of avoiding damage to your ears. Finally, hearing protection (e.g. earplugs or earmuffs) are readily available, inexpensive and quite effective at reducing sound levels to safe levels (see accompanying article by Berger).

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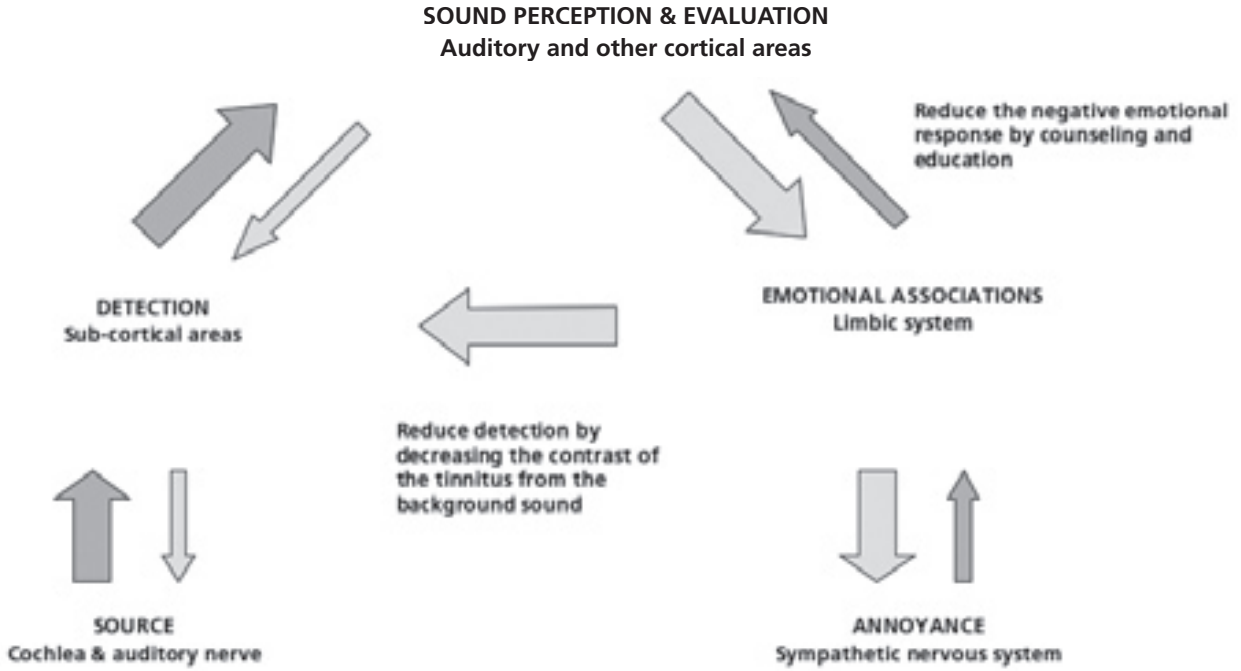


Figure 2—Simple schematic of the neurophysiological model of tinnitus. Note that the tinnitus begins in the ear (SOURCE), is detected by the lower parts of the brain (DETECTION), processed (SOUND PERCEPTION & EVALUATION) by the upper parts of the brain (Auditory and other cortical areas), then reactions set in from the limbic system. The later systems feed back into the earlier stages (DETECTION), increasing the brain's preoccupation with the tinnitus sound, causing anxiety and fear, and making the tinnitus become a serious problem for the patient.

Restoring the Soundscape with Hearing Aids

Deanna K. Meinke M.A.

Our sense of hearing provides a fundamental connection between an individual, the natural world and society. Recognition of sound allows us to be comforted, enlightened, surprised, warned, frightened, reminded, pleasured and intrigued. When sound recognition is diminished by hearing loss, the connections between individuals, nature and society are broken or distorted.

Impact of Hearing Loss

It may appear self-evident that hearing loss can have significant effects on an individual. The ability to detect sound, to decipher the nuances, to comprehend meaning, to fully appreciate music and to respond appropriately becomes an ongoing challenge. It takes listening endurance to compensate for hearing loss on even the most basic level. It is common for individuals with hearing loss to gradually withdraw from social situations and remove themselves from activities that require accurate hearing skills. They mourn the loss of their favorite sounds.

Wayner and Abrahamson, (2001) describe the hearing circle of communication comprised of the emotional, social, psychological, occupational, environmental and educational aspects of hearing. Within each of these facets are the unique reactions of each person to hearing loss and the ramifications for different types of auditory communication. For example an individual who is a socially active extrovert may experience more impact than an individual who spends time in solitary activities. If the individual with hearing loss works as a waiter/waitress, then the acoustics and noise of the workplace restaurant could be an issue. Possibly an audio engineer with a hearing loss finds his/her ability to perform adequately on the job jeopardized. For each person the effects of hearing loss are variable and the demands for hearing unique.

What are not as obvious to the person with the hearing-impairment are its effects on others. Personal relationships are impacted by hearing loss. Spouses frequently report negative consequences of their partner's hearing impairment, including a loss of communication during intimacy. Family members and friends are often left compensating for the person with hearing loss, by repeating menu choices in restaurants, answering phone calls, handling business transactions etc. In essence, significant others become the "hearing aide."

Hetu, Getty and Quoc (1995) evaluated the communication impact of noise-induced hearing loss (NIHL) between spouses. These authors list a larger number of communication difficulties reported by the hard-of-hearing spouse than the number of items reported by the non-impaired spouse. For the hearing-impaired partner, complaints included, 1) effort and fatigue from having to ask the partner to repeat things and to pay close attention, 2) frustration with not communicating, not understanding, being left out of conversations, disagreements over television volume settings and 3) stress, anger and resentment due to an intolerance of the hearing loss by others and their listening difficulties not being understood. For the unimpaired partner, complaints included 1) stress, tension and irritation at having to tolerate loud speech and television, compensating for the social dependence of the impaired spouse and worrying because of unreliable hearing of warning signals, responsibility for the telephone and taking messages, 2) effort and fatigue at having to repeat things, bearing the burden of interpreter and disguising the severity of the hearing loss and 3) frustration, anger and guilt at being isolated from groups, restriction of social activities and limitations on communication. Ultimately, the challenge of hearing impairment is faced by both partners and their family and friends.

Aside from these impacts on human speech communication, there are also effects on the joy and necessity of hearing sound in natural environments. For one person, it was an experience with his young granddaughter that was most disturbing to him. While sitting on the porch one summer evening, she asked him "What's making that sound Grandpa?"—he listened; she asked again—"What's making that sound?"—he strained and listened as closely as possible and heard nothing but a ringing in his ears. "I don't know" he reluctantly replied. Ultimately, his wife joined them on the porch and when the granddaughter directed the question to her, she was able to immediately identify the high-frequency chirp of a cricket coming from under the wooden slats. The grandfather felt inadequate and sad at missing that acoustic experience with his family. Later he related, "What if the cricket where a rattle snake?" He wondered if he might have missed the subtle rattle and perhaps been unaware of the need to protect his young granddaughter. These concerns were enough to motivate him to pursue hearing-aid fittings.

Hearing Aid Technology

Hopefully through the encouragement of friends and family members, the person with a hearing loss can be motivated to seek help in re-establishing their connections to nature and society. This re-connection can be through the use of hearing aids which are sophisticated miniature amplification systems.

Technological advances in hearing aids have progressed to the point where hearing aids are worn ear level (Fig. 1) and may be virtually undetectable in the ear canal. They commonly contain sophisticated computer processing strategies that can be customized to each wearer and their selected acoustic environments. Today, digital hearing aids dominate the market and have significant advantages in terms of fitting flexibility. There are other signal processing strategies and features used in hearing aids; however it is beyond the scope of this article to review them in detail.

A simplified digital hearing aid design is illustrated in Fig. 2. A microphone picks up sound from the environment and provides the input to the amplifier and the computer processing chip. The digital signal processor (DSP) is the heart of the hearing aid, controlling the signal manipulations necessary to improve speech intelligibility. Once the sound source has been electronically manipulated, it is converted back to an analog signal for the hearing aid receiver (speaker) and delivered to the ear canal.

An audiologist will connect a desktop or laptop computer directly to the hearing aid to "program" the settings for the DSP. Several models of hearing aids have multiple memories, which is analogous to multiple hearing aids in one case. If a hearing aid has three memories as illustrated in Fig. 2, then one memory might be used to program the hearing aid for speech understanding in a quiet listening environment, another memory for speech understanding in noisy listening environments and the third memory can be reserved for music listening. This is ideal since the listening and acoustic characteristics of music are very different than those necessary for speech. Memory parameters can be set for any unique listening demands a wearer might have. The wearer simply pushes a button on the hearing aid or uses a remote control to select the preferred memory, or in some instances the hearing aid may automatically sample the acoustic environment and self-determine the settings. If the hearing aid does not have multiple memories, then the programming has to be compromised in order to meet diverse listening demands.

The sophistication of the DSP capabilities and the style of hearing-aid shell are the primary price determinates. Smaller is more expensive. Enhanced signal processing parameters are more expensive. There is an inverse trade-off between space and circuit capacity. The smaller the hearing aid, the less physical space there is to incorporate multiple microphones, larger DSP chips, add-on features and larger batteries necessary for increased power demands.

Hearing aids are primarily dispensed in a private-pay system in the U.S., however socialized medical programs and third-party pay sources are more common in many other parts of the world. In some locales, the government-delivered healthcare system limits the kind of hearing aid technology that can be dispensed (often to a less-than-state-of-the-art level) and may even limit amplification to just one ear rather than two. One might expect to spend between $800 and $3500 per hearing aid in the U.S.; twice that much if both ears are fit. The local economy and the distribution system drives the pricing in other parts of the world, with the amount being comparable to the U.S. or somewhat less expensive. The average price of a hearing aid sold in 2004 was approximately $1400 (Kochkin, 2005b). The average life of a hearing aid is approximately five years. This extrapolates to approximately $1.50 per day for an average pair of aids worn over their lifespan. During this five-year period one should expect to have two to three repairs performed by the manufacturer. Repair is necessary because the hearing aid is worn in a hostile environment for electronics. The ear canal is moist and waxy and the hearing aid is subjected to daily handling. This creates problems for the hearing-aid microphones and receivers that must remain "open" and clean in order to process sound. Extended warranties are available to cover this inevitability. Routine cleaning and maintenance will also prolong the life of a hearing aid beyond its typical five-year lifespan.

Aside from purchasing and maintaining the hearing aid, a wearer should receive regular hearing evaluations and hearing aid checks. Hearing loss is not always a static situation. Hearing levels may fluctuate and/or the listening demands change. It is common for hearing to decrease as one ages and new ear diseases might develop. Due to these situations, the hearing aids may require reprogramming to maintain the optimal level of performance and benefit. It is not uncommon for a hearing loss to have progressed significantly between the time a person first becomes aware of their hearing loss and the decision to rehabilitate with hearing aids. If years have passed, then hearing aid dispensing should be supplemented with a rehabilitation program to help re-learn to recognize the auditory subtleties and distinctions that have faded away over time. Physiologically, our auditory systems must stay active to perform optimally.

Figure 1—Hearing aid styles are described by the way the shell fits into the ear. From left to right; CIC: completely-in-the-canal; Canal: fills canal; HS: half shell; ITE: in-the-ear; BTE: behind-the-ear. It is not possible to differentiate the specific features and circuit technology used within a hearing by visual inspection alone.

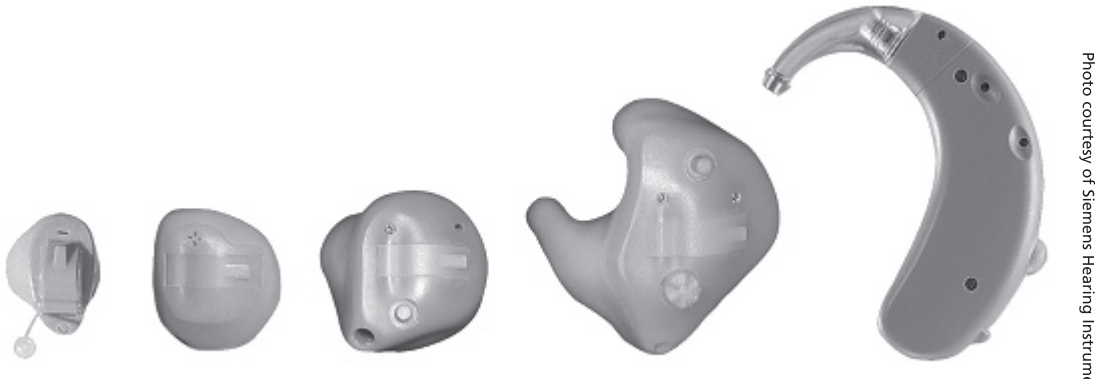


Photo courtesy of Siemens Hearing Instruments

Sensing the soundscape with hearing aids may take special consideration. Since the microphone's sensitivity and directional characteristics cannot exactly match those of the human ear, the reproduced experience can never exactly match the unaided normal-hearing ear. Furthermore the characteristics of the soundscape itself may also dictate particular programming considerations. For individuals using hearing aids outdoors for natural sound appreciation, omni directional microphone settings, wind-noise reduction and increased volume (gain) demands for all frequencies may be desirable. For a birdwatcher, there may be a desire to have a dedicated program tuned for increased gain for avian sounds that typically contain more high-frequency information than human speech.

It is important to recognize that the sound delivered to the ear canal by a hearing aid may have pristine acoustic characteristics; however the amplified sound must still be processed through the physiologically damaged auditory system of the wearer. In spite of this, the overall customer satisfaction with new hearing instruments is 77% and ranks within the top-third of all products and services sold in the United States (Kochkin, 2005b). Additional hearing aid tips are provided in the sidebar to this article and global audiology resources may be identified by visiting the International Society of Audiology at www.isa-audiology.org/links/lk.html.

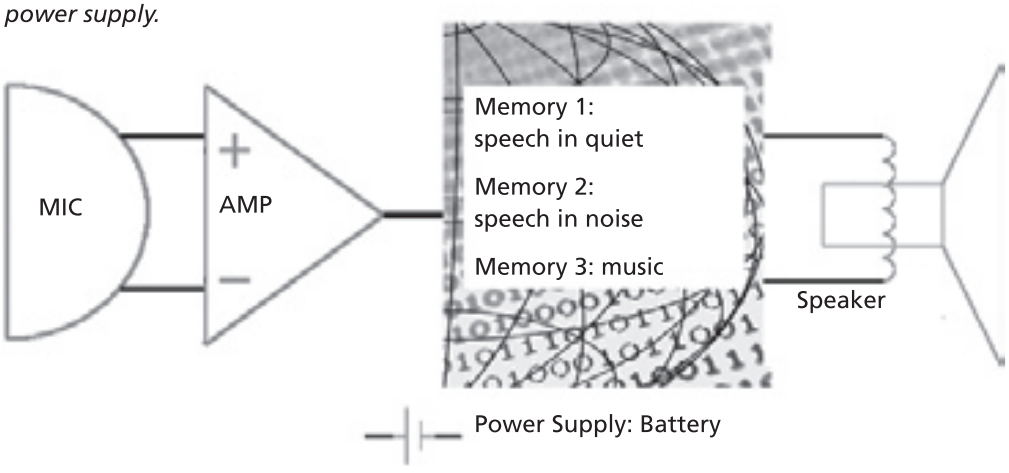
What Hearing Aids Can and Cannot Do

Fortunately, hearing aids do improve hearing for mild-to-severe hearing losses. There is ample evidence in the research literature to support this statement, especially when discussing speech perception ability. As mentioned in the companion article by Arehart, hearing loss creates hearing deficits in terms of detection, decreased dynamic range, diminished frequency resolution, decreased spatial resolution and decreased temporal resolution that combine to make speech less intelligible. Technology provides for an electroacoustic compensation for some of these hearing deficits, but not all.

Detection

A hearing aid restores the audibility of human speech by amplifying the sounds picked up by the hearing-aid microphone. For severe hearing losses, this means amplifying all of the various speech sounds or phonemes to a level that can be detected. In the case of mild-to-moderate degrees of hearing loss, the frequencies of the softer or missing speech sounds are selectively amplified. For hearing losses due to noise or aging, the missing speech sounds are usually the high-frequency consonants as opposed to the stronger vowel sounds. Speech becomes unclear and words may be mis-interpreted. If the phrase "take the fast car" is misheard as "rake the back yard," then the higher pitched phonemes of /t/, /f/, /s/ and /k/ must be amplified. The discrepancy between hearing low- and high-frequency speech sounds accounts for the typical complaints such as "if only people wouldn't mumble and would speak clearly" or "your voice is loud enough, I just can't understand what you are saying." Persons with hearing loss often hear only a portion of the speech message. With hearing aids, familiar voices may not be immediately recognizable due to the additional frequency characteristics that become audible with the benefits of the amplification they provide.

Figure 2—Simplified hearing-aid diagram. Sound is processed through a hearing aid from left to right. The *microphone* detects sound, the *amplifier* increases the sound levels, the *digital signal processor* shapes the sound for specific purposes and the *speaker* or *receiver* delivers the amplified sound to the ear canal. All of these processes require a *power supply.*



For listeners who appreciate "silence," amplification of weak signals may be undesirable. If the "silence" contains weak distant sounds in the ambiance, the hearing aid may over-emphasize these subtleties that usually are undetected by normal hearing listeners. In addition, hearing aids themselves generate electronic noise. This may become audible to the wearer in extremely quiet environments if normal hearing exists in some frequency regions. It may be more advantageous for the hearing-impaired person to go without hearing aids when the desire is to appreciate quiet.

Decreased dynamic range

For sensorineural hearing losses, the range of sound levels that are comfortable becomes drastically reduced. Louder sounds (e.g. cars accelerating at a stoplight) encountered in routine life may become physically uncomfortable for a person with a hearing loss. This then becomes an issue with hearing aids, since it is inappropriate to amplify all sounds with the same amount of gain as needed for soft constant sounds. If all sounds are amplified equally, then mid- to high-level sounds will exceed the wearer's comfort level and the hearing aid will not be well tolerated. This was often the case with the older linear type of hearing aids, which were commonly dispensed prior to the advent of compression circuitry that automatically reduces the amount of volume as the input sound gets louder. Hence, most modern hearing aids "compress" the broad dynamic sound levels of the environment into a narrower range that can be heard comfortably.

Hearing in Noisy Environments

A healthy ear can detect fine differences in frequencies (frequency resolution) and discriminate speech from background noise. As hearing loss progresses, the ear becomes "mushy" in the frequency domain; the greater the degree of hearing loss, the poorer the ability to differentiate speech sounds. An analogy might be a listening to music on a piano with only 60 keys instead of the usual 88 keys, because some are "stuck together." This becomes a major disadvantage when it comes to understanding speech in a background noise.

Hearing aids can only partially compensate for decreased frequency resolution. It is difficult for a hearing aid itself to differentiate the target sound from other sounds when they are similar in frequency. This is especially true when a listener is focused on one conversation embedded in a background of other voices. The hearing aid cannot recognize which voice should be the amplification priority. Perhaps in the future hearing aids will incorporate some form of familiar voice-recognition intelligence.

Currently, there are several strategies incorporated into hearing aids to promote better hearing in the presence of background noise. First, the hearing aid microphone(s) can be designed and oriented so as to be more sensitive to the target sound source. This is called a "directional" microphone; typically this involves a microphone or multiple microphones being most sensitive to sound originating from one direction (typically the front) and suppressing sounds from the side and back. A microphone that is equally sensitive in all directions is termed "omni-directional." Second, a remote microphone placed at the target speaker location can transmit sound via FM (frequency modulation) to a hearing aid. Finally, a hearing aid can be designed and programmed to differentially amplify low-frequency sounds from higher-frequency sounds.

Strategies to improve the signal-to-noise ratio (SNR) are essential for the hearing-impaired listener. Positioning a hearing-aid microphone in close proximity to the sound source and distancing it from competing noise improves the SNR. Frequently, SNR is improved by using practical communication tips such as moving closer to the speaker, dining at restaurants with quieter ambient

noise levels, turning off competing noise sources (e.g. dishwashers, radios etc.), selecting quieter places in a room to converse and facing away from the noise source. It is not advisable to shout or raise the voice in order to help a hearing-impaired listener understand while wearing a hearing aid. This tends to push the limits of their dynamic range and distort the amplification process.

Localization

Accurate localization of a sound source requires that all of the frequency components of a complex signal are audible since the brain uses subtle differences in the timing and sound level between the ears to accomplish the process. If hearing is asymmetrical between the two ears, then localization becomes a greater problem. Binaural hearing aids are necessary to compensate for this limitation and also facilitate listening in an environment with background noise.

Temporal Resolution

Speech sounds are strung together in rapid succession and weaker sounds can become lost in the louder speech sounds that immediately precede or follow the softer sounds. This can make speech unintelligible for a hearing-impaired listener. Hearing aids must operate quickly to provide increased volume for the soft sounds and decrease gain or "compress" the louder sounds. This will help restore some of the intelligibility of speech.

Quality of Life

Hearing-aid use provides for more than just auditory benefit. Several quality of life indicators demonstrate a positive relationship with hearing aid use. Kochkin (2005a) provides a succinct review in his article posted at www.betterhearing.org/hearing_solutions/qualityOfLifeDetail.cfm. Beyond the obvious repair of communication problems, hearing-aid use was shown to correlate with physical health, earning power, family relationships and emotional stability. It has also been shown to mitigate many of the psychological and emotional consequences by reducing frustration, anger, anxiety and depression.

Ultimately, the success of hearing-aid fittings is dependent upon the ability of a hearing-impaired individual to effectively describe and interpret their own listening experiences to the audiologist. It requires combining the technology, science, and art of audiology, in order to optimally sculpt the hearing-aid performance for each individual. Perception of an acoustic "space" will be altered for persons wearing hearing aids; a familiar soundscape will be partially restored, and an environment will be created that is more conducive to communications, and more protective and pleasurable as well.

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Hearing Aid Tips and Internet Resources

- Prevent further hearing loss; seek prompt medical and audiological care for your hearing loss.
- Maintain your hearing abilities; utilize hearing aids when first advised to do so. Delaying amplification only contributes to greater communication problems and poorer long-term benefit.
- Work with a licensed audiologist who is willing to spend time understanding your individual communication demands and listening needs, when programming your hearing aid.
- Be patient and use the hearing aid consistently; sounds may have gradually disappeared from your soundscape and it takes time to relearn to recognize and integrate the sounds again.
- Make your own decisions; what works for a friend or relative may not be ideal for your personal needs. Brands are not as important as the technology and programming used to solve the hearing problems.
- Maximize the trial period; all hearing aids are dispensed with a 30-day trial period. Use this time to assure your satisfaction with the fitting or ask for an extension to make additional modifications.
- Educate yourself; the more you can learn about your hearing loss and hearing aids, the better able you will be to participate in your hearing care. Consider some of these internet sites as beginning resources;

  American Academy of Audiology: Consumer Resources
  www.audiology.org/consumer/guides/howtopurchase.php/

  American Speech-Language-Hearing Association: Treatment and Rehabilitation www.asha.org/public/hearing/treatment/

  Expectations: A consumer checklist
  www.hearingresearch.org/Dr.Ross/expectations.htm

  Hearing aids: reasonable expectations for the consumer
  www.audiologyonline.com/articles/arc_disp.asp?id=347

Listening to Acoustic Energy and Not Hearing

By Maria Blondeel

I am an artist working in the field of sound art. After studying painting in the late 70s, I became fascinated with audio and visual technology. Since then I have worked on artistic experiments that are intrinsically connected with the lapse of time as visualized through sunlight, as well as through changes in light as day becomes night. I use sonification to obtain insight into this complex visual process. I have devised an electronic system that allows me to turn visible light into audible frequencies ranging between 60 and 16,000 Hz (sound waves), using photoelectric resistors to modulate the frequency of square waves. The generated pitch rises with the intensity of the light falling on a sensor. Fading light, in contrast, causes the pitch to drop to a point where it converts into clicks. I have experimented with the sonification of light in both urban and rural environments. In most of the site recordings I have made, particularly at night, electric light has a major impact on the sonic image. When using wireless systems and radio waves I often noticed interference from other sources. I became interested in waves that lie beyond the range of sensory perception as pollutants of the contemporary environment and in their influence on people.

Since 2002 I have suffered from a moderate noise-induced hearing loss, with a noise notch at 4 kHz and permanent tinnitus (see also the article "Tinnitus and Sound", p. 15 of this Journal). Because of my artistic sound work and my participation in numerous intermedia productions I have operated for many years in continuous sound environments. There were often high work-stress levels, late nights, and a lot of car driving. And I exposed myself regularly, though not always voluntarily, to excessively loud music. Owing to damage to the hair cells in my cochlea the external sounds, though received, are not adequately transmitted to my brain. Whether scientifically correct or not, I imagine the damage as a vacuum preventing the transmission of external vibrations to my hearing brain. Initially I experienced the tinnitus, which is a consequence of this damage, as being external in origin. And, possibly because I work with the sonification of light, I imagined it as some sort of radio wave—something like an electromagnetic field. In my listening experiments I even tried to shield myself with metal in order to make sure that my inner sounds were not external radiations (the Faraday shield, see self-portrait on page 23).

A lot of research has been conducted in the past century into hearing impairment, tinnitus, audiology and neuro-otology, and there is a significant amount of interesting literature available, both in print and on the internet. My own research stemmed from a purely artistic interest in listening to the acoustic energy within our hearing range, which I am no longer able to hear completely. For my experiments I searched for silence, in spite of the fact that I find silence unbearable—because it is in silence that inside noise attains maximum clarity. In a silent environment I can hear only that and thus can listen to it best.

I can best describe my tinnitus as multiple frequencies without simple mathematical ratios. Our ears have the fascinating capacity to perceive sound waves and vibrations and to transform them into information that our brain can understand. But I cannot find an acoustic equivalent for the inner sound they produce. I imagine I am hearing my own bioelectric activity in my hearing brain, 8 kHz/65 dB, 4 kHz/50 dB, 2 kHz/35 dB, 1 kHz/30 dB, 500 Hz/15 dB and 250 Hz/10 dB. Right and left have a different fundamental and seem to have two separate sources. But that is not where the sound is produced; it is where I hear it. I hear numerous frequencies and they can behave very differently. I can also hear them stereophonically, in which case I hear patterns with continuous minimal shifting, like moiré. I would compare the sound with an electronic sound wave, like a sine wave, but a very complex assemblage of sine waves. I have tried to reproduce it with my square-wave generators but very quickly came up against my hearing impairment. When I find a frequency that comes close to what I hear inside and try to fine-tune it, it will always either sound too low or disappear on the loudspeaker, out of my hearing range.

In the area where I live there is a pond, protected as a natural reserve, where birds and waterfowl come to breed. It is surrounded by a 2-km path. West of the pond there is a motorway intersection (A10, E40) and, when the wind comes from the west, which is often the case, the hum of the vehicle engines pervades the area. The intensity of the traffic noise matches the loudness of the sound inside my head. Both are between 30 and 50 dB, but the frequencies are quite far apart. My tinnitus is at its loudest between the highest audible frequencies and 4 kHz, fanning out and diminishing in intensity down to a soft 250 Hz. The sound of the motorway traffic peaks between 50 and 100 Hz, with some surges up to 2 kHz and occasional higher frequencies from a siren.

Last year I started learning to listen with two digital hearing aids. For a period of ten months I had the opportunity to compare different brands, which is a little bit like choosing between different microphones and loudspeakers for a recording studio, except that it is for my head. At first I experienced my hearing aids as a highly technological instrument allowing me to understand voice again and providing me with an accurate perception of sound levels. It became a digital extension of myself that I can switch on and off. And I still have the impression that now I can in fact open and close my ears. In most situations, without this device, I rely on lip reading and body language to be able to understand speech. I wear the hearing aids all the time and only remove them for sleeping. It does help, but most of the higher pitched sounds above 6 kHz remain inaudible. This is the range that matches the sibilant sounds inside my head.

I have four different settings for my digital hearing aids: two programs for speech comprehension and two programs for music audition. After the first six months I mainly listened using the music programs, in which the sound is amplified without much processing. I only use the speech programs when the surrounding noise is over 80 dB. I have looked very carefully at where I hit this level, and it happens more often than I would have expected: a busy office, heavy road or railway traffic, flushing the toilet, filling the bathtub, the ringing of a bell, a mixer, electric power tools, shouting, a busy supermarket or shopping centre, a bar, heavy city traffic, driving a fast car, a symphony orchestra, percussion, amplified concerts, a group of noisy children, an alarm.

I switch OFF: the harmonics disappear. I try listening to a low 20 Hz. I can hear an A" (27.5 Hz), A' (55 Hz) sounds loud, A (110 Hz) still loud, a (220 Hz) sounds good, a' (440 Hz) normal, a" (880 Hz) far too quiet. My hearing seems more focused on the low frequencies, which are perceived more richly than the middle range. The harmonics no longer cover the lower frequencies. Instead of the bass it is now the clarinet

and the voice that disappear. In the days before the hearing aids I slowly adapted, put felt underneath all the wooden objects that produced low, dull sounds and tried to insulate all the electrical appliances in the house as much as possible. I played music day and night. I listened with a different musical ear, hearing in a limited frequency range. Some tones I could no longer appreciate while others came to sound harmonic and pleasing to my ear.

I switch ON: much of my tinnitus disappears; only a thin layer of high frequencies remains. I hear a soft hiss. I hesitate: the microphone, the loudspeaker or the silence in the room? I switch to the second program, which has a compressor that modulates incidental surrounding sounds and reduces noise. The environment sounds quieter, and my tinnitus becomes louder and covers the hiss. I switch back to the music program. The surroundings are back, and the hiss is gone. My subjective experience alters the way things sound. After a while the changes I am able to make to my hearing with the hearing aids are exhausting. The first week all the sounds I could hear again had a similar intensity. It seemed as if everything was amplified with a contact microphone. Objectively the difference in intensity between the various ambient noises is limited. After a time my brain arranged the sounds back into different attention fields. The sound level produced in the ear and the intensity of the sound that we consciously allow to reach the brain differ greatly.

Now I can again hear sounds from the distance, from behind the walls. Objects have regained their own sound, the tabletop sounds woody when I hit it, and whatever is on it vibrates gently. On the path around the pond I can hear the singing of the birds and the splashing of the ducks in the water. I can hear the rustling of the leaves in the wind. I can hear my own footsteps, crisp, in the gravel. I can hear the sounds of the wooded area, reflecting off the surface of the water, diffused by the wind. Through this layer, which I estimate at between 100 and 3 000 Hz at a level of 50 dB, I can hear the rumble from the motorway intersection in the distance. In the clearings it sounds louder and it resonates in the treetops with the rustling of the leaves.

Translation from the Dutch: Guy De Bièvre, Maria Blondeel

Text editing: Anne Buckingham

Shield experiment by Maria Blondeel (*Self-portrait*)

The Faraday cage is a metallic shield designed to prevent the passage of electromagnetic waves.

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Emerging from Loss: Hearing Regained

By Randolph Jordan

Around 12 years ago I found myself attending an outdoor rock concert at Autzen Stadium in Eugene, Oregon, USA. I had recently turned 20 and by this time had been to many such events. While I generally found them to be too loud I was not in the habit of making consistent use of hearing protection. I was still engaged in a youthful notion of invincibility and figured that, like a sun tan, post-concert ear-ringing was only a marker of a certain level of exposure rather than an indicator of impending permanent damage. Of course we now know differently about the imprint of the sun on our skin, and I certainly know differently about signs of auditory damage.

One such audible sign I experienced that night in Eugene has had a lasting effect on the way I have conducted myself in the world since. I was standing at what seemed like a reasonable distance from one of the speaker arrays. Though I was experiencing some discomfort I had a good view of the stage. So I decided to stick it out. This was a classic case of putting more trust in my eyes than in my ears. The array looked far enough away, but what I was hearing told me something else. This says a lot about my attitude towards concert going at the time. While theoretically there for the music, I was quite enraptured by the visual spectacle that accompanied the experience—perhaps too enraptured. It was in the midst of such overemphasis on the visual that my hearing was caught off guard. Suddenly I heard a crumpling/crackling sound in my left ear. In that brief moment the usual sharp snatches of auditory pain sometimes experienced at loud concerts seemed to yield to something a little more temporarily forgiving, but ultimately uncompromising. It was as if my ear was overdriven in a way in which—I would later realize—it was unable to recover. I wasn't exactly sure what to make of it at the time.

Ever since I heard that inner crackling I have been far less tolerant of sound coming at me from the left. Instinctively I began to turn my head away from loud sounds where in the past I would stand defiantly, aware of the pain but unwilling to make any corrective adjustments. I was disturbed at what seemed like an oversensitivity on my part, ever proud of my poker-faced exterior and always striving to shield my reactions from the world. Thus, the way I presented myself in public changed. I became slightly less domineering and a little more ready to bend with the breeze, albeit reluctantly. And this was the first stage of a long and gradual change in the way I would subsequently interact with my environments.

The world had become unbalanced, but only ever so slightly. I would wear headphones and start questioning obsessively why all the music I liked seemed to be mixed with an emphasis on high frequencies in the right channel. I even asked some music specialists if there was some known tendency amoung sound engineers to work this way. But for the most part I was given blank looks in return. I decided that my headphones were faulty and took them back to the shop where I had bought them. Although the owner couldn't hear the problem, he was accommodating enough to change the drivers for me. This did not help and I started to feel like a bit

of a lunatic. I would find myself tilting my head in various listening situations, trying to figure out if I was positioned incorrectly or if there was some inherent channel imbalance in whatever source material was playing. I would sit in front of my stereo, head cocked as though I was hearing my master's voice from beyond the grave. There was no escaping the fact that I wanted to reach for the balance knob on my amplifier whenever I was sitting in the sweet spot. It was as if a black hole had opened up on my sinister side, an unevenness creeping into my consciousness, just gently enough to keep me functional but unsteady. Something was not right. Eventually I had my hearing tested. Lo and behold the results showed a slight but clearly identifiable drop in the high-frequency range perceivable by my left ear.

I have been told that life is about balance. A bit of my balance in the world was lost that day in Eugene. The ecology of my contextualized being was disturbed. I am still coming to terms with this, but it is getting better. I am lucky the damage was as minor as it was, but due to the subtle nature of the effect it has taken time even to recognize the problem, much less deal with it. But I am adjusting, and am much more careful about my ears as a result. Such care demands awareness, and the appreciation I have for my surroundings has grown. I had to be broken down in order to begin rebuilding my understanding of the world with a new level of attention. I had been slightly removed from my presence in the environment as I knew it, and I had to find my way back with a fresh perspective on how separation from the world can eventually lead to a more solid footing within it.

I think of Schafer's concept of schizophonia, for I was clearly detached from my environment as the result of a deafeningly over-represented soundscape created by technologies of sound reproduction. But as many have observed in the years since Schafer coined the term, schizophonia has much value if we can get over its obvious negative connotations. As Andra McCartney has suggested in a previous edition of this very journal, perhaps we should be working towards an electroacoustic ecology whereby re-contextualization through technologies of reproduction becomes an important part of the way we learn to be whole within the world (McCartney:22).

I am reminded also of Mike Davis's concept of "Nature II," used to describe the return of ecological balance to post-apocalyptic urban space (Davis:367). Like a memory that has changed along with time, Nature II is an example of a re-growth, the flow of nature back into the urban space from whence it was once banished. This growth is marked by its difference from the form it once took, and it is a function of its return to spaces that have been changed by urban development and subsequently have been neglected or, in some way, destroyed.

This destruction could be literal, the way that a post-apocalyptic environment allows for the return of nature in new and unexpected ways. Or, it could be psychological, a change in the way we understand our place within cities and the role of the structures created for our existence within and around them. Understanding the concept of urban destruction that would allow the dissolution of the boundaries between nature and civilization might entail nothing more than the simple changing of one's mind.

My mind has been changed. It was cultivated on civilized principles for 20 years, and then a wee taste of the apocalypse created a space to be filled with a pattern of orientation that had not been necessary since my earliest days of infancy. This is a re-awakening of the knowledge of how to learn. And I am learning that while the youthful perfection I once had has started to wane, a new kind of perfection born out of the imperfect is emerging. My experience has shown me first hand that ideas about the ecology of the world's soundscapes are established upon various biases towards particular notions of balance. In terms of Schafer's enthusiasm for the hi-fi soundscape, this is a balance established by the characteristics of pre-industrial sound (which nobody alive today has ever experienced). In terms of the hi-fi stereo enthusiast, balance is about the sanctity of the sweet spot, and its privileging of people with a certain quality of hearing that allows them to properly experience the equipment's sound characteristics. I have no access to pre-industrial soundscapes, and sound engineers are not producing music with the hearing damaged in mind. So I am positioned outside of these two realms of idealized sound production and reception. But if I can take this experience and apply it to a much greater appreciation of, and sense of responsibility for, the qualities of my being that have remained intact, then so much the better. Such responsibility born of appreciation and awareness is the true call of the ecologist.

There is value in imperfection and decay. Guitarist Marc Ribot has suggested that to ignore this value is an error akin to that which plagued Faust in his quest to find immortality. In his essay "Earplugs," Ribot discusses the bizarre situation whereby amplifier distortion no longer indicates equipment at risk and has turned into an effect that can be turned on and off at will. He believes that the overuse of distortion to unnaturally extend the sonic life of a plucked string is tantamount to a "Faustian error," a fight against the natural process of decay that all life must contend with (Ribot:234). For Ribot, the extension of the life of a sound through extreme amplification must come with the risks of electrical failure if it is to be justified as a noble pursuit.

Ribot wants electrified guitar-playing to be grounded in the physical realities of real-world context rather than be subject to representations that ultimately separate the sound from its source. Like Schafer, he wants sound to be attached to its source, even if the sound is created by what Schafer would consider to be technologies of schizophonic sound transmission. Ribot's position is an example of the evolution that a line of thought can take, for he offers a way in which arguments both for and against schizophonic technology can co-exist simultaneously.

The implications of Ribot's thoughts are as follows: to properly push the medium to the edge of its limits he must turn his guitar up to potentially dangerous volumes whereby he, and the audience, will have to live with the consequences. And there are always consequences to experience, something I have come to understand more as I get older. I never leave the house without my earplugs these days. At concerts I will pop them in as soon as I sense that the show is going to be too loud. Sadly, this is almost always the case with anything amplified, a fact that seems to lend credence to Schafer's desire to return to an unamplified world. But amplification is not the problem. It is the hand of the person on the master volume knob. I do not trust this person anymore, and this trust must now be re-gained on a case by case basis.

Yet once in a while the music will hit me and I will be moved regardless of the volume level. So moved will I become that I can no longer stand to hear the music filtered through the artificial barriers protecting my ears. In these instances I will pull the plugs and relish the full sound of the performance, and it is always a relief

to hear the dimensions of the soundspace open wide after having been confined to a muffle.[1] It is like a breath of fresh air, a sense of connection to my sonic environment impossible to achieve with covered eardrums. So I take a risk, hovering on the edge of tolerability in order to allow the music greater access to my inner being. In the hands of musicians like Ribot who understand the material realities of their medium, my risk will generally provide a good return. Such musicians take responsibility for the power they wield, and I am willing to sacrifice a bit of my safety to let them demonstrate their care for the audience. Should such a show venture a bit too high into the decibel register, I am willing to sacrifice a tiny bit more of my balance in order to have the experience that I came to have, rare that it is. This is a sacrifice that many people make without even realizing it until the day they wake up and feel the imbalance as I did. If only more propagators of sound understood the sacrifice we make as their audience and treated us with according respect.

We are in an era of amplification and this is not going to change anytime soon. To grasp at that which is no longer in reach is to try and defeat the processes of decay that are part and parcel of regeneration. For me, this means that I cannot attain the experience of my pre-damaged hearing, just as I cannot attain the experience of having been alive before the industrial revolution. To embrace my loss for what it can rejuvenate in my present experience is to achieve a high level of fidelity in the world in which I live right now, and this is the world that I privilege. But I take this seriously, and will make my decisions on how to be in this world based on a heightened awareness of my position within it at any given time. This is the lesson I have learned from my damaged hearing, and it is now up to me to do my part in creating a world in which this damage is no longer understood as damage, but rather a different way of being. This way of being is not necessarily equal to everyone else's, but is nevertheless as authentic as anyone else's. This is my acoustic ecology.

Endnotes

1 Editors Comment: See point 8 in the article in this issue by Elliott Berger (p. 9). Not all hearing protectors cause the muffled sensation reported by this author. Some earplugs are specifically designed to reduce all sounds equally, regardless of frequency, so that the result is equally as natural and bright as the original, just quieter, safer, and potentially more pleasant.

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Sounds, Power, and Landscape

By Günter Olias

An international symposium entitled *Klänge, Macht und Landschaft* (Sounds, Power, and Landscape) was held at the Institute for Music and Music Pedagogy, Potsdam University, Germany from April 22 to 24, 2005. The symposium was endorsed by the World Forum for Acoustic Ecology and was organized by its affiliate Forum Klanglandschaft (FKL)—founded 10 years ago in Aarau, Switzerland—together with the regional association *klangforum brandenburg e.V.*, founded last year, and also by the course in didactics and pedagogy of music at Potsdam University.

Sixty years after the end of World War II Potsdam presented itself as a remarkable 'place of remembrance' and at the same time as a battlefield for the 'politics of remembrance', exemplified through the commemoration of the destruction of the *Garnisonskirche*, on the one hand, and the polemics regarding the church's reconstruction, on the other. The *Roter Adler* (red eagle, symbol and title of the Brandenburg anthem), the marching of military and para-military columns of recent history, the legendary Glockenspiel of the *Garnisonskirche* (playing the very popular tune *Üb immer Treu und Redlichkeit*), the shouts of protesters of various political affiliations—all this provided specific sonic expressions to power and powerlessness, action and reaction, progress and resistance. Sounds also signalled the industrial construction and deconstruction of the large coal mines, the traditional iron, steel and chemical factories. Last year *klangforum brandenburg e.V.* documented many of these acoustic events on a CD which, together with a publication edited by Günter Olias, was presented to the participants of the symposium.

But the region is mainly characterized by its well-known and cherished vast parks, forests and water areas. Thus the spectrum from *locus amoenus* to *locus terribilis*, from almost noise-free to heavily noisy areas, from rural to urban space, from one type of agriculture to another, mark the soundscape profile of Brandenburg and our notion of landscape in that region.

Speaker, Walter Tilgner

Walter Tilgner, honorary member of the FKL since its inception and famous researcher of natural soundcapes and bioacoustician, had gladly accepted to give a lecture, entitled "Open your ears to the sounds of nature!" He is known in particular for his sonic portraits of the complex natural environments of the Bodensee, a large lake bordering South Germany and Switzerland and the Darss—Germany's most beautiful peninsula on the Baltic coast, and every autumn a rest area for a large part of the Northern European crane population on their way from Scandinavia to the warm South. In connection with his lecture there were demonstrations of Neumann-Kunstkopf microphones and Manger loudspeakers that guarantee optimal recording and playback conditions for soundscape recordings. Both enterprises

had generously provided a wide range of equipment and information material.

Individual papers were given by Michael Schlottner ("Community Radio in an Indian Reservation in the USA"), Giacomo Ruspa ("Sound Effects within the Wood") and Rolf Bostelmann ("Sound Travel—Listening Experiences") as well as round-table discussions. One dealt with the sonic dimensions of power, including special geo-ecological aspects that are presently studied by Ines Carstensen and Karl Geldmacher of Potsdam University. Carolyn J. Birdsall, Amsterdam School of Cultural Analysis has worked for some years on the acoustic representation of power and demonstrated it through an impressive propaganda broadcast of the Thirties.

The other round-table discussion included introductory papers by Volker Bernius (Hessischer Rundfunk) and Axel Brunner (Potsdam University) and dealt with new challenges for the media, schools and universities regarding the development of Soundscape Competence and its institutional pre-requisites.

The program also included sound installations by Christian Gude ("In Erde") and Francesco Michi, Anton Roca and Luca Miti ("A Matter of Lost Frequencies"), a workshop with Hannes Heyne about the fascinating world of basic and archaic sound sources, a concert with recent soundscape compositions presented by Gabriele Proy, the president of FKL. A special regional aspect was presented by Michael Schenk (*klangforum brandenburg*) in his performance "Impera et Permuta" that centered around the multifarious history of the Potsdam carillon.

In the months preceding the symposium, high school and university students had worked on soundscape-related studies and projects. This was the object of a lively discussion, chaired by Günter Olias, between the students, sound designer Hans Ulrich Werner, composer Gabriele Proy and Eva-Maria Ganschinietz of the Institute for Music and Music Pedagogy, Potsdam University.

The symposium was made possible thanks to the financial support from the University Society, Potsdam and from the Ministry of Cultural and Scientific Affairs of the Land Brandenburg.

GÜNTER OLIAS, professor in Music Education at Potsdam University (retired 1998), board member of the FKL and chairman of the *klangforum brandenburg*. He has published numerous articles about music and soundscape oriented learning and teaching strategies in professional journals, presented papers at national and international conferences, authored volumes about Music Learning (Potsdam 1987, 1990, Essen 1994) and worked as co-author on school-books and CD-productions.

Ascolta Palermo/Palermo Ascolta

A Report about the International Meeting on Soundscape Studies

Palermo, April 27—30, 2005

by Andrea Martignoni

The project of a soundscape conference in Palermo began to take shape when the Sicilian Soundscape Research Group, founded in Catania, in 2004 started co-operating with the association Curva Minore that has actively promoted innovative approaches to sound since 1997. This co-operation led, for instance, to a series of soundscape-related classes and workshops in various schools and to an extended workshop at the University of Palermo. In preparing the conference we were successful in obtaining the co-operation and organizational support of the Aglaia Department at the University of Palermo. In particular we want to thank Professors Giovanni Giuriati, Anna Tedesco and Amalia Collisani.

We also would like to mention that Ascolta Palermo/Palermo Ascolta was included in the activities endorsed by Echologos, a pool of organizations promoting "sustainable art and culture in Sicily". Lelio Giannetto, curvaminore@tiscali.it and Stefano Zorzanello, ne12662@iperbole.bo.it

Flying into Palermo always creates strong emotions in me. The view onto the Conca d'oro is extremely beautiful. The town is always very lively, full of colours, sounds and . . . chaos. Also, the location where the meeting took place is remarkable. The Sala Magna of the Gothic Palazzo Steri is magnificent. In addition, the atmosphere was very cordial, and the audience was sufficiently large for a field of study that has found followers in Italy only in recent years. Many participants (not only the speakers) came from far away, which shows that soundscape-related issues are capable of 'moving' people.

The sessions began with a workshop led by Helmi Järviluoma (from Finland and director of *Acoustic Environments in Change*), Albert Mayr and the Sicilian Soundscape Research Group. It was interesting but perhaps too brief for an in-depth discussion about the changes that have occurred in the villages which were re-visited after 25 years.

Stefano Zorzanello playing R.M.Schafer's *Nocturne* for solo flute inside one of the upper rooms at Grotte della Gurfa (Palermo, Italy)

The following three days, the main part of the conference, were divided into six half-day sessions. They were rather dense but well organized, and featured three types of presentations: papers, listening sessions and activities in the environment. I personally was a bit concerned, but also excited, by the quantity of presentations (only one was cancelled). But the level stayed high both in quality and variety.

Helmi Järviluoma spoke on "Soundscape and Social Memory". She emphasized that memory is an essential tool for the researchers studying the soundscape from a social and historical angle—particularly in periods of cultural transition such as ours. Antonello Ricci (Università La Sapienza, Rome) talked about his experience in "Aural Anthropology" and underlined the importance of listening as a cognitive tool, in fact as important as vision in ethnographic research—in other words, visual observation should be complemented by an equally involved acoustic observation. In his study on the sheep-farming culture in Central and Southern Italy he illustrated the importance of acoustic perception in this context. But he also remarked that the preservation of this culture is now limited to very few areas where noise pollution and

the transition from a rural to an industrial soundscape are not yet devastating,

Paolo Emilio Carapezza's paper "Musurgia naturalis" displayed profound erudition in the first part, with its distinction between 'natural' and 'artificial' musics through an analysis of ancient Greek and Latin literature on this subject. The second part of the paper appeared less convincing in its analysis of works by Giovanni Damiani and Federico Incardona, as in these pieces the soundscape aspect is certainly marginal, both conceptually and with regard to the materials—particularly when compared to the work of other composers today.

In the second session two projects were presented that have to do with Sicilian territories. The first was a documentation of traditional Sicilian markets. The second one was "Agoràfonia", a large-scale project in progress by the Sicilian Soundscape Research Group. Its interdisciplinary approach focuses on the acoustic situation of Catania today—its squares, streets, passage ways, and other places typical for spontaneous gatherings—through an analysis of architectural and urban-structural characteristics, conditions of mobility, phonometrical measurements, field recordings, acoustic cycles and their quality, demographic studies, and questionnaires.

Alia (Sicilia)

The following day Lena Dietze, Dirk Marwedel and Sabine Breitsameter presented "Wiesbaden Er-hören" that was described in *Soundscape* 1/1. Furthermore Dietze informed us about recent projects carried out by artists and students in co-operation with Hessischer Rundfunk in Frankfurt. Pascal Amphoux (Cresson and University of Nantes) spoke about new approaches to architectural noise barriers and described in particular a project for the viaduct in Chillon, Switzerland, which unfortunately has not been realized. The project proposes new and original solutions with regard to environmental and aesthetic perception.

"Aesthetics and communication" was the motto for the last session of papers. Albert Mayr reported on his exploration of the temporal and spatio-temporal qualities of a minuscule Istrian village as they manifested themselves through sonic events, including the smallest and simplest ones. Stefano Zorzanello developed a new, politically revolutionary approach to the concept of Soundwalk. As possible forerunners he cited the surrealistic practices of Breton and his movement, the "Dérive" of the Situationists around Guy Debord and some examples of Land Art, all leading towards a new use of everyday spaces and places. Gabriele Proy spoke about the aesthetic and poetic questions involved in soundscape composition and the relationship between the composer and the original context of the sounds used.

Two evenings were dedicated to "organized sound materials;" Antonello Ricci presented the interesting *Paesaggi sonori nel Museo della pastorizia e della transumanza* based on materials he had collected. Gabriele Proy introduced various soundscape compositions, out of which I particularly liked Proy's *Wien Westbahnhof* and *Habana*, and Zorzanello's *Robaan Grüsse Dich*.

But perhaps the most surprising and enjoyable part of the days in Palermo were the "outings" from Palazzo Steri. On Friday afternoon a bus departed for Alia, a village almost in the center of Sicily with the characteristic grottos called *Le Grotte della Gurfa*—an authentic monument of rupestrian architecture dating back as far as 5000 BC, with two levels of grottos of different sizes. These excavations were the scene for various stimulating events: Albert Mayr's sound installation Hora Harmonica, performances by the Sicilian Music Crew (Lelio Giannetto, Sandro Librio, Perla Manfré, Enrico Sorbello, Stefano Zorzanello) of Christian Wolff's *Sticks and Stones* (from the *Prose Collection*), and an homage to R. Murray Schafer, the *Nocturne* from *Wolf Music* for solo flute played by Zorzanello at dusk, as requested by the score. It was a truly special occasion as the sounds were accompanied by a breathtaking view and followed by excellent, fragrant wine and delicious cheese.

The next morning offered soundwalks 'à la carte' where we could choose between four different routes. They had been designed by the participants of the *Soundscape Lab* held at the University of Palermo a few months earlier. I chose the one that led us through the old centre with its various markets, renowned beyond Palermo. From *Piazza Villani* we crossed the *Vucciria* market, various areas where craftsmen are still practising their trade, undisturbed by traffic, and finally reached the very lively *Mercato del Capo*. Those were multifarious sonic stimuli which connect the listener strongly to the Mediterranean world, a cross-road of cultures.

For the final event and after the official opening hours, participants were taken to the *Orto Botanico* and had the opportunity to visit one of the richest and most important botanical gardens in Europe at night. Instrumental performances happened in different places at different moments letting us savour different botanical-musical combinations—the only short-coming: far too many people, but was it really a shortcoming?

Meetings such as this one in Palermo, which was organized very efficiently while retaining a rare light atmosphere, should happen on many other occasions and in various places and soundscapes.

ANDREA MARTIGNONI, born in Bologna in 1961, holds degrees in music (1994) and geography (2005) from the university of Bologna, works with 'organized sounds' for animation films by artists; in 1998 he released, in co-production with CBC and RAI a sound portrait of Montréal.

Academic Sound News from Sweden

By Henrik Karlsson

Sound Environment Centre

A new multidisciplinary Sound Environment Centre was established at the University of Lund, Sweden, in March 2005. It is the first of its kind, national as well as international. The Centre will study sound as a phenomenon, sound worlds and sound environments from a multi-disciplinary perspective. It is proposed that it will act as a common body for the whole university for training and research. The organisation of the Centre will be completed in 2005—06, including fundraising, research projects and curricula, combining competences of University departments in acoustics, audiology, architecture, city and landscape planning, environmental medicine etc., as well as other disciplines at the 14 universities and colleges within the Öresund region (Copenhagen—Malmö—Lund). A series of seminars will start in the fall of 2005.

Transmission

Architects Catharina Dyrssen and Björn Hellström have started a network, *Urban Sound Institute*, together with two composers specialising in sound and art installations in public places. The network also runs a two year practice-based research project called "Transmission", funded by The Swedish Research Council, which will focus on sound, sound art, sound space and architecture, primarily in urban public environments. The aim is to study the spatial characteristics of sound and how people interact and relate to them. Björn Hellström is also engaged in the acoustic design of two underground train stations under construction in Stockholm, and Catharina Dyrssen is the co-ordinator of a sound design curriculum at Gothenburg University.

An acoustic scarecrow

The flocks of jackdaws wheeling around the cathedral towers of Uppsala, long the picturesque acoustic emblem of the university city, are said to consist of the lost souls of the steadily increasing number of grieved docents who never advanced to professors. Anyhow, the birds are becoming a nuisance these days, screaming, contaminating and ravaging the surrounding farm land. City Council will therefore test a new acoustic scarecrow, a recorded scream of anxiety from a jackdaw just being caught by a hawk. When the flock hears the scream, it is presumed that the birds will rush to rescue the distressed one. But when they do not find anyone (except for the loudspeaker) they will get confused and fly away.

HENRIK KARLSSON is a musicologist, assistant professor of Gothenburg University and former research secretary at the Royal Swedish Academy of Music in Stockholm.

HearWear—The Future of Hearing, a new exhibition at London's Victoria and Albert Museum, shows off trendy deaf-tech prototypes like gadgets that can filter out annoying noises and memory glasses that replay the last few seconds of conversation. The exhibition runs 26 July 2005—5 March 2006. Read more online: www.vam.ac.uk/exhibitions/future_exhibs/hear_wear/index.html

It was with sadness and regret that we recently said farewell to Reanna Evoy as the layout designer for this Journal. The WFAE has been so very fortunate to have had the benefit of her expertise and energy. Reanna played no small part in helping us to launch the Journal and build it into the quality product that it has become. And, through this often frustrating process, I cannot ever remember hearing her complain! I feel that says a lot for her character and professionalism and no doubt is playing a hand in the success in her career, which is drawing her away from us now.

And so with our thanks and best wishes for a successful future to Reanna comes a warm welcome to Andrea Schmidt, our new designer. Andrea has been working away on this very issue of *Soundscape* and we look forward to a fruitful future together on the Journal.

Nigel Frayne
Chair, WFAE Board.

Correction:

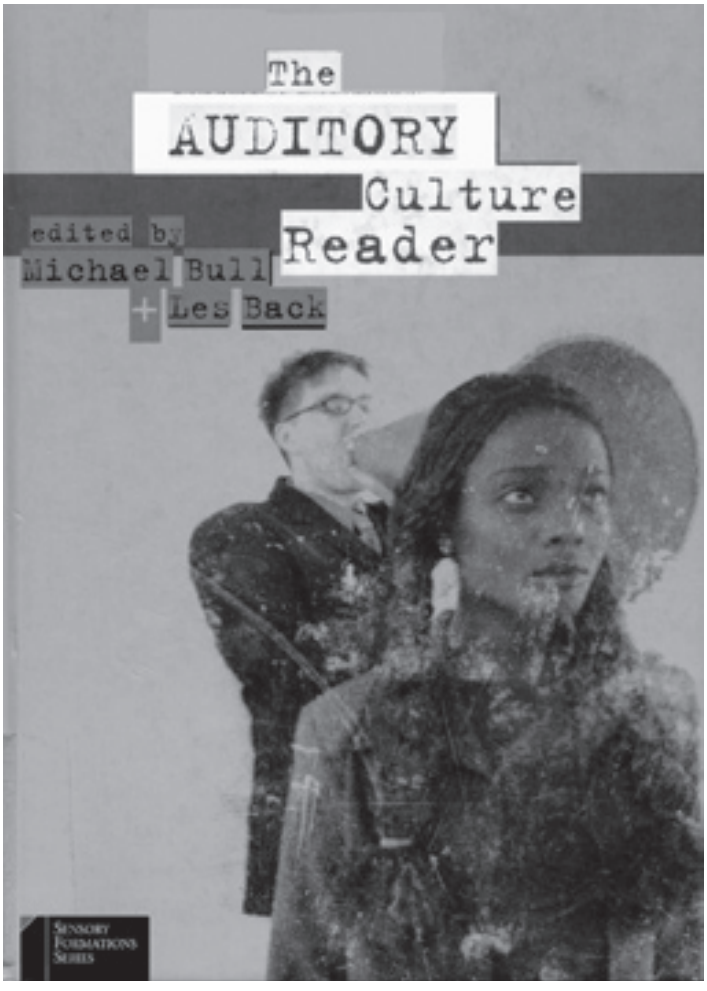
In the last issue of *Soundscape* Vol 5 Number 2, p.42 the image accompanying John Wynne's article "Fallender Ton für 207 Lautsprecher Boxen" was cropped at the top so that the large speaker attached to the wall above the chorus of loudspeakers on the floor was not visible. People reading the article may have been puzzled by the reference to it in the text! And just in case people noticed that there were only 206 speakers in the photo, the image should have looked like this:

The Auditory Culture Reader (Sensory Formations)

Michael Bull & Les Back, eds. (Berg, 2003)
US $32.95

Reviewed by Barry Truax

Three interdisciplinary approaches to sound are familiar to most readers of this journal, namely soundscape studies, acoustic ecology, and acoustic communication. We can now add a fourth termed "auditory culture", or what in North America is being referred to as "aural culture". This anthology, edited by two sociologists at Goldsmiths College and the University of Sussex in the UK, with several contributions by them and their colleagues, shows that a growing number of academics are now listening to cultural history with new ears. It is an approach based in sociology, cultural studies and anthropology which the editors hope "will open up new ways of thinking about the 'senses of sense'".



The 28 chapters, plus an Afterword by Hillel Schwartz, include several influential texts previously published or presented, that are now conveniently made available in one book: Murray Schafer's "Open Ears" presented at the Melbourne conference and published in this journal (Vol. 4(2)); chapters from books by L.E. Schmidt (*Hearing Things*), Don Ihde (*Listening and Voice*), Douglas Kahn (*Noise, Water, Meat*), Alain Corbin (*Village Bells*); and articles by Mark Smith (on antebellum America), Karin Bijsterveld (on noise abatement campaigns in Europe and North America), Johnathan Sterne ("Medicine's acoustic culture"), Steven Feld ("A rainforest acoustemology"), and Susan McClary (on Bessie Smith). Although not acknowledged as such, at least two contributions, Paul Moore's on sectarian sound in Northern Ireland, and Brian Smith's on the soundscape of London in 1600, were previously presented at the Dartington conference, "Sound Practice", in 2001 and appeared in the Proceedings.

The original contributions to this book, mainly from sociologists and cultural theorists in the UK and Europe, analyze specific cultural phenomena, such as Objibwa Powwow sounds (Cora Bender), radio consumption in Bristol (Jo Tacchi), city soundscapes (Fran Tonkiss, Jean-Paul Thibaud), football songs (Les Back), clapping (Steven Connor), mobile phones (Caroline Bassett), automobile soundscapes (Michael Bull), and document various musical enthnographies (Paul Gilroy, Vic Seidler, Sanjay Sharma, Stuart Hall, Lez Henry, Julian Henriques, and Richard Sennett). The volume also includes a rather dense essay by sociologist Paul Filmer on the shifting roles of music making, with an emphasis on the relation of rhythm to sociality.

A much more readable, even entertaining, chapter is the Afterword by cultural historian Hillel Schwartz (author of the encyclopedic *The Culture of the Copy* and raconteur extraordinaire) called "The Indefensible Ear: A History", which is hopefully a foretaste of his long-awaited book on the history of noise. Although not as systematic an analysis of early 20th century noise campaigns as Emily Thompson's book, *The Soundscape of Modernity*, Schwartz argues that a major shift in aural culture, spurred by noisy assaults on the ear, characterized this period. He concludes, somewhat tongue in cheek, that anti-noise activists should stop referring to the ear as defenceless, and adopt a motto such as "The Ear Strikes Back".

Given the diversity of contributions, and the mix of reprints and new studies, it is difficult to say if this volume represents a unified approach to cultural studies that integrates the missing elements of sound and listening. There is a distinct lack of theoretical foundation, such as that provided by acoustic communication models, with an emphasis instead on extensive descriptive and ethnographic methods. By focusing exclusively on culture and society, this work also differs from the broader concerns of acoustic ecology. What seems most encouraging is that, following in the footsteps of such disciplines as geography, history and urban design, which have recently started including the soundscape in their research, social and cultural theorists are starting to realize the wider role that auditory information (and not just music) can play in their work.

BARRY TRUAX is a Professor in both the School of Communication and the School for the Contemporary Arts at Simon Fraser University where he teaches courses in acoustic communication and electroacoustic music. He has worked with the World Soundscape Project, editing its *Handbook for Acoustic Ecology*, and has published a book *Acoustic Communication* dealing with all aspects of sound and technology. As a composer, Truax is best known for his work with the PODX computer music system which he has used for tape solo works and those which combine tape with live performers or computer graphics. A selection of these pieces may be heard on the recording *Sequence of Earlier Heaven*, and the Compact Discs *Digital Soundscapes, Pacific Rim, Song of Songs, Inside, Islands,* and *Twin Souls*, all on the Cambridge Street Records label. Website: www.sfu.ca/~truax

The Wolves of Bays Mountain

Judy Klein
CD available with a subscription to Open Space (www.the-open-space.org), 2004

Reviewed by Dave Aftandilian

Perhaps more than any other animals, wolves exist in a liminal space from the human point of view. Definitely wild, they kill for a living, and haunt deserted places at the edges of the human realm. Yet they also often act very much like our domesticated canine companions, and they can show remarkable tenderness toward their mates, pups, and other pack members. Small wonder, then, that the history of wolf-human interaction is such a vexed one, with humans alternately taming, slaughtering, imitating, ennobling, and demonizing our wolf brothers and sisters.

All those thousands of years of wolf-human history, all those tangled emotions, are crystallized instantly in the depths of our beings when we hear a wolf howl. There is something so utterly alien, and yet so terribly beautiful, about that sound and the feelings it evokes in the human listener that it is practically indescribable. Yet somehow Judy Klein captures the essence of the experience of hearing wolves howl, of the soundscape of the wolf, in her fascinating and moving 21-minute recording, *The Wolves of Bays Mountain*.

Klein recorded the source material for this piece during a number of trips in the 1990s to Bays Mountain Park (www.baysmountain.com) in Kingsport, eastern Tennessee USA. As she writes in the liner notes, some of the source recordings were used unaltered, others were slightly modified, and still others were used "as source material in musical settings and transitions" using the C-sound computer music software. For wolf admirers, the result is pure poetry, an aural love affair with one particular pack of six captive-born gray wolves.

One of the things I like best about this piece is the way it captures both the familiarity and the eeriness of wolf song. Klein begins with composed sounds; a hushed, ethereal, crystalline ambience that prepares us for our journey into a vastly different world. Slowly then she brings in the voices of the wolves in a winter chorus, yipping and howling, and the result is a distinctly otherworldly feel, like listening to transmissions from another dimension. Yet once the composed music fades to the background, the wolf songs take center stage, and a different mode of awareness opens in the listener. As we hear individual wolves in the pack call and respond to each other, we realize that these sounds are not the howls of demons or aliens, but rather the voices of friends and lovers, adults and children speaking to one another. By the end of the piece, when we hear a duet between the alpha pair, Kashtin and Navarro, it's almost as if we can understand what they are saying: "I'm here, you're not alone, we're together, here we are." How much sadder, then, to think of what Kashtin must have felt when she called for her mate Navarro, and he no longer answered (Navarro died in 1996; Klein wrote this piece in his memory).

I do have a couple of quibbles with this CD. For one thing, I wish the packaging gave the listener more to jump-start their imagination. The CD insert is black and white, with no photos of the wolves or of Bays Mountain. Also, the liner notes could provide a lot more contextual information than they do. For instance, the notes do not say that the wolves in the recordings are captive wolves, nor that they are gray wolves (rather than red wolves, who have been reintroduced nearby in North Carolina; gray wolves are extinct in Tennesee, which also is not mentioned in the notes), nor when or why they howl. On the one hand, the absence of this contextual information leaves more room for the listener's imagination to take over, which is a good thing in our overly scripted world. Yet this absence of information also misses an opportunity for education, and some might even call it a bit dishonest—listeners expecting to hear wild wolves will not hear them on this CD, and I wish the liner notes had made that clear. (Many photographers and filmmakers have been taken to task in recent years for using captive wolves in their photos and films, without acknowledging that fact.)

Those quibbles aside, though, *The Wolves of Bays Mountain* is an impressive achievement. Making the familiar strange and the strange familiar—what better role for a soundscape recording? Judy Klein's work achieves that goal, and more, presenting a composition of otherworldly, haunting beauty that remains with the listener long after the last wolf howl has faded into the distance. In the end, we find that the soundscape of the wolf lives not only in a captive wolf enclosure in Bays Mountain Park in Kingsport, Tennessee, but also in the mind of the listener.

DAVE AFTANDILIAN is Communications/Publications Coordinator for the American Society for Acoustic Ecology (www.acousticecology.org/asae) and Preceptor and Program Coordinator for the Environmental Studies Program at the University of Chicago. His current projects include writing up his dissertation, which looks at how their perceptions of animals changed when Native Americans living in Illinois started farming intensively; editing a collection entitled *What Are the Animals to Us? Approaches from Science, Religion, Folklore, Literature, and Art* (to be published by the University of Tennessee Press in 2006); and working to help people understand the protection of the environment as a spiritual as well as practical issue, through a group he co-founded called the Religion and Environment Initiative (http://rei.uchicago.edu).

There are two websites which carry the CD:
The CDemusic website at the Electronic Music Foundation, www.cdemusic.org. Most keywords (wolves, klein, etc.) will get to the CD. Copies sell for US $16.00.

Also, Monty Sloan, from Wolf Park sells the CD at his site: www.wolfphotography.com. It is listed under "CDs & ScreenSavers". Monty sells the CD for US $14.95.

Soundwalk: Brooklyn (Dumbo) "audio guide for insiders"

led by Asa Mader

Reviewed by Lisa Gasior

When I go on a soundwalk, I set my pace, my route, I decide whether I'm going to record it or not, and, perhaps most importantly, I listen intensely to my environment. While conflicting definitions of the term exist, you will be hard-pressed to find anyone who does not encourage listening while soundwalking. An essential part of any soundwalk is listening, and so, the lack thereof is precisely my beef with Oversampling Inc.'s *Soundwalk* series of audio guides—they appropriate the term "soundwalk" to be synonymous with "audio guide." The listener is aurally guided through a particular place but the listeners (tourists, in particular) are not encouraged to listen to the environment.

I took the tour of Dumbo, New York City, an area of Brooklyn that is home to hundreds of artists such as tour guide Asa Mader,

a filmmaker. This audio guide (I will refrain from calling it a soundwalk) is peppered with scenes from a fictional film. Asa sets the scene and then there we are, listening to Vinny, a mob boss, who has fixed the outcome of a boxing match. Once Asa gives the rules—"don't cross any street without me . . . follow my footsteps—don't move without me ... if you get lost, jump back a track . . ."—you're on your way. During the tour, the listener learns bits of information about the neighbourhood from locals, merchants, artists who call Dumbo home. Unfortunately, I was an armchair (and headphone) traveller on this audio tour but I visualize walking through the environment. "Here, every sound fights to survive," says Asa. I imagine the sound from my headphones mixing together with the sounds of the actual environment and I adjust the volume, trying to create a balance just like the sound mixer for a film.

Music is present throughout the tour. Sometimes it's part of the neighbourhood (speeding by, left to right in your headphones, as if from a passing car), sometimes it's part of the film, and sometimes it's just for the listener. It covers any "silences" or "lulls" in the narration and interviews. We are rarely given the chance to listen to the recorded soundscape nor are we ever prompted to listen to the real environment. Moments of silence on the CD, encouraging active listening for the person actually walking the tour would have been a worthwhile addition. Instead, we are constantly stimulated. This stimulation is also problematic in that it is always pleasant, "hi-fi" sounds that we hear. The rumble of the city is omnipresent with the occasional car horn sounding but not once do we hear the beeping of a truck backing up, which is common in any city, let alone the Big Apple.

From a technical standpoint, *Soundwalk* does a great job of taking the listener from their reality into a fictional environment and back again. Utilizing equalization, it makes evident when we are listening to sounds of the neighbourhood and when we are in parts of Asa's film. And, while the narration of the walk seems to have a visual bias (describing a scene from a film or enjoying the view from atop of a building), this is all admirably done through sound—the home listener is free to create his or her own images of that environment. Along with the high production values, the ability to tell a story through sound is one of *Soundwalk's* redeeming qualities.

At the end of the tour, you are left sitting on a bench near a dock close to the Brooklyn Bridge and music plays, or as Asa says, the credits roll. If you have patience, wait for the music to end and you will be left with the sound of water hitting the pier.

Futher information:

Oversampling Inc.'s *Soundwalk* series includes eight other audio guides for different New York neighbourhoods, including their newest release, "Ground Zero: the sonic memorial soundwalk". For more info, visit www.soundwalk.com

LISA GASIOR has been hearing since birth but started listening in September 2000. She received her BA in Communications and Journalism with a minor in Electroacoustic Studies at Concordia University, Montréal, and she is currently pursuing her MA in Media Studies at the same university. Lisa is a research assistant for Dr. Andra McCartney and a teacher's assistant in advanced sound production at Concordia. Her thesis project, *Sounding Griffintown*, is taking her back in time as she explores the soundscapes of this Montréal neighbourhood. Lisa hopes to introduce others to the joys of listening and find beautiful soundscapes wherever she goes. For more info, please visit: www.griffinsound.ca

The Lesson of Freedom: Remembering Luc Ferrari (1929—2005)

By John Palmer

I remember Luc Ferrari with the same warmth and affection as I remember John Cage. Indeed, these two men shared so many things on both a human and artistic level. For Luc, meeting John Cage in Darmstadt in the early 1950s had been a moment of revelation. As he would put it, "what was so curious and attractive for me was that this man [John Cage] could both play around the piano and write serial scores, but also write a piece such as Sonata And Interlude which had nothing to do with serialism. For me it was fantastic: the lesson of freedom! Why be a prisoner of a style, a technique or an ideology? That was for me the beginning, because I do think that ideology is a reduction of life".[1]

Luc's attitude towards art and life became clearer as a result of this encounter. The open-mindedness that characterized his artistic output made him not only a unique composer but also one of the most versatile voices in the contemporary music scene. Luc's aesthetic world reflected a sensual macrocosm where creativity is to be understood as a tool for self-criticism and continuous artistic renewal. Writing music was expressing his vitality and the desire to live in the most real meaning of the word. A minimal sensuality, as he would put it, was not interesting to him.

Luc Ferrari (1929—2005)

"We have nothing without sensuality, he once told me. We are cold, warm; we can always see, hear, taste and touch. Clothes are impermanent sensations on the skin. The body is always a permanent sensation. When I sit, I feel my legs, my fingers. I feel all. Images come through my head into my body. It's the same with music. All that constitutes the most important aspect of our situation, because when we are cut off from sensuality there is no life anymore. Maybe that is death. I don't know. . ."

Art was for Luc a process of continuous vivification also including chance, randomness and the desire to progress while constantly looking at new horizons. He would listen to literally any kind of music and look at other forms of art with great attention and interest. And he would move from one artistic activity to another with the same authority, commitment and enthusiasm. From orchestral music to musique concréte, from film production to musical theatre, from painting to film music and experimental Hörspiel. Everything was for him evolving composition in a truly pluralistic spirit.

I remember Luc telling me how important it was to work with the meaning of sound, including the word. It was a crucial link with what he would call the "inner dimension." As he would put it,

a "direct connection with psychology and intimacy." Basically, that was for him the essential semantic of the *objet trouvé*. But if sound was indeed an *objet trouvé* by chance, composition was *philosophy, intimacy, psychoanalysis: all that is around expression*, as he would stress.

Unheimlich schön, written in 1971, typifies an amazingly compressed process of introspection and emotion, psychology and sensuality that is unprecedented in the history of 20th century music. The listener is forced to undertake a journey into an implacable reduction of sonic material: a female voice repeating the words *unheimlich schön* at various points in time, interspersed with chunks of silence of dissimilar duration. Each vocal intervention is spoken out with slight nuances of attack, diction, articulation and agogic. An amazing tour de force proposed with such an uncompromising focus on the changing states of mind of the speaker. Luc would describe such an experience as an emotional circumstance of great importance to be played with. Contemporary romanticism in condensed symbolism.

He was always searching for artistic authenticity and freedom. And I have seldom come across a composer where the artist was always in tune with the man, where artistic integrity would marry human authenticity in such a natural and wonderfully witty manner. (Again, I cannot but point out the similarity with John Cage.) I am sure Luc Ferrari will always be remembered as one of those rare gems that remains engraved in the lives of those who have known him.

The last time I saw Luc and his wife Brunhild was in 2001 when I went to visit them in Paris. I remember feeling how spontaneous, authentic and genuine they had remained throughout their lives, and sensed a glimpse of immortal youth that characterized both their personalities (Luc was 70 at that time!). I have very seldom met a man so much in love with life and so much in love with a woman as Luc was with Brunhild. With her, he shared some 45 years of his life. It is with the memory of this wonderful, young love that I want to conclude this tribute. When we die our body ceases to function, but the essence of our life, as the results of our thoughts and actions, remain. The spirit strikes off the shackles of our body, but nothing gets really lost. I shall always remember the life of Luc Ferrari and the love of Luc and Brunhild as a flash of consciousness that reminds me of the joy of earthly existence and life beyond.

Endnotes

1 All quotations are extracted from "Conversation with Luc Ferrari" (1999), an interview I conducted with him in 1999. The interview has been published in '20th Century Music', USA, December 1999 and in *SAN Journal of Electroacoustic Music,* Vol. 13, September 2000, ISSN 1355 7726.

JOHN PALMER is a composer with a strongly international and cross-over musical background. In the mid-seventies he began to compose and perform as a pianist and directed several groups of experimental music and jazz. Since the mid-eighties he has focused on instrumental, orchestral, vocal and chamber music and in the early nineties he extended his compositional interests with electroacoustic resources. His current music is particularly characterised by both a sensitivity for subtle transformations of timbre as a cardinal element of the musical discourse, and a refined perception of space and silence. Since the early nineties Zen, and Buddhist philosophy in general, has become an increasing source of inspiration. For a list of works, please see: www.johnpalmer.info.

Guilherme Vaz

Luc Ferrari was a great artist and as any great artist far from the mainstream. Perhaps he was one of the few who reached a truly artistic state in electroacoustic music—a rare artist full of philosophy, desires and imagination. His breaking point with Schaeffer was essential for this. Being a non-mainstream man gave him less visibility but more passion and basic happiness. His work, crowded with human poetry, went against the basic aesthetics of pure and cold engineering, a horrible taste evoked by much contemporary music nowadays. He was never completely a contemporary composer but an artist of all ages. That is why he is so special. He made a difference in a steely, cold hearted period of musical art—a period of art without art—during which he remained an artist. In the face of the engineered music's massive propaganda to create an empire, he is a hero. To realize this completely in these noisy, nonsensical times in which we live, full of lost energies and ongoing struggles against the 'machine-composers', we must understand his absence as sonic/musical *presence*. Because what cannot be said in words must be shown through his composition.

GUILHERME VAZ. Brazilian composer. Artist. Writer. Has worked with post "contemporary music" aestethics and philosophy for more than a decade—with the possibility of a new art and a new relationship between art, spirit and nature. Invited artist to the Biennalle de Paris [VIII] and the mega exhibition "Information" at the Modern Art Museum of New York [MoMA]. Recently edited one DVD and nine CDs. Worked with artist poet Dick Higgins of "Fluxus" New York at many events, conferences and happenings.

Hildegard Westerkamp

Luc Ferrari would never have called himself a soundscape composer. And yet he listened and composed with an ear deeply sensitive to everything in and around him, including the soundscape. In 2000, when I met him and his wife Brunhild Meyer for the first time, I heard the premiere of his 90-minute opus *Far-West News* in Amsterdam as part of *Soundscape be)for(e* 2000. It was then that I thought he is a true soundscape composer. *Far-West News* is a sonic journey through parts of the USA, from Santa Fe to Los Angeles, which he composed from the sounds and soundscapes recorded by himself and Brunhild. This work does not simply document the journey, it *expresses* in a sensitive, sharp-minded and often witty way the deeper experiences of two travelers in a foreign country and culture. Luc's notes reflect the tone of his compositional language:

> " . . . In Taos, in the Pueblo-Indian village, I listen in my headphones for the first time to the sound of my footsteps on this foreign soil. A dry crunching sound, not European, the same sound until the end of the trip. Then there's the road. The silence of the road . . ."

> " . . . I've got used to the desert; a car every hour suits me fine. When we reach Los Angeles I'm scared stiff. There are cars all over the place… From certain characteristic signs, it is clear that we're back in civilisation. There are buildings, houses that are not on wheels, even men wearing suits, elegant women wearing makeup, and a piano bar with post-modern music . . ."

Brunhild wrote, "*Luc went to sleep definitively on August 22nd in Arezzo, Tuscany, in Italy where we hoped to spend a week of vacation. He slipped away quietly. His face was so beautiful, calm, with a tiny wrinkle of humour under his left eye. . . . He was too tired because of the chemotherapy, then he caught pneumonia and no hospital, no doctors could save his life.*"

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“But what a humiliation for me when someone standing next to me heard a flute in the distance and I heard nothing, or someone standing next to me heard a shepherd singing and again I heard nothing. Such incidents drove me almost to despair; a little more of that and I would have ended my life – it was only my art that held me back.” —*Ludwig van Beethoven*

“Blindness cuts us off from things, but deafness cuts us off from people.” —*Helen Keller*