“Why Aren’t Hospitals Designed to Look More like Churches?!”
Professor Henry Marsh
Neurosurgeon St. George’s Hospital, London

“The myth of Orpheus tells us that music can heal both body and soul”
Professor Romano Del Nord
Deputy Rector for the University of Florence; Director of the Scientific Committee of the International Academy of Design and Health
Architecture Out of Tune: The Hospital as Instrument
steve roden  
*pavilion scores, 2005*  
serpentine gallery, hyde park, london

alvaro siza  
eduardo souto de mora  
cecil balmond

“architecture generates a score”
The sounds and spaces that used to accompany illness... When Vivaldi was violinist in residence at the Ospedale della Pieta in Venice...

Handel and Foundling Hospital in London

Sung liturgical services as one of the principal forms of comfort offered to the ill
...the sounds and spaces that accompany illness now
A City Where You Can’t Hear Yourself Scream
MICHAEL SLACKMAN
April 14, 2008
CAIRO — Egyptians in this capital city say it is harder and harder to be heard and to have a voice, but they are not talking politics. Well, not only politics.

Salesmen shout in Cairo, where the noise is like living with a running lawn mower next to you.

“Whatever I talk to people, they always say, ‘Why are you screaming?’” said Salah Abdul Hamid, 56, a barber whose two-chair shop is on the corner of a busy street on the north side.

Mr. Hamid was, of course, screaming.

“outrageous, unceasing, pounding noise” forms the unnerving backdrop to city life.

Hospitals aren’t the only places getting noisier....
Bureaucratisation of the Senses

• Visual considerations dominate architectural research
• “With grids of asphalt laid over stone, and streets bounded by reflective glass curtain-walls, urban sound was newly difficult to locate, pervasive, indirect – amplified and indeed produced by the giant resonance-making machine of an acoustically live [city]...” (Jones 2005)

  ▪ Reflective glass walls
  ▪ Chaotic public spaces

• Features that lend energy to the modern city, but possibly torment a hospital environment
• A city’s “nervous whirlpools” of sounds may need to be subtracted “to allow the body to think its own thoughts”.

...
Aims

• Elevate acoustic environment to same level of importance as light, colour, nature...
• Review evidence that there is a problem
• Strategies for intervention
• Case Studies

*not intended as a private/public medical system comparison.
Perhaps routes for improvement would have been easier had there been a direct correlation curve sweeping quality upwards as funds increased...

*music therapy
Effects on Patients

• Sleep
• Physiological + Psychological Stress
  ▪ World Health Organisation: Cardiovascular response
    ▪ Hypertension
    ▪ Tachycardia
    ▪ Tachypnoea
    ▪ Ischaemic Heart Disease
• Recovery Outcomes
  ▪ Decreased rates of healing, increased dosages of pain medication
• Can ultimately extend hospital stays
  ▪ Hagerman et al. (2005): higher incidence of rehospitalisation for patients with chest pain was higher among patients treated in poor acoustical spaces.
  ▪ Fife and Rappaport (1976): length of hospital stay post-cataract surgery was significantly lengthier during periods embellished with construction noise than periods without.

Corollary:
Most patients have little control over their exposure to acoustic hazards, and often cannot remove themselves from such a situation.
Specific Patient Needs

- WHO (1999) – groups less able to cope with the impacts of noise and particularly vulnerable to its harmful effects:
  - Neonates
  - Elderly
  - Mentally ill
  - Visually impaired
  - Hearing impaired
  - Cognitively impaired
  - Radiological patients – loud sound + claustrophobia -> 20% missed appointments
  - Stage of convalescence
    - AIDS Hospice – variety of ages, cultures, and stages of illness
Sleep Deprivation

- Geriatrics
- Critical Care
  - Impaired immune function
  - Ventilatory compromise
  - Disrupted thermoregulation
  - Delirium, Acute Confusion

51% of CCU patients had significant changes in sleep architecture: decreased efficiency and quality (Yinnon et al, British Journal Clinical Practice)

- Of the reasons specified, the most important was noise made by other patients or by the medical staff.
- Sound-absorbent ceiling tiles reduced EEG arousal spikes and decreased sound-induced sleep fragmentation.
NICU

High noise levels:

• Decrease neonatal oxygen saturation (increasing need for oxygen support therapy)
• Elevate blood pressure
• Disrupt thermoregulation
• Raise heart rate & respiratory rate
• Disrupt sleep
• Interfere with Immunological and Neurological development (frequency discrimination)

• Research labs; Vibration effect
• NICU as hospital-lab hybrid
Mental Health

- Psychiatric hospital design has historically reflected treatment trends and attitudes towards psychiatry
  - asylums → socially integrative villages

- Sleep Deprivation → **Tendency to Medicate**

- Sensory-Perceptual disorders
  - Hyperacusis, Phonophobia, Auditory Hallucinations
  - **Distortional power of spaces**

- Behaviours amplified
  - Aggression, Self-regulatory ability, Panic Disorder, Depression, Anxiety, Acute Confusion
  - Auditory evoked potentials and CCK-4 (cholecystokinin-tetrapeptide), triggering behavioural, cardiovascular and neuroendocrine panic responses (Journal of Psychiatry 2008)

- Disorientation
  - 60% of pts with Autism report increased sensitivity to sound and difficulty filtering out important info; can be disabbling in hospital environment

- **Space must be clearly defined.** If not, can be disorienting at best, and lead to disruptive inappropriate behaviour at worst. Acoustic considerations of primary importance.
Communication

Speech Intelligibility

Privacy

• Multi-bed spaces:
  • Breaches of Confidentiality
  • Less patient disclosure
• 1996 Health Insurance Portability and Accountability Act (HIPAA) stringently safeguards the use and disclosure of individuals’ health information.

Informative Sound - Orientation and Wayfinding

• “Listening to the foot traffic became my way of constructing a map of my outside world and from that I could extrapolate a rationale for my place in it”.
• Visually impaired St. George’s tour:
  • Unhelpful spaces: atrium and grand piano disguise sound of lift
  • Carpet dampens footsteps
  • “Dead” anechoic spaces can be stifling, make you lose balance and alter behaviour
  • Wards painted and named after colours, intended to help wayfinding...
• Positive stimulation, for dementia, sensorially deprived, cognitively impaired
Effects on staff

- Stress
- Fatigue
- Emotional Exhaustion
- Mental Efficiency
- Short-term Memory
- Medical Errors
- Quality of patient care
- Staff Commitment/Attrition rates
- All of which affect patient safety, patient satisfaction, even a community’s loyalty to the hospital and the media’s portrayal of it.
Guidelines

• In 1999, a World Health Organization task committee published guidelines for acceptable noise levels in the community.
  ▪ Conversational speech 100% intelligible with background noise levels of 35 dB
  ▪ Maximum for continuous background noise in “rooms in which patients are being treated or observed” = 30 dB, with nighttime peaks in wards not to exceed 40 dB.

• Not a single study published over the last forty-five years on hospital noise reported levels that complied with the WHO guidelines.

• Royal College of Surgeons (March 2008) called for “urgent measures” to rectify noise pollution on acute surgical wards, where peaks reached 95.6 dB, exceeding even those at main entrance & coffee shop
How Can Architects Help?
Hospital Architecture

- The **surfaces** that envelop **form**, which encloses **space**
- “The infinite varieties of these are the joy of architecture” (Scher, Arts for Health Study)

Hospital architecture unique:
- Social purpose and responsibility
- Process
- Challenges
- “Architecture of quality must be...the most adept, profound, and skilful **synthesis** of all the knowledge that can be had of the total elements which exist and are foreseeable at the time of the building; a clear expression of the total wealth of our society; not just material, but spiritual, social, technical and moral as well".
Architectural Strategies

• Four S’s
  ❖ Size
  ❖ Shape
  ❖ Surface
  ❖ Space Adjacencies

• Irregularity
  — Long rectangular rooms with parallel walls increase reflectivity → ideal concert halls
  — Irregularly shaped rooms or recessed areas diffuse sound waves

• Provision of adequate spaces for private discussion

• Control + Choice
  ▪ Architecture can empower by offering options
  ▪ WHO: “Physically, there is no distinction between sound and noise. Noise is thus defined as unwanted sound. Control and predictability are key determinants of perception

Figure 1.3 The geometric concentration of sound reflection is illustrated in this seventeenth century drawing.
Hammersmith Bridge Road Surgery, Guy Greenfield Architects

- GP surgery – standard NHS budget
- Situated in a context that borders on aggressive
- White sails protect from sound
- Don’t fight context, but charm it with a sculptural form
Long Term and Psychiatric Care – Laguna Honda

• Balancing needs of modern equipment with patients use of facility as a long term home.

• Separation of service flows (backstage, back of house) from spaces of social interaction.

• Integration of protected historical landmark (Flo Nightingale wards, seismically unsafe and clinically outdated).
Creation of a separate circulation space for service, maintenance, and transport staff.

*Corridor-length window of views and daylight, remedies the perception of long distances.
NICU – Kaiser Santa Clara

- Kaiser Permanente, largest managed care organization in the United States
- 8.7 million members and 37 medical centres
- Completed in 2007, Kaiser Santa Clara occupies what used to be the last orchard in Silicon Valley.
- Notoriously cost-constrained template
- Mantra: “no glitz”
- Sequence of courtyards, evoking the memory of the orchard.
- Pervasive reliance on glass → garden views + light
• NICU design driven by:
  ▪ Separate family flows from intensity of clinical zones
  ▪ Breakdown of scale for ease of control
• Radial geometry of beds provides for maximum visibility and access
• Acoustics remain a challenge.
  ▪ Materials by necessity hard and reflective
  ▪ Concave geometry focuses sound
• Family area helped by carpet and concave wall
Clean Culprits
“we tell our staff to wear soft-soled shoes”
Paediatrics - Stanford

- Packard Children’s Hospital at Stanford University
- 33 roof terraces, beds centred around octagonal courtyard
  - angular corners rounded to soften outdoor acoustics.
  - All corridors carpeted to offset generous glass

What is ideal for a children’s hospital?
Acoustic Art Program
Comer Children’s Hospital, University of Chicago
Sound as architecture – creating space

Theme: Poetry written by, for, and about children
Interwoven with sound design to engage children
poetry phone, sound garden, poetry hopscotch
corridors, proposed Roger McGough as poet in residence.
• Subtle changes result in acoustical surprises
Arup Sound Lab

- Violinist Paul Robertson in his collaboration piece on music and Alzheimer’s Disease: Alzheimer’s is difficult to articulate in words. Quoting Mendelssohn: “music is too precise to express in words”.

- Auralization of different spaces before they are built: simulating how various spaces would perform acoustically, and how architectural interventions can alter sound quality.

- “Every room has a response to sound; an acoustic signature”: predict what features will shape a room’s character, and what features will need to accommodate for sounds whose sources cannot be controlled – such as is often the case with equipment and people.

- Along with the sound lab, significant research has gone into fine-tuning the acoustics of a myriad of spaces, such as homes, classrooms, concert halls and performance venues, even monasteries.

- Why not hospitals?
Dichotomies

- Complexity of hospitals
- Complexity of design
- Cannot look at acoustics in isolation,
- Just as difficult to isolate what specific interventions are responsible for successful spaces

- Single-bedroom Privacy Staff access and monitoring
- Glass Daylight Notoriously sound-reflecting
- Atrium Iconic Acoustically chaotic
- Curtains, carpets, Absorb sound Point of reference
  perforated ceilings
- Do such tensions force a hierarchy among these dissonant principles?

Æ Infection risk?
Conclusion – Lament of the IV

• Jones and Kang: “acoustics is an area in which many interesting claims were made”
• Are Acoustics legitimate and helpful formal determinants of buildings?

• Medical practitioners appreciating design? ...“like saying architecture would be better if the architect read up on a new antibiotic”...

• Power of habituation
• Naaz Coker, Chairman of the St. George’s NHS Trust: doctors and staff become institutionalised, accustomed to such things as futile curtains, poor privacy, and unbearably loud trolleys.

• At least staff members can begin to re-educate themselves on “the common sense principles which we have lost sight of” (Marsh) and subsequently begin to demand, implement, and preserve thoughtful
Until then...
sources


- Berg S. Impact of reduced reverberation time on sound-induced arousals during sleep. Sleep 2001;24:289–92


