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CHRISTMAS 2020: HOUSE OF GOD

The sound of medicine

Hospitals are noisy and stressful places, and noise can induce anxiety. **James Weaver** considers whether more can be done to improve soundscapes in hospitals

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My working day involves researching how acoustics affect a musician's performance and thinking about the intelligibility of sound. I became interested in this through my part time role as a musician. I went from playing in the back rooms and basements of pubs to large venues almost overnight. I became aware that my performance changed based on the natural acoustics of the space. This interest led me to my current doctorate, in which I use computational methods to analyse how different reverberation conditions impact on musical performance and expressivity.

In November 2019 my wife, Annabell, died from metastatic melanoma at St Bartholomew's Hospital. I spent many days and nights in hospital with her, waiting in foyers surrounded by random bleeps and multiple conversations, and being on wards where, in the quiet of the night, alarms sounded until someone attended to them. Somewhat ironically, my research involving intelligibility of sound coincided with Annabell progressively losing her hearing. She became profoundly deaf and subsequently used hearing aids and finally a cochlear implant.

Noise can be a pleasurable, comforting thing. As anyone who has experienced an anechoic (or even semi-anechoic) condition will attest, the absence of any noise is unpleasant. In contrast, too much noise, particularly in a situation where one needs to discuss complex matters, or simply recuperate, can have a negative impact.¹⁻³ This is a difficult balance in a hospital setting.

Sound and noise became all encompassing for Annabell, and me. We constantly battled against her diminishing hearing, especially in the hospital environment where communication is a key part of the patient experience. In the time between her complete loss of hearing and having her cochlear implant activated, something Annabell found particularly challenging was the speed and complexity of information delivered to us, which, as an understatement, is difficult to understand when you can't hear. Annabell was a skilled lip reader, but consultations became emotionally and physically draining. After her implant she was better able to handle this situation, but it could still be problematic as ambient noise can occlude speech—something she also found with hearing aids. This led me to realise the importance of the soundscape in a hospital and how important this is when designing facilities and spaces for patients. It also got me thinking about practical solutions.

The soundscape⁴ is the ordered (musical) and non-ordered sounds of the environment. Features of the soundscape can be divided into keynotes, signals, and soundmarks. In a hospital these could be the following: a keynote, that pervasive sound which anchors the auditory landscape might be the low level hum of equipment being used; the signal, a foreground sound that requires attention would be an alarm sound coming from a finished intravenous line, or from a patient bed; and the soundmark is a sound that might be unique to that environment—on a ward it could be the particular noise of a machine or type of interaction.

A person on a ward might have their own variations on this, and if you are in this setting, I would encourage you to take a minute and consider it. The soundscape of a ward can be a stressor to patients and their families: for example, the natural night time quiet of a ward punctuated by an avoidable alarm, or a key moment in an important discussion disrupted by a parallel conversation.

Hospitals are usually large buildings and sound is affected by the size of a room and can have a long reverberation time. This measurement looks at the decay of a sound from its original source. Think of, say, a large religious venue, the sound of music or a call to prayer reverberates through the room with a long tail of volume, whereas the same sound in your own home would take less time. In a ward setting the sound of an alarm, at a necessarily loud volume, would potentially have a long decay and begin merging with other sounds to create a cacophony. This isn't solely dependent on the size of the room but also the surfaces and other factors that can diffuse (and, of course, increase) sound. Rooms designed to be easily cleaned will likely have strong reflective surfaces for sound, but carpeting and soft furnishings would diffuse it. And, of course, the larger the space, the longer the reverberation time and the likelihood of larger surfaces that would reflect sound. Hospitals such as the Nightingales which are built in large facilities can be particularly problematic. Long reverberation times and loud and cluttered soundscapes are distressing for patients and families and also present difficulties for doctor-patient communication and conversations between health professionals. Factor in the use of personal protective equipment and communication is challenging, particularly for those with hearing loss.

Annabell and I discussed different tactics that could help make her experience better. As hearing loss is a hidden disability it can be difficult to detect unless

declared. Annabell became so adept at lip reading that sometimes people didn't realise she was deaf and her hearing loss wasn't always fully documented, so doctors or nursing staff would launch into a conversation at speed, facing their computer, and possibly in a space with large amounts of background noise.

It would have been helpful if we had had access to quiet spaces to discuss sensitive matters. These should feature some diffusing material, such as carpet or soft furnishings, or have acoustic treatments such as wall or ceiling panels; these can make a huge difference to the listening experience. Some alarms are essential for patient safety, but research is needed into their necessity and whether any could be rationed or vibrating devices be substituted without compromising patient safety.

Mitigation of these pervasive sounds coupled with increased acoustic treatment and awareness of the problem would make a better environment for both patients and staff.

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