EXPLORING THE USE OF SOUNDSCAPING AND SPEECH MASKING IN POST-COVID OFFICES

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1   INTRODUCTION

Out of the blue, March 2020 saw us all desert our offices and set up our workspaces in our homes. This was non-negotiable and came with very little notice. Some companies had policies and plans in place that made the transition to home-working easy, for others it took a while to start working efficiently.

No one could have predicted that this enforced change would have lasted for so long, but we made things work and adapted to our new environment.
What did we learn from this period? What positive lessons can we take from it as we move forward in a world where we learn to live with, rather than hide from, Covid-19?

2   WORKING DURING THE PANDEMIC

2.1   Home working

Our workplaces have been carefully designed to promote productivity, privacy and collaboration; they have the right amounts of daylight, artificial light, ventilation and temperature control, with ergonomic desks and chairs. Overnight, we left all this behind and set up our home offices, in environments that did not have the same rigour in design. Some of us were hunched over a laptop on sofas, some on kitchen tables, some in spare bedrooms, some in studies. Our workfellows changed from people who do similar tasks to us, to our partner, housemate, children or pets.

So, why didn't the world fall apart? How were we able to keep working effectively even though we were outside of these controlled environments? Some did struggle with home-working and couldn't wait to get back into their offices. The challenges of drawing the distinction between work and home life, lack of suitable space to work, lack of decent internet connection, disturbance by other family members or housemates, were cited as the most common issues. But for some, working from home was, and remains to be, a time of unsurpassed productivity, without the hassles of long commutes. Clients have realized that projects run efficiently when meetings are virtual, shorter but more often, rather than needing the whole design team to get together physically, wiping out days of working time.

But what were the good things about working from home? Access to nature, views of the garden, the sound of the birds – especially in the first few months of glorious sunshine, it helped to soften the blow when the world fell apart in front of our eyes.

2.2   Office working

Enforced restrictions of social distancing, reduced occupancy, sanitisation stations every few metres, Perspex screens everywhere, have been relaxed. The extreme measures were a means to an end but were not friendly or enticing environments. They worked well as a stop-gap but we now look forward to how offices will be long-term. In the UK (at the time of writing) social distancing measures and the wearing of masks indoors are no longer mandatory and offices are beginning to get back to 'normal'.

But what is 'normal'? Is the new normal the same as the old one? If it is then we have learned nothing, not developed or moved forward, over the last 18 months.

3 ENCOURAGING WORKERS BACK TO THE OFFICE

As we mentioned above, a lot of the home-working aspects were, and remain to be, attractive to workers. How can we distil the benefits of home-working into our physical office designs? Which of the aspects that people have enjoyed and appreciated so much can we implement?

Biophilic design must be an easy win. That innate connection between people and nature. It can be as easy as having a pot plant on a desk in sight of a worker, or it can be so much more. When we experience nature, it is a multisensorial experience; the sights, the smells, the sounds, the feel, all contribute to that experience. It is possible to reproduce elements of this in a subtle and realistic way, such that workers can be stimulated positively, having that sense of home. Sitting perpendicular to the window such that view of the outside are the in the peripheral vision and not distracting, having dense foliage which gives off oxygen and absorbs carbon dioxide (depending on the plant type), hearing subtle sounds that compliment the other senses.

The fundamental purpose of the office has changed. No longer is it just the place to go to 'get work done'; for some it still is, but for others it has taken on more of a social destination. With most companies adopting hybrid working policies, days in the office tend to be coordinated so that teams are all in together. The office therefore needs to be able to support those activities that cannot be achieved at home, i.e. face to face meetings, collaboration, social interaction. It is for this reason that many office fit-outs now contain relatively few traditional working desks but rather provide a variety of different collaborative working areas.

We have all become familiar with video conferencing as a method of effectively meeting (in a virtual context). This has many benefits, the most important being cutting down on travel emissions and time. One of the most difficult acoustic challenges in the modern workplace though is how to accommodate hybrid meetings in the open plan. There is an inevitable delay in all forms of videoconferencing, such that if two people within earshot of each other are involved in the same conference call then the delay between what they are hearing in real time and audio from the call is highly unpleasant. There is currently no technological answer to this, as the delays are caused by long-distance data transfer. Some therefore resort to gathering around a 'spider'-type microphone and loudspeaker such that only one input/output device is required – this solves the delay problem but if this is done in the open plan then the disembodied voices from the speaker unit are off-putting to others. If a sound comes from something/someone without an appropriate visual cue then it can be deemed more obtrusive than sound level alone would give rise to. If multiple people in an open plan office are on the same video call then the best solution is for them to carry this out in an enclosed meeting room with appropriate levels of sound insulation to those outside, who are not on the same call.

3.1 Personality types

Much has been written about how different personality types cope with office working. Extroverts wake up craving social contact and fill themselves with these experiences throughout the day. Introverts wake up content but then get worn down by social contact. It is commonly regarded that extroverts favour working in the office so they can get their fill of social contact. For introverts, they do not need these interactions and would prefer to be left to get on with their own thing.

But a workforce is made up of both extroverts and introverts. It is therefore difficult to accommodate both personality types within the same open plan space. Having a variety of working environments is therefore a good solution. This may include collaboration spaces for activity-based working, quiet library spaces for concentration (similar to a quiet carriage on a train, where phones and talking are not permitted), phone booths, scope rooms etc. The greater the variety of spaces the more likely there will be a place where everyone can work to their full capacity.

3.2   Neurodiversity

In addition to different personality types, a significant proportion (typically 30 to 40%) of the working population are neurodiverse – this covers people with autism, ADHD, dyslexia, Tourettes, dyspraxia etc. This provides acoustic challenges also, as distraction becomes much greater an issue. For example, it will be more difficult for someone with ADHD to concentrate on a task if there is disturbing sound from nearby workers, coffee machines etc. Conversely someone with Tourettes may have sudden and loud involuntary verbal outbursts, which will be disturbing to those around, as well as being embarrassing to the sufferer.

How can we make the office an inclusive space for all workers, such that their time there is optimised and they get the most out of the interactions they have?

4   SOUND MASKING

Speech communication and privacy are determined by speech intelligibility. The physical factors that govern this are therefore reverberation control and signal to noise ratio.

By providing a good standard of sound absorption to control both direct and reverberant sounds, this can provide an acoustically comfortable environment. As demonstrated in the Essex Study[1] a significant coverage of sound absorption can not only physically reduce the reverberant sound level, but have a psychoacoustic effect whereby people make less noise in the first place (calm breeds calm).

We have just as much control over the signal to noise ratio as we do to reverberant conditions. The 'signal' (usually speech) can be controlled to a limited extent by absorption and barrier attenuation. But what about the 'noise' element? That background L_{90} that persists when all other sounds cease.

If there is a mechanical ventilation system then the L_{90} may be between 35 and 43 dBA. For passive chilled beams or displacement then this could be as low as 30 dBA. For normal speech at 55 dBA, even with a Class A ceiling throughout and desk dividers, the radii of privacy and distraction are painfully large. This would be fine if everyone wanted to work in silence, not collaborating or speaking, and we were not interested in the needs of Introverts or Neurodiverse. But, back in the real world…

We cannot consider the acoustics of an open plan office without knowing, and having control of, the background sound level.

4.1   White/pink noise systems

Electronic speech masking has been used in office design for many years. It is prominent in North America, increasingly common in the UK, MENA and Asia Pac, but is still rarely used in European countries. There are genuine fears in some regions, and in some areas of acoustics consultancy, that speech masking systems are damaging to health.

The idea behind speech masking systems is that a uniform level, non-fluctuating signal with a broad-band spectrum is emitted throughout a space. Systems are designed to be invisible; if there are level fluctuations, or if there was tonality or other character, then the ear would be drawn to it and it would cause annoyance.

There is no international standard to define the spectrum or level of speech masking systems, but ASTM E1573-09 defines a methodology for determining the spatial and temporal uniformity of such systems.

Levels for speech masking systems are generally 45 to 48 dBA in open plan, 40 to 42 dBA in cellular spaces. Levels higher than these can lead to fatigue and draw attention to the system.

Emitters are either surface-mounted in ceilings or rafts (direct-field) or located above ceilings to create a diffuse 'wash' of sound (diffuse field).

4.2   Biophilic systems

There is some research into the use of natural sounds, specifically running water, for use as speech masking.

Abdalrahman and Galbrun[2] found that noise from a physical water feature at 3 dBA below irrelevant speech signal level had a beneficial and pleasant effect on speech masking.

Hongisto et al[2] carried out wider-based research into the use of water-based masking sounds (WBMS) and found concluded that WBMS were not suitable for a replacement of traditional pseudo-random signals. However, it should be noted that this study involved reproduced water sounds via a loudspeaker array, with some visual cues on television screens. Workers in the offices under test viewed dimly the disembodied water sounds, reporting that it sounded like someone had left the bath running upstairs.

The results of these two studies are in line with our own findings in Cundall offices. Our brains are incredibly complex and not easily fooled. If we can hear water but not see it, or vice versa, the result is not pleasant. We found the same when experimenting with virtual reality: replacing only one sensory stimulus is not sufficient to convince our brains that we are in a different reality. As we said above, our life experiences are multi-sensorial.

Reproduced water noise (rain, waterfalls, babbling brooks etc.) are contrived and have a tendency to increase people's frequency of toilet visits. However, the use of physical water features, with actual running water, is viewed more positively. Water features have the added benefits (in addition to visual and audio stimuli) that they emit coolth (acting as a heat sink) and help humidify the environment (beneficial in air conditioned spaces). We have set up a water feature in the context of a space which has lots of planting, natural untreated wood and birdsong being played over a loudspeaker system. This seems to hit the multi-sensorial sweet spot, with each of the sensory cues making sense and not seeming out of place. This is in a communal space but is open to the rest of the office, with birds being audible across the floorplate.

The water feature is not used for speech masking. But could it be? It is a 'water wall', which is a 1.8 m sheet of glass with water running down then being pumped back to the top from a reservoir at its base. To comply with landlord and insurance requirements it sits in its own tanked boxing which itself is on castors, therefore portable. If a number of such installations were placed around the office floor plate along with planting, to help divide team or zones, then they would act as physical barriers, and emit masking noise at source. This would not be speech masking in the traditional sense, with the sound not at an even level throughout, but would rather be biophilic havens distributed around the office.

5   THRIVING IN A POST-COVID WORLD

Thinking of all the user groups within an office, many tools are required to make it a welcoming and enabling space to not only different personality types, but also those who are neurodivergent.

As acousticians and office designers we are taught that distractions are the thing to be avoided at all costs. However, for the neurodivergent, positive distractions are an important method of coping with everyday life. How can we, as office designers, introduce positive distractions acoustically that not

only provide comfort and relief to the neurodivergent but also help everyone to be able to concentrate and collaborate.

What better to facilitate this than biophilic design with appropriate audio accompaniment? If we are looking for something that can positively distract, soothe, mask and enhance our experience in the office then we need look no further than nature.

We don't have all the answers yet. We are still in the phase of gradual return to the office, not even having reached equilibrium as to how many days are spent in the office vs at home. But, the offices we are designing now need to take into account what we knew already, what we have learnt over the last 18 months, and what we are still learning. The new normal is not the same as the old normal – it cannot be. So let's get creative and be willing to challenge some of our pre-conceptions. Offices are no longer just plain rectilinear spaces with rows of desks, white ceilings with recessed lighting offering uniform lux across the floor plate. Design has moved on, our knowledge has moved on, our needs have moved on.

Those of us involved in office design have a duty to design them to suit the needs of the users. To do this effectively we must get to know our clients, their needs and what helps them to be most effective at their jobs. One size does not fit all. An office has unenviable duty of being home to a variety of different people, all working together towards a common goal. Let's create some fantastic spaces that help people be their best.

6   REFERENCES

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