

Sensors | Wellbeing | IoT

# How intelligence from sensors is evolving our understanding of workplace productivity

Gilbert Lennox-King

Health and wellbeing in the workplace are becoming more important as increased bodies of evidence come to light about how the physical workplace affects our minds and bodies. COVID-19 has accelerated this evolution as occupants become acutely aware of the risks of infection and the value of being in an office is being re-evaluated. This article considers how sensors are evolving the workplace and what that means for workplace professionals.

## In sickness...

There is a growing body of research on how the indoor environment can affect performance and productivity. This research started back in the '80s with the rise of 'sick buildings syndrome,' and more recently it has been bolstered by studies such as Joseph Allen's book<sup>1</sup> on how indoor spaces can drive performance and productivity. In addition, there are several ways that workplaces specifically can affect people's health negatively.

Some of these effects can be easily measured, others less so. A ready-to-hand statistic is absenteeism (sick days). The average U.K. worker is absent from the office 4.4 days per year; this reality is influenced by being in a space that has poor air quality.



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This impact is followed closely by presenteeism<sup>ii</sup> – presence at work despite sickness. Presenteeism, as defined by researchers, isn't about malingering (pretending to be ill to avoid work duties) or goofing off on the job (surfing the Internet, say, when you should be preparing that report). The term refers to lost productivity because of real health problems.

Underlying the research on presenteeism is the assumption that employees do not take their jobs lightly, that most of them need and want to continue working if they can<sup>iii</sup>. 39% of employees and 57% of managers in Europe go to work even when they do not feel healthy. This behaviour encourages a cycle of sickness.

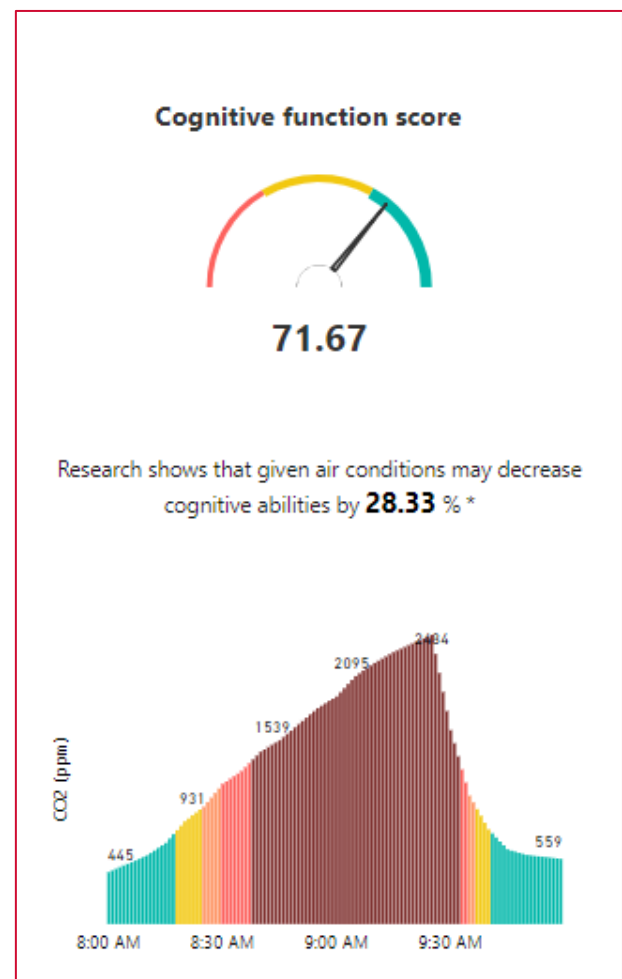
Likewise, it is interesting to consider this thought-provoking quote from scientist James Levine<sup>iv</sup> about sitting in your chair all day: "We lose two hours of life for every hour we sit". Combine all these factors together and it seems as though we should be re-evaluating the importance of health in our places of work.

## ...and in health

### CO2

Looking in more detail at the effect air quality can have on productivity, it is striking how high carbon dioxide (CO2) levels have a demonstrated negative effect on the brain's ability to think. Do you remember trying not to fall asleep in a long, crowded meeting room? This drowsiness is most likely due to a rise in CO2 levels. According to research published by Joseph Allen and Harvard University<sup>v</sup>, CO2 levels, which is a good proxy for the availability (or lack thereof) of fresh air, can have a huge effect on cognitive function. During the meeting described above a typical person's ability to think changes from functioning at 100% capacity to a 20% loss in cognitive function.

Figure 1: Cognitive function and CO2 levels in a meeting room from the Symbiosy platform



## Humidity

Of course, CO2 is not the only factor in good air quality. With relevance to our current COVID-19 times, cold, dry conditions can be particularly conducive to spreading viruses, as can extremely high humidity. This situation can be seen in Figure 2 below.

## Temperature

Our economy is built on brainpower; however, we often tend to think of our brains as somehow separate from our bodies, when of course, they are all part of a functioning internal ecosystem.

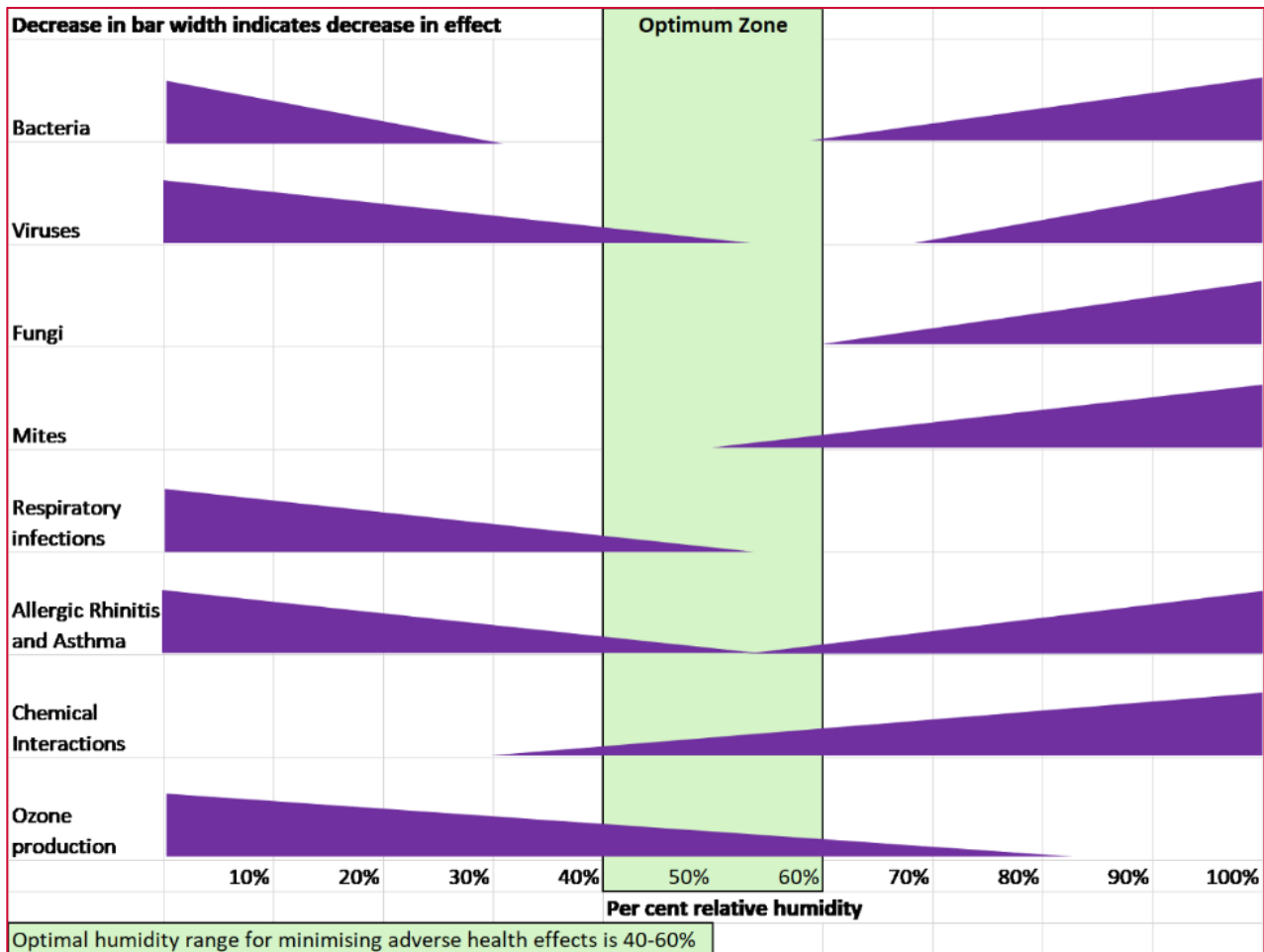


Figure 2: Optimal humidity range for minimising adverse health effects is 40-60% - Credit: Arundel, Sterling, et al.

The third factor affecting productivity with regards to the air around us in the office is temperature. Firstly, men in general prefer the office to be colder and women prefer the office to be warmer. The fact that most offices base their temperature settings around those that are ideal for men may be hampering the cognitive abilities of their female staff. Giving people the knowledge of where it is warmer and where it is cooler on the office floor may be a good start in helping to navigate these issues.



Figure 3: Who is getting frozen out of your office? Temperature in different zones / Image Credit: Symbiosy 3D model screenshot

Air quality includes several other factors beyond humidity, CO<sub>2</sub>, and temperature. Air filtration, pollutants such as particulates<sup>vi</sup> (e.g. PM<sub>2.5</sub>),<sup>1</sup> and Volatile Organic Compounds (VOCs)<sup>vii</sup> can also have considerable effects on staff health and productivity in the working environment<sup>viii</sup>.

Several initiatives have been developed to rate air quality in real time, including the RESET index, which is a data standard, accompanied by a set of assessment tools, created and managed by an organisation called GIGA to develop actionable, long term strategies towards health and sustainability for the built environment. Recently, the RESET index has been expanded to include the risk of viral transmission from aerosols. This expansion has been made possible by painstakingly translating laboratory science into an operational standard for air quality metrics that can be tracked by sensors - evaluating virus survivability, immune system impact, dosage (exposure over time), and final infection rates.

The company I work for, Symbiosy / HB Reavis company, is piloting the RESET index and using the data gained to create user-centric smart spaces that nurture wellbeing, productivity, and, most importantly, health.

<sup>1</sup> According to the US Environment Protection Agency, PM<sub>2.5</sub> describes fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller.

## Sound

Alongside air quality, other factors affecting the quality of a workplace must also be considered. Sound can be a huge distraction to those trying to do focused work, particularly in open plan offices. A study reported in the Harvard Business Review<sup>ix</sup> found that face-to-face interactions **dropped** by 70% when an office transitioned to open plan. The reason? People did not want to disturb others on the open floor. The same study also found that face-to-face interaction was directly proportionate to an individual's proximity to peers.

## Engagement

According to Gallup<sup>x</sup>, engaged employees make it a point to show up to work and do more work; highly engaged business units realize a 41% reduction in absenteeism and a 17% increase in productivity. Highly engaged business units achieve a 10% increase in customer ratings and a 20% increase in sales.

## The commute

On top of all of the above factors, there is the commute to and from work, which wastes a huge amount of time (40 minutes global average to 80 minutes per day in London)<sup>xi</sup>; and the pollution faced during that commute can be a major health hazard, not just short term with COVID-19, but long-term with pollutants affecting our respiratory systems and hearts.

## **The important question now is: 'How does the office drive business value, and can sensors prove it?'**

COVID-19 has illustrated that the ball now sits firmly with landlords for action. Occupiers must be wooed back to the office, as occupiers have proved that they can, for the most part, manage many of their office-based duties working from home.

The recent Leesman index home working survey<sup>xii</sup> across over 10,000 people, concluded that most people believed that their home productivity score was on a similar level to what they would define as a high performing workplace.

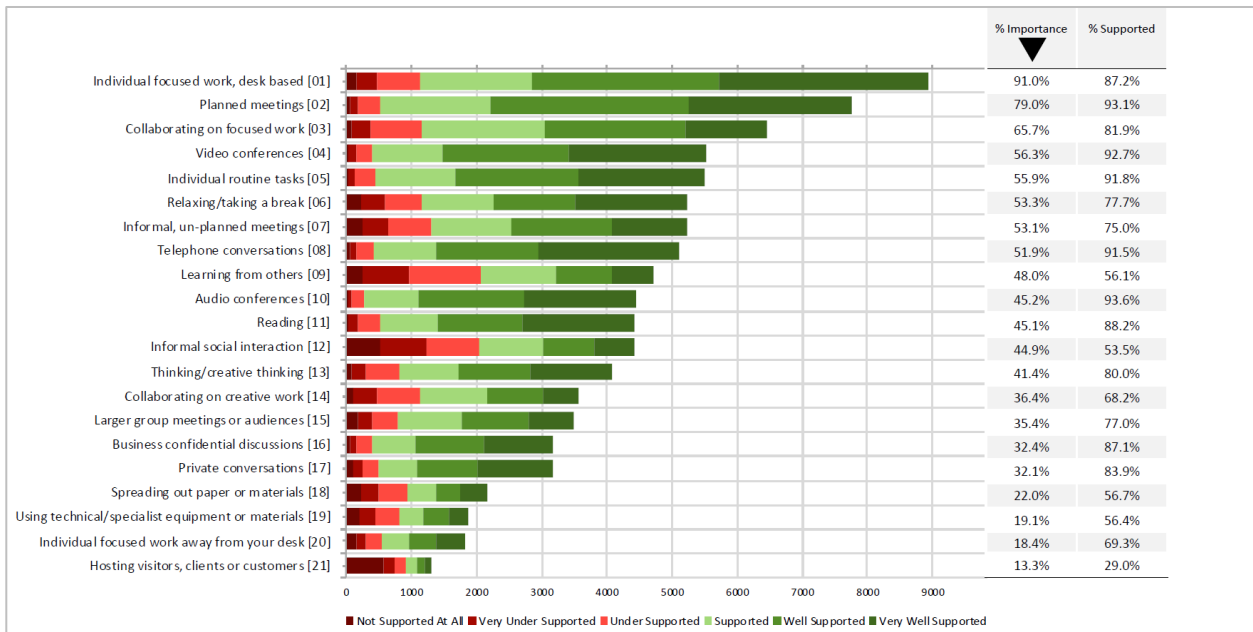


Figure 4: Work activities importance and support / Image credit: Leesman

## Sensors, sensors everywhere

Allowing for inflation, the cost of a sensor is approximately 30% of what it was 15 years ago, and the cost is decreasing all the time.

From a 'Working from Home' perspective, many people have invested in home air quality sensors such as the AWAIR or Netatmo sensors that show what their home workplace environment is providing to their bodies. People can easily monitor their air, steps, and hearts, stress levels, and health through fitness monitors.

Putting this information in context, it is reasonable to expect that occupiers will demand this same transparency from their office workplace in respect to air quality levels, humidity, and temperature levels. It would only need a few people per office to complain that they don't have the same transparency into air quality as they do at home, and there is nothing to stop employees bringing these same portable battery powered air sensors into the office and testing their work environment themselves. With the COVID-19 risk still present, doesn't this seem sensible? Would this experience force landlords and employers to quickly default to transparency?

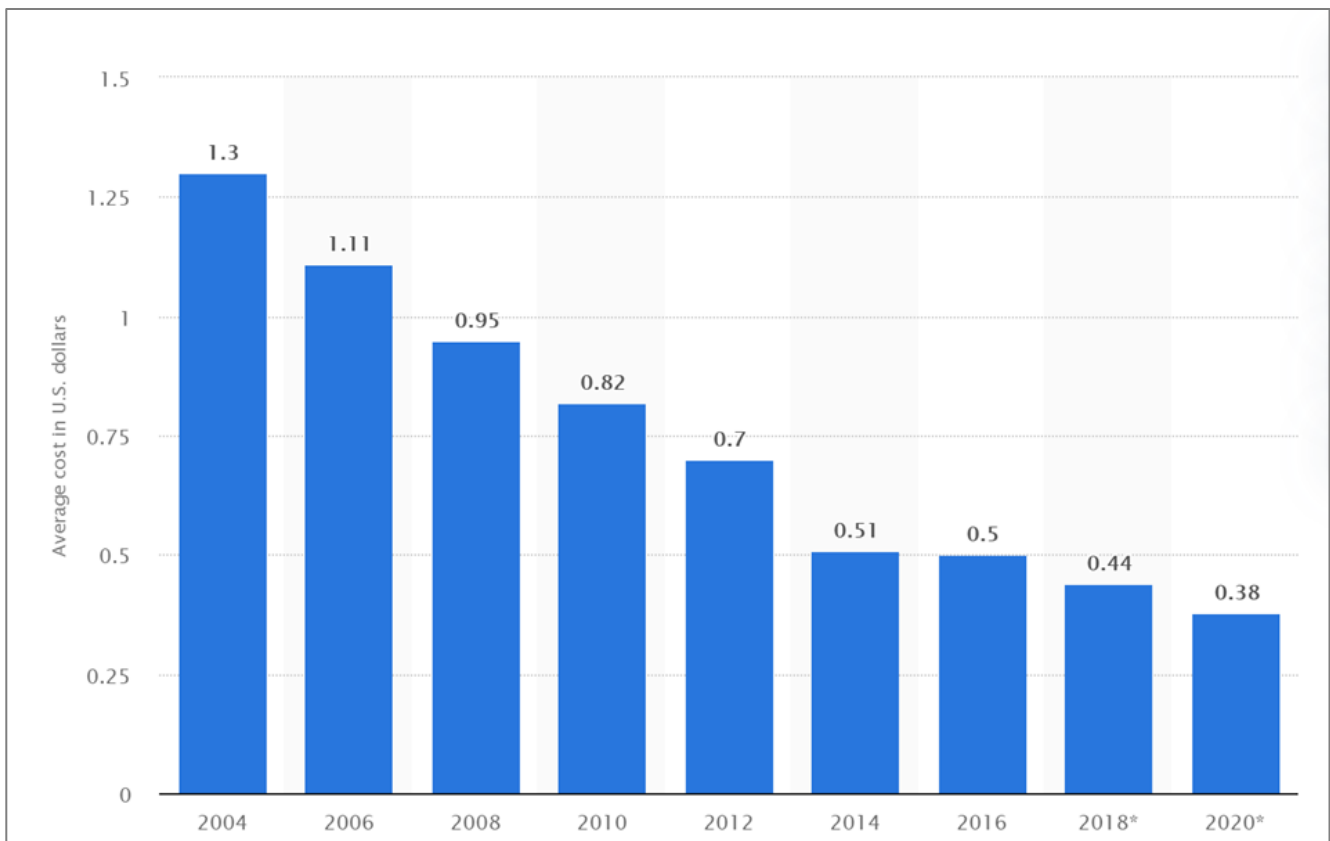


Figure 5: The average cost of industrial internet of things (IOT) sensors from 2004 to 2020 / Image credit: Statista.com<sup>xiii</sup>

Absenteeism will be significantly reduced as people will demand good air quality in their workplace. Presenteeism will be undoubtedly reduced as the ‘face time’ need to be in the office will surely be reduced. Simply put, if you can prove that your home environment is healthier, why go into the office? There is a large (and growing) number of companies who have said that coming back to the office is optional for the foreseeable future (i.e. Google, Airbnb, Microsoft, Twitter, Github).<sup>xiv</sup>

Ultimately, the reason why sensors are valuable is that they provide live feedback loops on how the space is providing environmental conditions, how people are using what type of spaces, and how people are interacting with each other physically. The question that must be answered, with perhaps more urgency than ever for landlords, is, **so what for my occupier’s business?** Occupiers urgently need to know when they come into the office from a business-as-usual standpoint – are they maintaining social distancing standards? How can they protect their business from an outbreak? Does our office layout create hotspots? How many people can we safely increase density to? Where are the least crowded areas? When are the best times to go to the office? When was the office last cleaned? And a host of other questions. These will need to be provided in order to transition back to a normal office scenario.

These points only start to tackle the big question: Why go back to the office at all?

## Show me the money: Collaboration

*"What they need to go to an office for is ... spaces and places that catalyze human skills."* – @antonyslumbers, Twitter.

Collaboration in a physical environment has long been hailed as the irreplaceable element that means that the office will never be substituted for by remote working. Yet, many organizations have been collaborating 'online' for months now with apparently little effect on productivity. This experience challenges the very premise of that assumption.

Where sensors need to evolve, and what needs to happen for landlords to keep pace with tenant requirements, is for spaces to prove that they are providing more business value than they cost. The average central London rent per employee is approximately 15,000 GBP per year.<sup>xv</sup> Businesses are emerging from lockdown, completely re-evaluating their real estate spend, and asking questions that would have been ludicrous only months ago: Should we ditch the office altogether? How much of that office spend do we really need?

Workplace technology can effectively streamline organizational processes during lockdown, for example, by using real-time location systems. Using data from such devices we can understand how departments and teams interact within the workplace.

How is this useful? As a senior manager, imagine how, if you could see how teams interact within a space over time, you could arrange physical meetings in situations where links between departments were weakening. Imagine then, that you could also have departmental information for digital interactions. For an example of this technology, see Microsoft workplace analytics<sup>xvi</sup>.

You could compare how your company interacts physically pre lockdown and post lockdown (completely digitally). Having this data, you could now have a much clearer view of what lockdown has done to your company. Increased silos and a smaller network with fewer to no incidental interactions seem to be the first indications from early data.



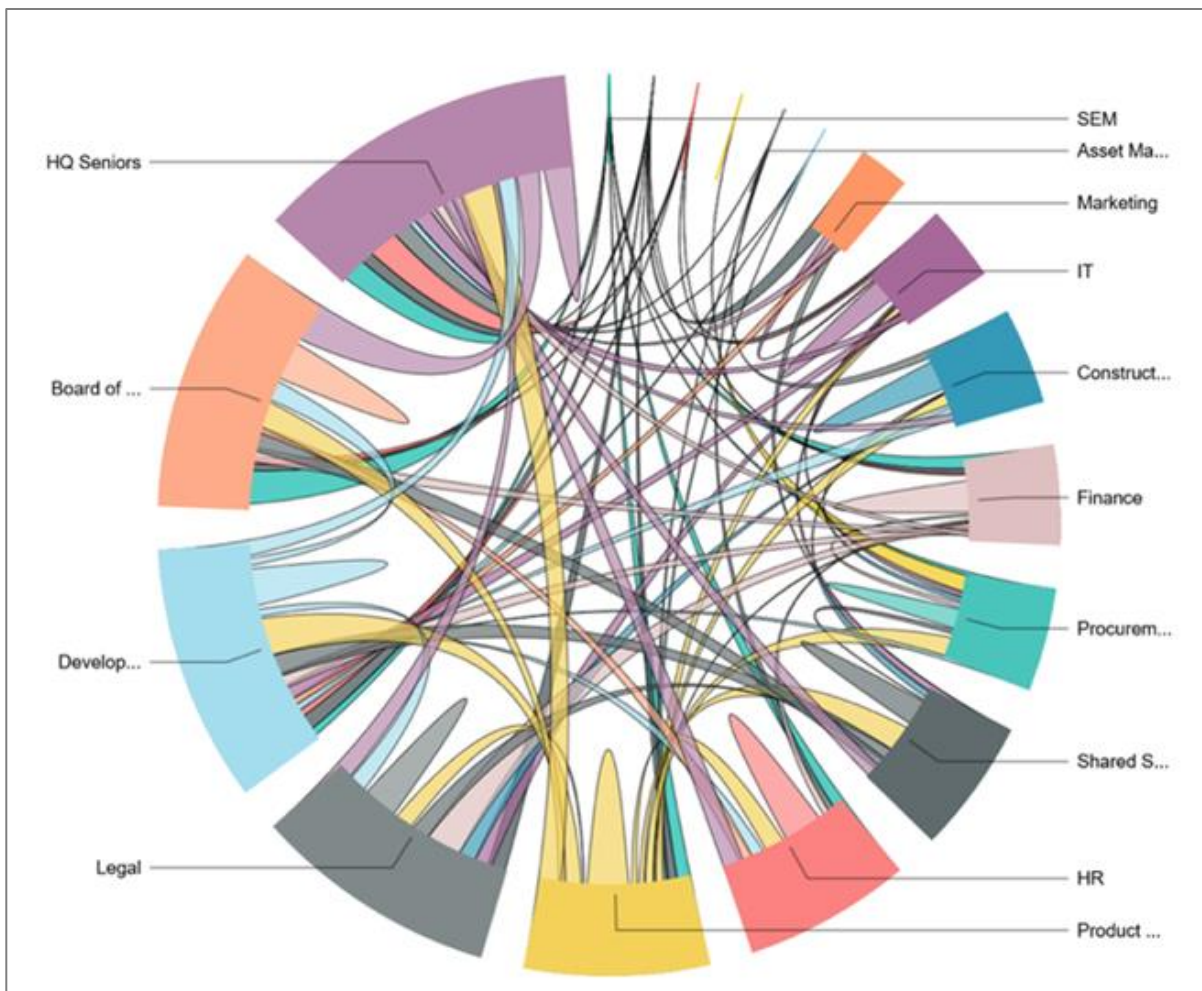


Figure 6: Physical collaborative networks within an organisation, made possible using real time location sensors

## Bringing it all together

In the typical office environment, there are many systems working together to control the indoor environment. Now add to this capability to control the physical environment an indoor positioning system connected to a dynamic interface that the user interacts with, that delivers way-finding functionality and is connected to room or desk booking. Then imagine that all these features are personalised and contextualised to your phone by an app that is designed to optimise your ‘experience’ across the whole of the working day.

You could even imagine a system that ensured you personally kept interactions between certain people and departments strong. Now add to these ‘curated positive connections’ a further ability to integrate digital interactions into your personal analytics profile. Based on that profile, the system might prompt you to interact with others in – shall we say - a more productive manner.

It is at this point that you can start to imagine how technology could evolve the workplace experience to meet the needs of a more connected workforce – across both physical and virtual worlds. You would have a workplace experience bolstered by technology that contributes to daily wellness, and one that has evolved to a point that it helps you understand what going into an office represents in terms of your workplace productivity.

## How do you make the most of these trends in your career?

A bright future awaits those who embrace sensors and their evolution in the future of workplace design and operations. There will be a huge demand for individuals who understand what technology should be used now, and what to specify in the future. This can be seen in an increase in demand for WELL and RESET AP practitioners as well as a host of other qualifications such as the Real Innovation Academy course run by Dror Poleg and Antony Slumbers that can help real estate executives navigate how best to exploit the intelligence derived from such sensors, both from a landlord and a corporate occupier perspective.

Rachel Gutter, President of the WELL building institute, recently said that there has been an incredible increase in WELL AP enrolments and requests for WELL rated buildings and that WELL AP practitioners have reported a huge surge in requests for proposals<sup>xvii</sup>. Combine these perspectives with the recent report by Cognizant<sup>xviii</sup> on their Jobs of the Future career index showing that there has been a 208% annual increase in demand for fitness and wellness jobs, and the future looks bright for anyone embarking on a career in this area.

The ability to harness the technology available could create an unprecedented opportunity to boost the productivity of our workplaces and ensure that the office you have invested in adds considerable value to your business.


## The Author

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**Gilbert Lennox-King:** *Gilbert is Sales Director leading UK & Western Europe activities for HB Reavis' own technology platform, Symbiosy. Symbiosy is designed to enable excellent workspace management, boost cooperation and productivity. Gilbert previously co-founded Hong Kong based energy efficiency consultancy, Energenz Consulting, and has worked for over 10 years with building technology companies.*

 [www.symbiosy.com](http://www.symbiosy.com)

 <https://www.linkedin.com/in/gilbert-lennox-king-b7948521/>

<sup>i</sup> Healthy Buildings. Allen, Joseph G. and Macomber, John D. Harvard University Press, 2020)

<sup>iii</sup> <https://hbr.org/2004/10/presenteeism-at-work-but-out-of-it>

<sup>iv</sup> <https://www.latimes.com/science/sciencenow/la-sci-sn-get-up-20140731-story.html>

<sup>v</sup> Allen and Macomber, *op. cit.*

<sup>vi</sup> [https://en.wikipedia.org/wiki/Particulates#Size,\\_shape\\_and\\_solubility\\_matter](https://en.wikipedia.org/wiki/Particulates#Size,_shape_and_solubility_matter)

<sup>vii</sup> [https://en.wikipedia.org/wiki/Volatile\\_organic\\_compound](https://en.wikipedia.org/wiki/Volatile_organic_compound)

<sup>viii</sup> Allen, J. G. et al., 2015. "Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments." *Environmental Health Perspectives* 124 (6): 805-812.

<sup>ix</sup> Open plan offices and sound: <https://hbr.org/2019/11/the-truth-about-open-offices>

<sup>x</sup> <https://www.gallup.com/workplace/231602/right-culture-not-employee-satisfaction.aspx>

<sup>xi</sup> <https://www.independent.co.uk/life-style/health-and-families/healthy-living/air-pollution-environment-health-london-commute-a8423216.html> and <https://www.gensler.com/research-insight/blog/how-should-office-buildings-change-in-a-post-pandemic-world>

<sup>xii</sup> The impact of home working on employee experience, Leesman, 2020

<sup>xiii</sup> <https://www.statista.com/statistics/682846/vr-tethered-hmd-average-selling-price/>

<sup>xiv</sup> List of companies that have said remote working can continue indefinitely: <https://www.businessinsider.com/companies-asking-employees-to-work-from-home-due-to-coronavirus-2020?r=US&IR=T#uber-told-employees-that-they-could-work-from-home-through-june-2021-on-august-4-employees-will-also-receive-a-500-stipend-to-set-up-a-home-office-7>

<sup>xv</sup> <https://hubblehq.com/blog/how-much-office-space-do-i-need>

<sup>xvi</sup> <https://www.microsoft.com/microsoft-365/partners/workplaceanalytics>

<sup>xvii</sup> 'How to build and market healthy buildings' webinar, 1st July 2020

<sup>xviii</sup> The career index – Cognizant 208% annual increase in their fitness and wellness category  
<https://www.cognizant.com/jobs-of-the-future-index>

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