

BUROHAPPOLD  
ENGINEERING

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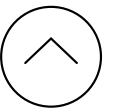
# Introduction

Is there a relationship between surroundings and performance? What is it that makes an environment conducive to learning? How can university leaders use this information to enhance their existing property portfolio? What do students really want from their university estates?

BuroHappold Engineering is researching the role university estates play in the business of higher education and the academic experience. Our ongoing study gathers together the views of vice-chancellors, estates professionals and students, to identify and address a number of key topics. This, the second paper in the series, examines how improving the internal environment of university buildings can boost an institution's appeal to students and staff in ever more competitive times.



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Director and Head of Education Sector, BuroHappold Engineering





IT'S WHAT'S INSIDE THAT COUNTS





# It's what's inside that counts

In today's uncertain academic climate, UK universities are facing increasing competition from overseas institutions. Because of this, it is easy to understand why the higher education leaders we spoke to in our survey rated the 'student experience' as their highest priority, with 'improving learning outcomes' in second place.

As the university estate plays a key role in delivering both these outcomes, are there any measures managers could take to better align existing facilities with students' educational and social needs? We thought the best people to ask were the students themselves:

“

*I would improve the buildings by incorporating more open plan areas, and make sure there is a good amount of natural light available.”*

“

*The university should consider the actual practicality of the facility. It would be wise to have the students who use it propose ways to improve the efficiency of a building.”*

“

*I find it ironic that the studio for the Sustainable Environmental Design programme has the lowest EPC rating on campus.”*

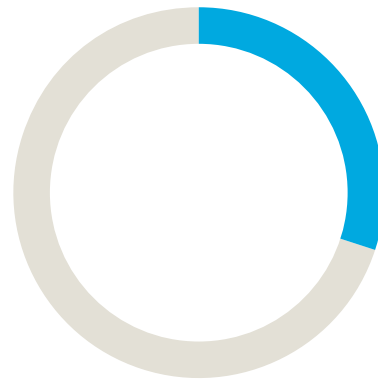
“

*I would bring in a consultant that could advise on user experience. For example, many spaces have nearly no natural light, and I've seen huge blocks in movement caused by people waiting for class outside.”*



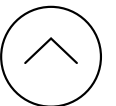
These statements reinforce our findings over the course of this study – that students feel the quality of the internal environments of university buildings has a marked effect on both their learning outcomes and overall experience. We've learnt that they value spaces that are inspirational, innovative, adaptable and comfortable. Yet when estate directors and vice chancellors were asked if their estates met these criteria, only 30% agreed that the spaces within their buildings were adaptable, and less than a quarter (23%) believed they were innovative.

Comparing these responses, it becomes clear that there is a distinct gap between what is valued by students and what is currently provided by most universities. This paper offers a response to this issue, investigating how higher education leaders can implement changes to their estate that will improve the internal environment for students and staff.



Only  
**30%**

of vice-chancellors and estate professionals agreed that the spaces within their buildings were adaptable.



# ENVIRONMENT FOR LEARNING



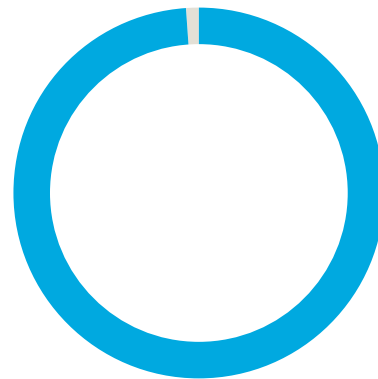
# Environments for learning

## QUIET ACHIEVERS

Disruptive background noise can cause a 66% drop in concentration.

In 1998, researchers Banbury and Berry found that different types of background noise can cause a drop in performance of up to 66%. Another study, conducted by the same researchers in 2005, found that 99% of people reported impaired concentration when subjected to background noise.

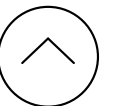
If we apply these findings to a classroom or lecture theatre environment, it follows that the reduction or elimination of such distractions would enable students and lecturers to concentrate with greater intensity for longer periods. This in turn should lead to greater subject absorption and higher grades among students, directly improving their learning outcomes.



# 99%

of people reported impaired concentration when subjected to background noise.

Banbury and Berry





## LOOK ON THE BRIGHT SIDE

*“Higher ceilings, more sunshine!”*

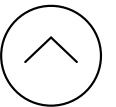
This plea from one of the respondents to our survey echoed a general feeling among students that daylight was an essential component to a space that is conducive to work in. And their feelings are backed up by scientific research, which has proven that learning outcomes are significantly improved by increased exposure to natural light.

In 1999, the Heschong Mahone Group demonstrated that increasing daylight in educational environments resulted in 20–26% faster learning rates, and in turn 7–18% higher test scores. So, simple measures such as enlarging windows in classrooms, lecture theatres, libraries and laboratories could have a very real effect on grades and pass rates in UK universities.



Increasing daylight in educational environments resulted in

**20–26%**  
faster learning rates



One of our most successful commercial projects, the Genzyme Headquarters provides tangible proof of the positive effect of daylight on productivity and output.

This mixed-use space includes offices, a cafeteria, a library, training rooms and a conference centre, all of which we illuminated with natural light using solar-tracking mirrors. With over a decade of successful operation, the building has stood the test of time, with a recent post occupancy evaluation demonstrating that this intervention alone has improved staff productivity to such an extent as to add almost £3.5 million in annual value to the business.





Image: Anton Grassl



## BAD AIR DAY

Good air quality can reduce sick leave by up to 35%.

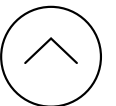
The relationship between air quality, productivity and health is another area of particular importance for higher education leaders evaluating how they can improve learning outcomes and overall experience for their students. A study by Park and Yoon (2011), found that increasing ventilation from 5l/s to 20l/s improves performance by 8%. This was also the subject of a 2000 study by Milton *et al.*, who discovered that increasing ventilation from 12l/s to 24l/s reduces sick leave by 35%.

To ascertain the impact of this research on UK institutions, we combined these findings with Higher Education Statistics Agency records that indicate there are currently 2.2 million students in UK universities (1.7m undergraduate, 500,000

postgraduate), and PwC's 2013 figures that show the national average absence due to sick leave is 9.1 days. By assuming that is also representative of student sick leave across the HE sector, an improvement of 35% (or 3 sick days per student), would regain over 5 million study days for undergraduate students and 1.6 million days of postgraduate research each year.

Even after dividing that total between the 130 universities that currently exist in the UK, the implications are dramatic. Estimating an 'average' of 115,000 undergraduates at each institution, three fewer days of sick leave would mean an additional 345,000 study days a year. This presents a clear opportunity for higher education leaders to improve learning outcomes for their students by reducing incidence of illness caused by poor ventilation.

2013 figures that show the national average absence due to sick leave is 9.1 days





## **Dennis Sciama Building, Institute of Cosmology and Gravitation, University of Portsmouth UK**

### A lesson in sustainable design

This project provides a good example of how installing a low energy, yet highly efficient ventilation system can improve the interior environment of a building for users. The Dennis Sciama Building is designed around a central atrium, which promotes connectivity between students, staff and departments. As all learning and social spaces radiate from this core, we installed a stack ventilation system there which delivers optimum levels of natural ventilation to the adjoining areas.





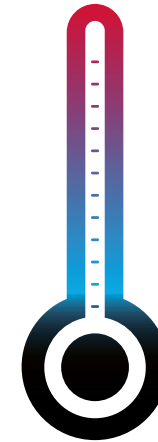
Image: Will Pryce

## BEAT THE HEAT

Over half of the students we spoke to (56%) felt that the internal comfort of their university buildings was difficult to control, while only 11% were 'very satisfied' with interior temperatures. But is this finding important? Does temperature affect performance?

Recent research shows clear links between temperature and achievement. In 2006, Wargorcki and Seppanen found that an increase in temperature from 19°C to 20°C boosted output by 0.9%, and a decrease from 30°C to 21.75°C resulted in an improvement of 8.9%. In a similar vein, Loftness *et al.* (2013) discovered that having personal control over workspace temperature gained 3% in overall productivity.

When taken in isolation, these figures may seem fairly inconsequential. But when considered alongside the findings detailed throughout this paper as a whole, we can see a clear relationship between personal comfort – arising from a combination of thermal control, good ventilation, balanced acoustics and plenty of daylight – and individual performance.

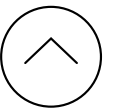


A decrease in temperature  
from 30°C to 21.75°C  
improves output

8.9%

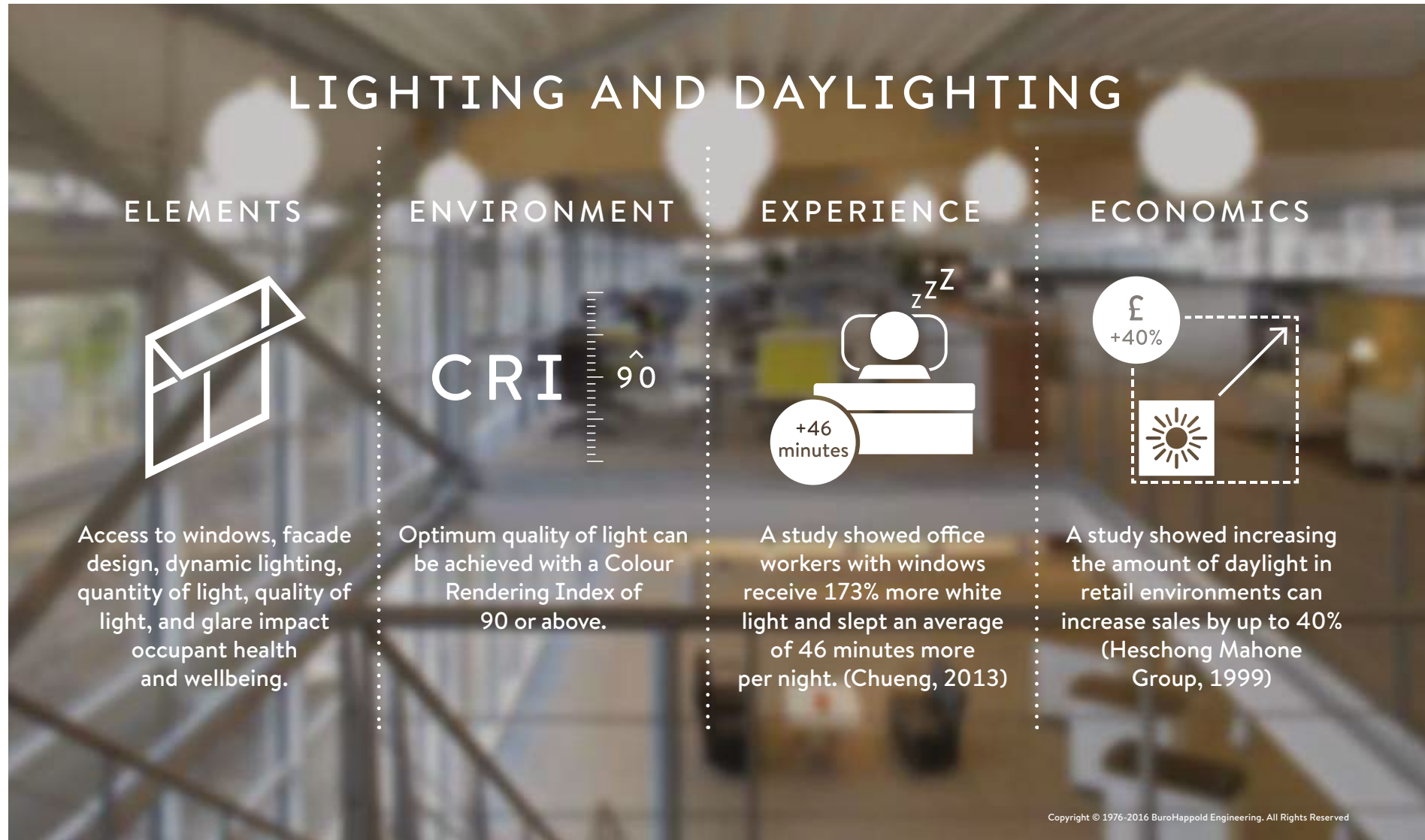


Infographic showing health, wellbeing and productivity key facts – thermal comfort.





Infographic showing health, wellbeing and productivity key facts – lighting and daylighting.



Infographic showing health, wellbeing and productivity key facts – acoustics.



Infographic showing health, wellbeing and productivity key facts – air quality.



KEEP CALM AND CARRY ON

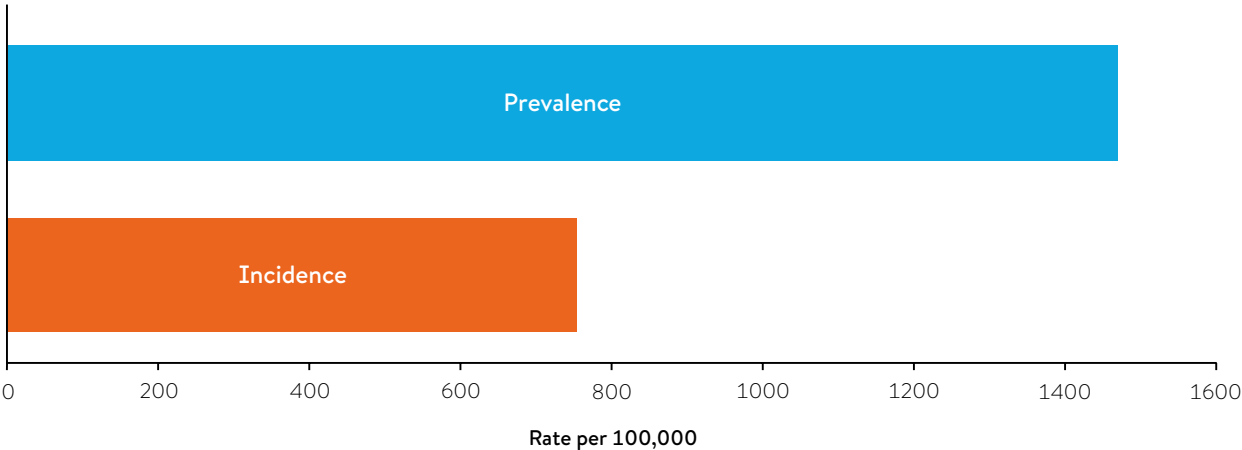
Enhancing the internal environment of buildings across the university estate would also significantly improve the wellbeing of academic staff. This benefit becomes of utmost importance when considered alongside statistics from the Health and Safety Executive (HSE), which show that incidents of stress, depression and anxiety in higher education leaders are the fourth highest of any profession in the UK (see Table 1 below right).

When combined with research undertaken by Briner and Dewberry in 2007, which presents a statistically significant link between job satisfaction and performance, it is easy to see how poor staff health and the subsequent use of supply teachers could have a knock on effect to the learning outcomes of university students. A recent report

by Estyn (2013) suggests a number of reasons for this, including supply teachers not knowing the needs and abilities of students, and having insufficient time to develop the meaningful relationships required to identify where their strengths and weaknesses lie. Continuity of teaching throughout the academic year is vital to students, so the health of staff should be a key consideration for university management teams.

**Table 1**  
Estimated prevalence and incidence rates of self-reported stress, depression or anxiety caused or made worse by work, for people working in the last 12 months.  
Averaged from 2011/12, 2013/14 and 2014/15.

Source: Labour Force Survey (LFS).  
Note: no ill health data collected in 2002/03 and 2012/13.  
Available online: [www.hse.gov.uk/statistics/causdis/stress/stress.pdf](http://www.hse.gov.uk/statistics/causdis/stress/stress.pdf)





## SUMMARY

Over the course of this paper, we've seen how higher education leaders could reap significant rewards by making small changes to the buildings on their university estate. Better noise control, increased daylighting, and enhanced ventilation would create a far happier and healthier academic community, and in turn meet managers' key priorities of improving both the student experience and learning outcomes.

Higher education leaders could reap significant rewards by making small changes to the buildings on their university estate.



TALK TO US



Across all sectors, BuroHappold has a proven track record of adding value to our clients' existing assets using simple and cost effective solutions. If you'd like to know how we can help you improve your university's estate, please contact:

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## RELATED PROJECTS:

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[Faculty of Music, University of Cambridge](#)

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[Michael Uren Building, Imperial College London](#)

[Graduate Centre, Queen Mary University of London](#)

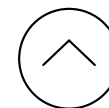
[Newcastle University Urban Sciences Building](#)

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Page 22 skynesher





## Dr. Mike Entwisle

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### Director and Head of Education Sector, BuroHappold Engineering

Mike graduated from the University of Cambridge with a double first, and returned to gain a PhD in materials science. This fledgling research career was soon overtaken by his long-term interest in building and the environment, and his keenness to apply his first principles thinking to an industry with more immediate results and benefits.

After developing an intensely customer focused approach across a wide range of cultural, education and heritage building projects, he joined BuroHappold in 2001.

Since then, Mike has specialised in sustainable and education projects. These include working with universities in Cambridge, Oxford, Bath, London, Portsmouth and Exeter, as well as projects in over

twenty schools – such as developing a new campus for Doha College in Qatar, and improving sports and science facilities at Harrow.

Mike provides a unique combination of high-level design and pragmatism on each project, and is always focused on achieving the best output for the client. He advises government and other bodies regarding policy and guidance issues, speaks regularly at conferences, and is a board member of the UK Higher Education Design Quality Forum and was a contributor to their recent book 'Future Campus' published in association with the Royal Institute of British Architects.





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# This project is likely to be replaced

## City of Westminster College London, UK

### Inspiring educational spaces

A key part of the success of this project was our treatment of the acoustics. The new college building revolves around a vast, central atrium, which interconnects directly with teaching and study spaces to create a cohesive academic community. The potential problem with this design was that noise from the busy hub could easily overwhelm the surrounding libraries and classrooms. To prevent this, our engineers responded with local solutions that were specifically crafted for each different environment, resulting in excellent aural experiences across the complex.







Image: Adam Monk



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