



SONITUS
SYSTEMS

Environmental Monitoring for Healthier Spaces

Sound decisions: building insight from
acoustic measurements

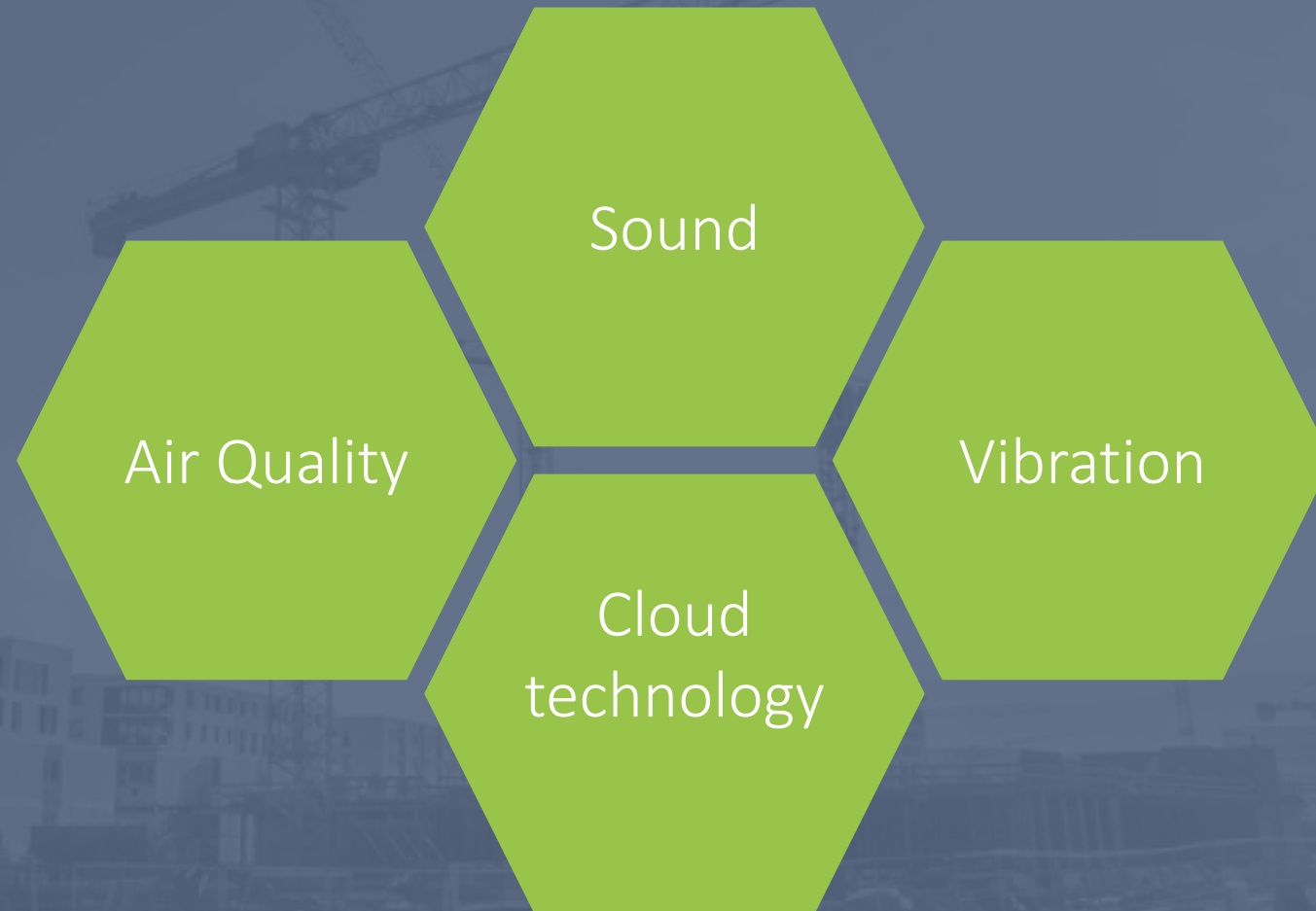
Sonitus Systems – What we're all about

Creating better
environments for people
to live and work

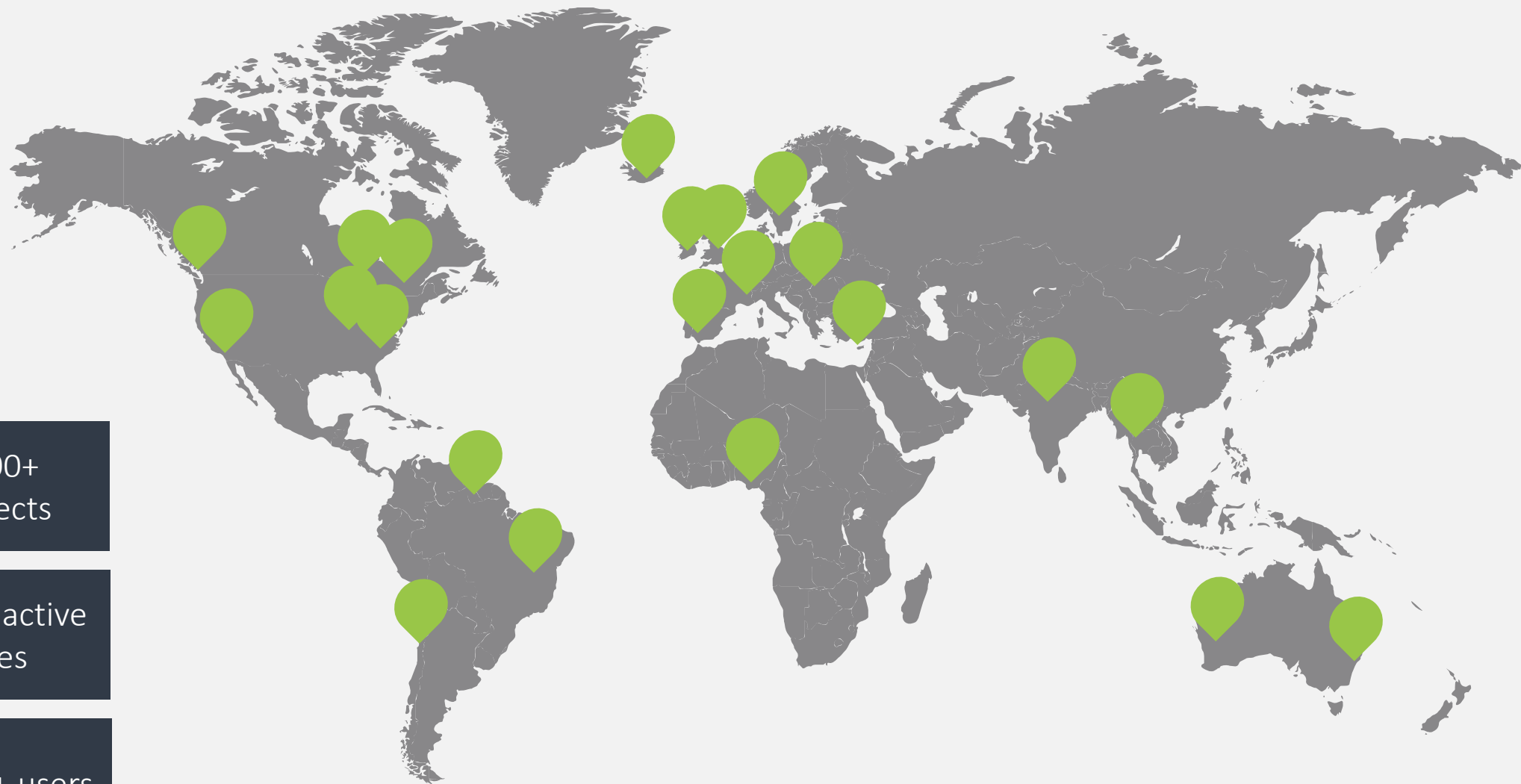
VISION

Protecting people and property in their living and working environments.
Sonitus Systems enables customers to make better decisions through insightful
analytics, deep understanding and trustworthy products.

MISSION



International reach



5600+
projects

5000+ active
sites

11000+ users

3 key pillars

Instrumentation
you can trust

Information you
can act on

Experts you can
talk to

Core applications



Construction

Save time and cost on
environmental checks



Manufacturing

Automatic compliance
with environmental laws
and limits



Smart Cities

Information for better
decisions



Smart Buildings

Monitoring for healthier
spaces

Sound in the built environment



Smart
Buildings

Wellbeing

Productivity

Optimised spaces

Workplace experience

Soundscape as part of the built environment

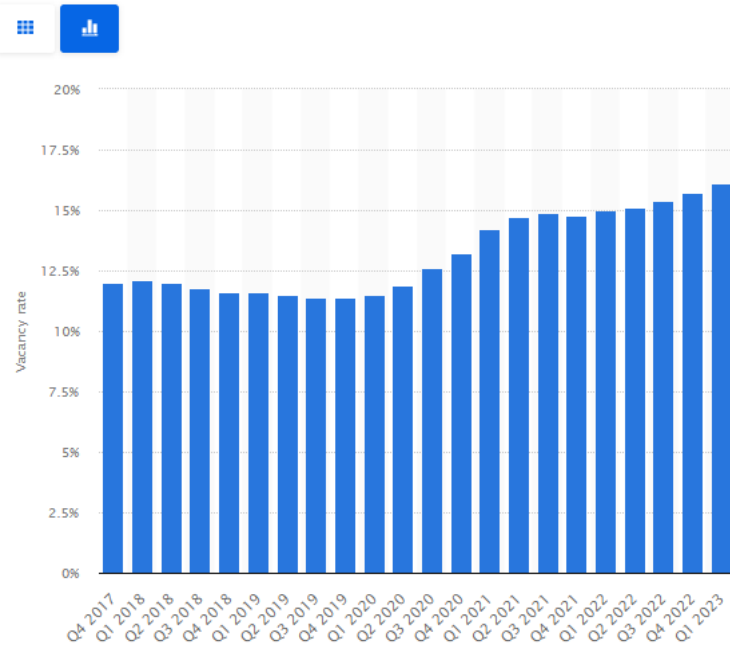
Commercial Real Estate Trends

Vacancy

Occupancy

Utilization & flex space

Quarterly office vacancy rates in the United States from 4th quarter 2017 to 1st quarter 2023



Sections

THE IRISH TIMES

17°

Subscribe

Sign

Business

Vacancy rate in Dublin office market likely to peak at 15% this year

Instead of seeking out tricks to make the numbers look healthier, analysts should focus on the fact that this downturn will be neither deep nor prolonged

Expand



Noise is one of the top complaints in
open office environments

Sound as a driver of behaviour

THE CONVERSATION

Academic rigour, journalistic flair

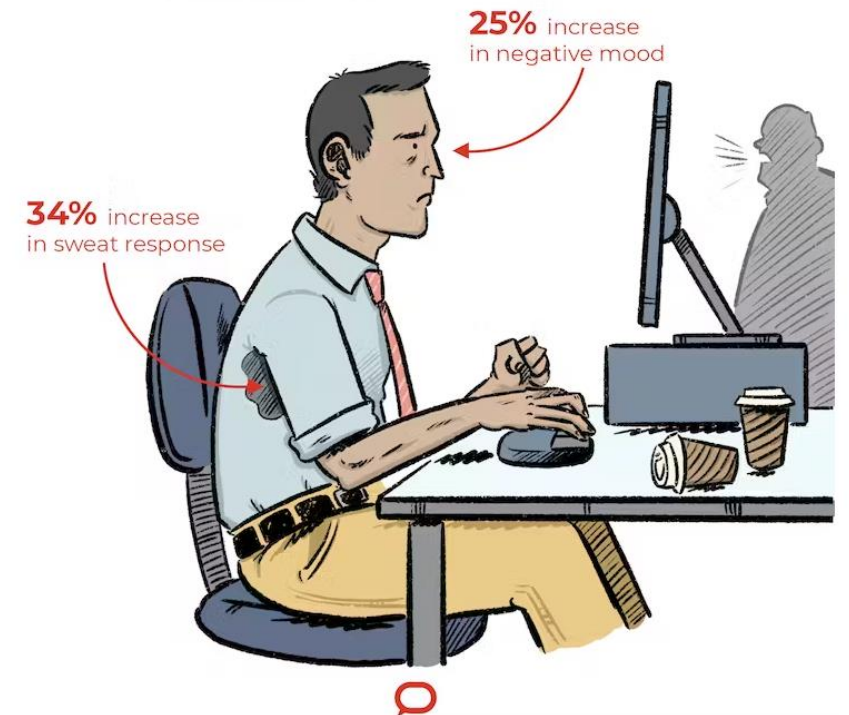


Open-plan office noise increases stress and worsens mood: we've measured the effects

Published: July 4, 2021 10:10pm CEST

What impact does open-office noise have?

Heart rate, skin conductivity and facial recognition response to 8 minutes of simulated open-office noise.



The Conversation, CC BY-ND

Sound as a driver of behaviour

Office-related tasks are highly affected by speech and office noise. In a study, researchers experienced a drop in performance by 66% in 'memory for prose' tasks when participants were exposed to different types of background noises. About 99% of the people surveyed in an experiment reported on their concentration being impaired by office sounds such as unanswered phones and background speech [71]. Both internal noise and external noise affect occupant's performance and leads to stress and anxiety and possibly creating long term health issues for occupants.

The Effects of Cell Phone Conversations on the Attention and Memory of Bystanders

Veronica V. Galván^{1*}, Rosa S. Vessal¹, Matthew T. Golley²

¹ Department of Psychological Sciences, College of Arts and Sciences, University of San Diego, San Diego, California, United States of America, ² Department of Liberal Arts, D'Youville College, Buffalo, New York, United States of America

Overheard cell-phone conversations: when less speech is more distracting

Lauren L Emberson¹, Gary Lupyan, Michael H Goldstein,

Why Are Background Telephone Conversations Distracting?

J. Marsh, Robert Ljung, +4 authors F. Vachon • Published 1 June 2018 • Psychology •

Journal of Experimental Psychology: Applied

Building and Environment 105 (2016) 369–389



ELSEVIER

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journal homepage: www.elsevier.com/locate/buildenv



Occupant productivity and office indoor environment quality: A review of the literature



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Does background sounds distort concentration and verbal reasoning performance in open-plan office?

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Department of Construction Management and Real Estate, School of Economics and Management, Tongji University, China



Noise is one of the top complaints in hospitals

A soundscape is the acoustic environment as perceived by humans, in context.

Common challenges

I want to see the noise levels throughout the day when a space is occupied

I want to understand the acoustics of a space – is it too loud or too quiet?

I want to understand noise transmission throughout a space

I want to quantify noise intrusion from one space to another

I want to control audio / sound / music within the space

How do we address these challenges with sound sensing?

Sound level trends to
understand activity

FIRST STAGE: OUT OF THE BOX

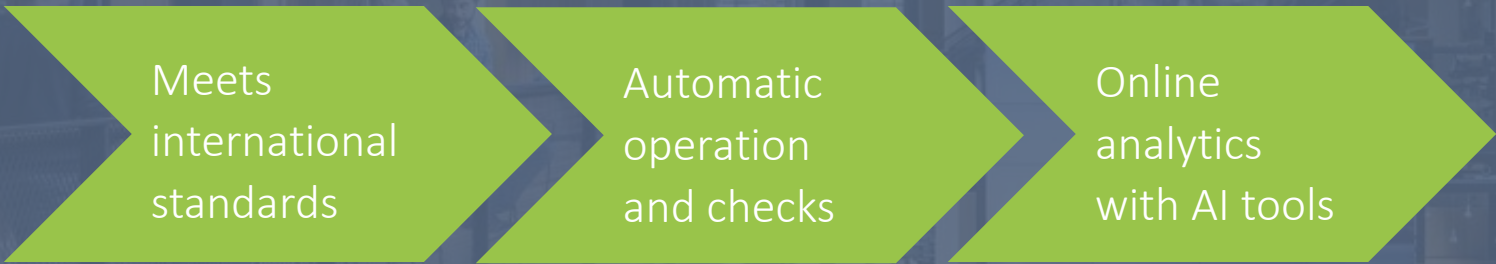
Architectural
acoustics to
understand usage of
space

SECOND STAGE

Psychoacoustics and
workplace
productivity metrics

DEEP DIVE INTO USER GOALS

Automated Environmental Monitoring



Accurate and reliable
sound levels and key
acoustic metrics

DEVICE DESIGNED FOR PURPOSE

Acoustic analysis at the edge and in the cloud

CUSTOM ANALYSIS SOFTWARE

Average number of days per month that the temperature is below 60°F in Madison, Wisconsin, from 1981 to 2010.

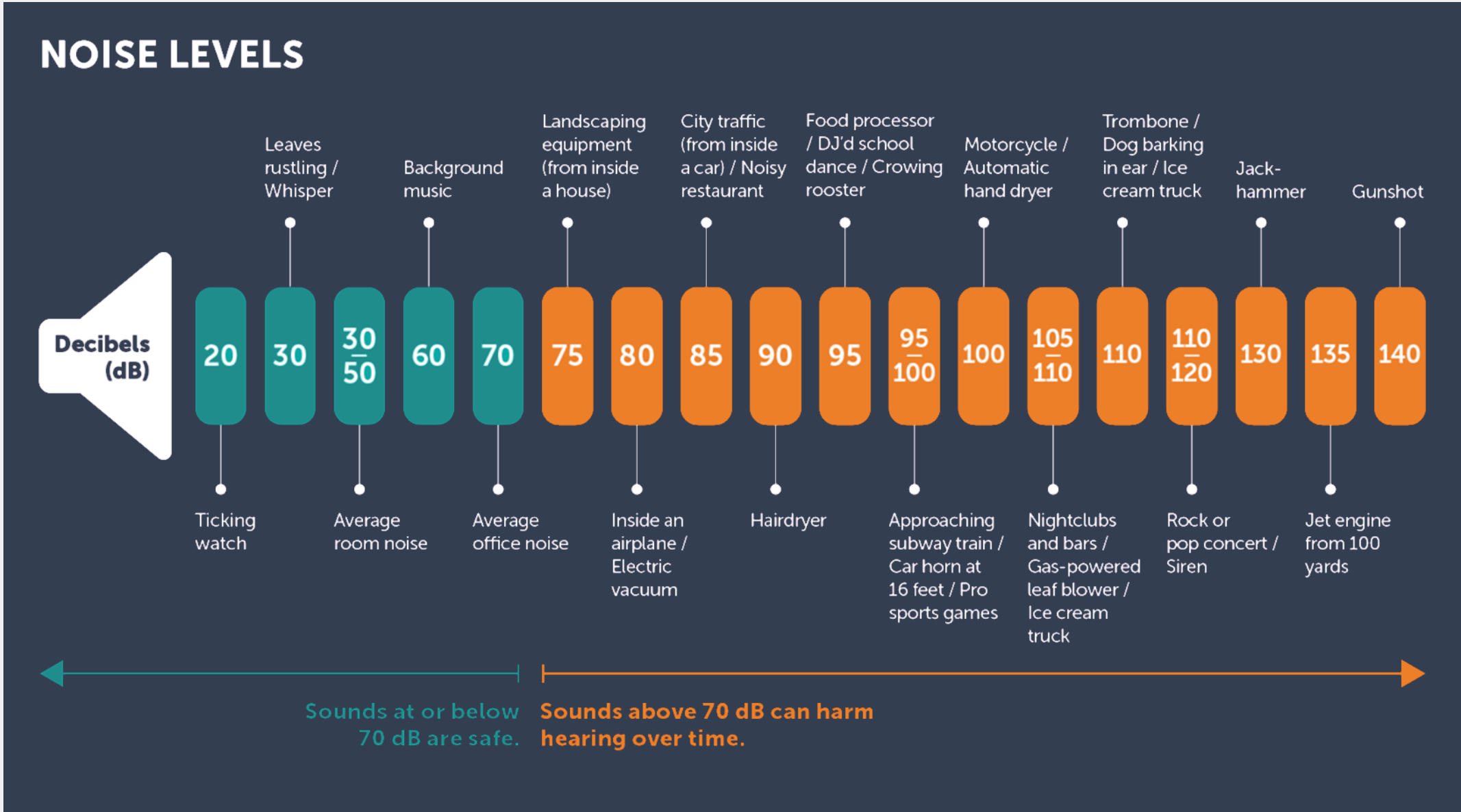
Month	Average (1981-2010)
Jan	25
Feb	25
Mar	25
Apr	24
May	24
Jun	28
Jul	30
Aug	30
Sep	30
Oct	31
Nov	30
Dec	30
Jan	31
Feb	31
Mar	31
Apr	31
May	31
Jun	31
Jul	31
Aug	31
Sep	31
Oct	32
Nov	32
Dec	31
Jan	30

Automated checks for key conditions

The floor plan shows a building with several rooms. In the center, a room is highlighted with a red circle. This room contains a large table and several chairs. Other rooms contain various furniture, including tables, chairs, and sofas. The plan also shows a staircase and a large open area at the bottom.

Decibels

Credit: <https://hearinghealthfoundation.org/keeplistening/decibels>



Processing sound levels

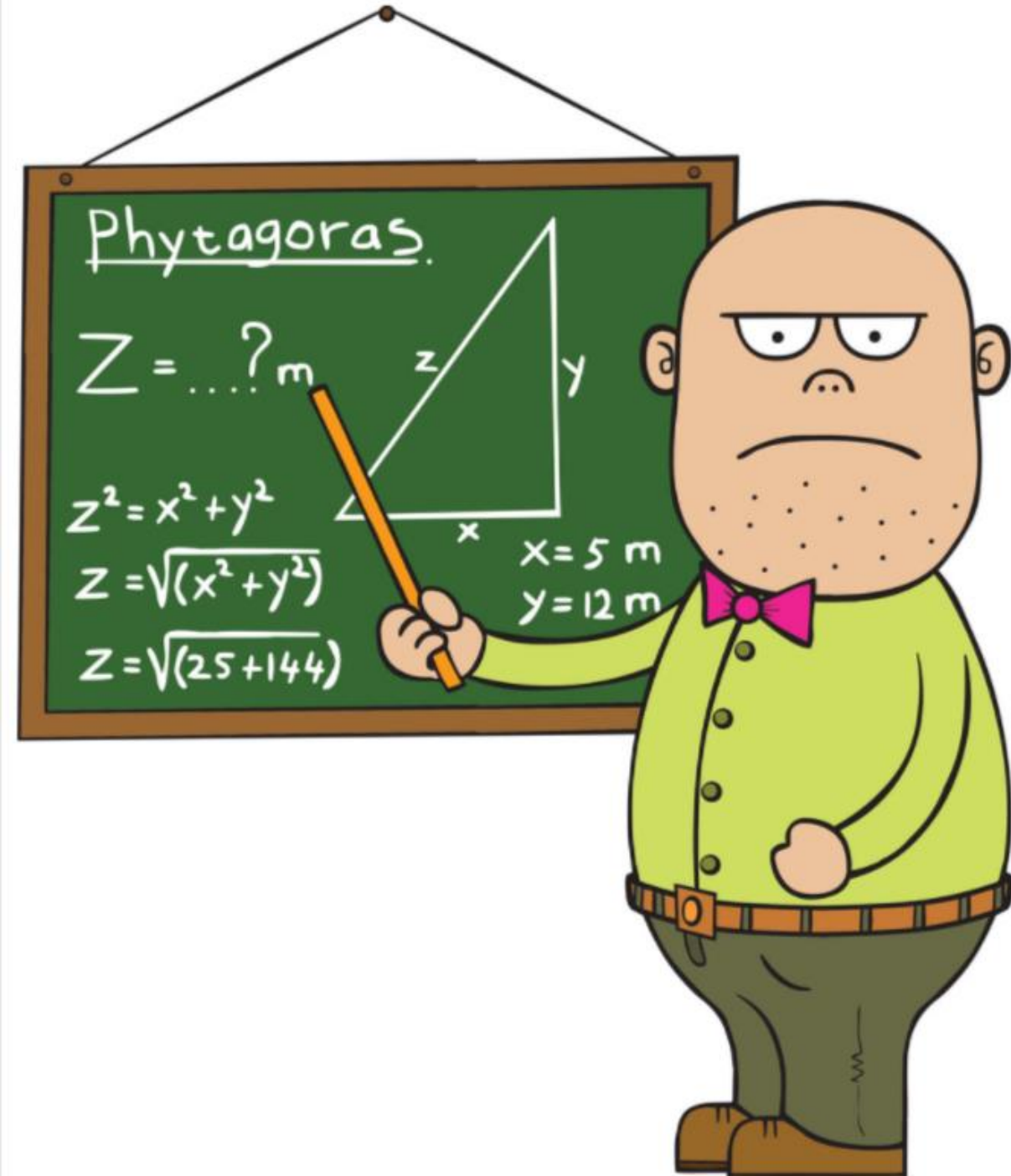
Sound levels are measured on a logarithmic scale.

This makes the very large range of numbers easier to manage. Since the measurements are in decibels, we cannot just get an average level with a simple averaging calculation.

First we convert the decibel values into pressure squared values.

Then we average *those* numbers.

And finally, the average pressure values are converted back to sound levels (decibels).



Some real world examples

Designing new hospital procedures around sound



Noise data to
healthcare
dashboard



Combined
with patient
stats



Hospital
procedures
designed
around sound

Monitoring the ICU environment

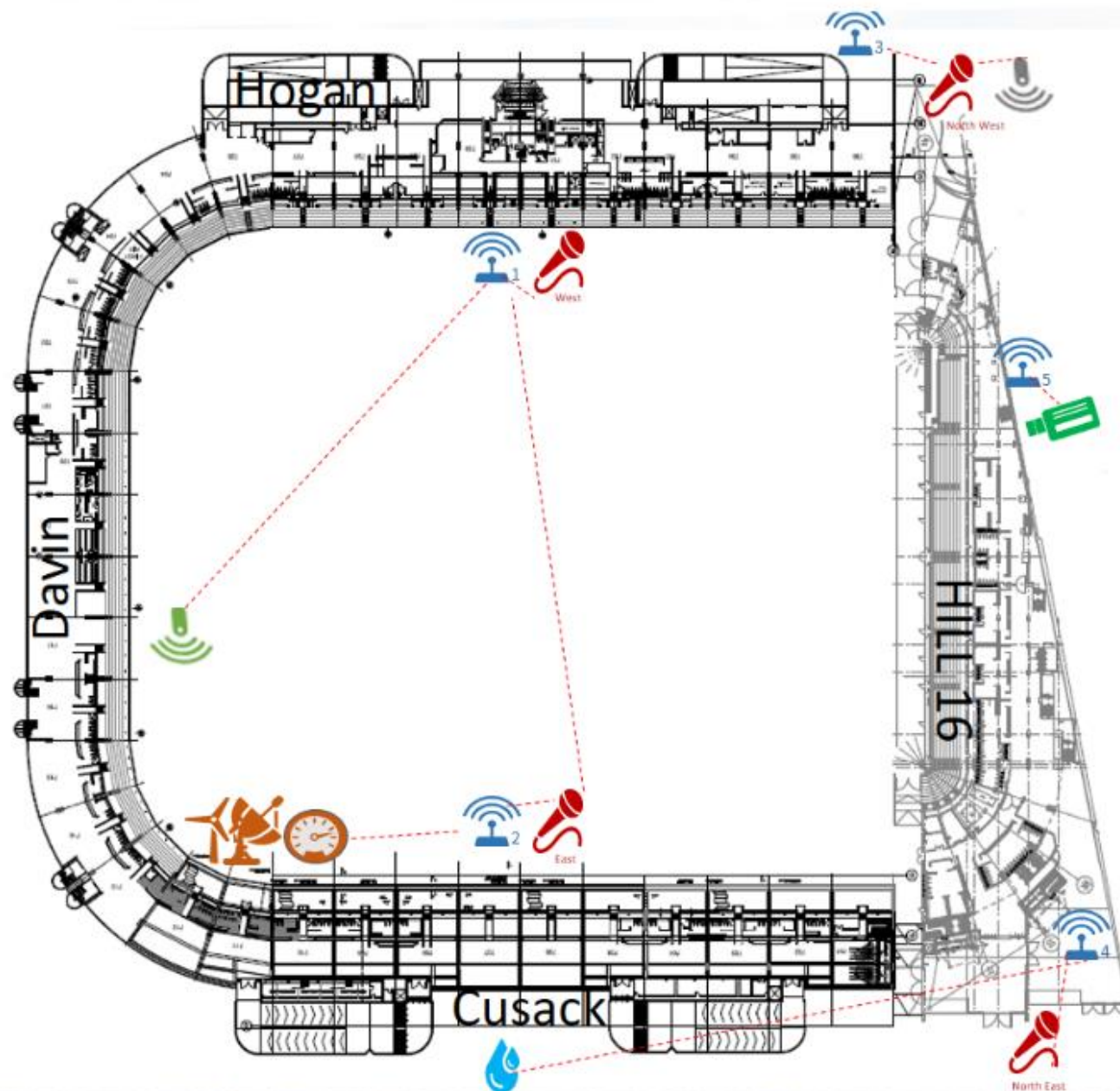
Sound levels matched to patient outcomes

Levels combined with air quality and temperature

New hospital procedures designed around sound

Noise masking systems installed to increase privacy





Infrastructure Key



Intel Gateways (*5)



Pitch Camera



Sound Level Monitoring (*4)



Rain Gauge



Weather Station



Sewer Monitoring sensor



Rain Water Off-Flow

#SmartCrokePark

Intel and Microsoft Smart Stadiums



Live readings
to Intel
gateways



Combined
with match
analysis



Tracking
social media

Smart stadiums – loudest crowd roar

How loud is the 16th player?

#SmartCrokePark

Teams enter

105
dB

Throw-in

106
dB

Mayo first point

110
dB

Dublin first point (goal)

114
dB

Smart Stadium for Smarter Living



Ollscoil Chathair Bhaile Átha Cliath
Dublin City University



License limit
controls

Still useful?

NO SLEEP
FOR 44
HOURS

CROKE
THE
NEIGHBOUR
FROM
HELL



Sonitus EM2010: Main Office

LATEST AVERAGE (LAEQ)

73.4 dB(A)

11:25 - 11:40
15th Oct

Sonitus EM2010: Main Office

LATEST AVERAGE (LAEQ)

74.6 dB(A)

01:25 - 01:40
17th May

Sonitus EM2010: Main Office

LATEST AVERAGE (LAEQ)

75.4 dB(A)

11:00 - 11:15
15th Oct

Corporate office upgrade

Generating insights across multinational organisations



Noise data to
facility
dashboard



Combined
with air
quality and
building info



Corporate office upgrade

400 sensors across multiple sites

Levels combined with air quality and occupancy

Deep investigation into long term patterns

Insights into what drives behaviour and use of space

% time acceptable+	% time undesirable	Daytime variance
100	0	Low (2%)
99	1	Low (2%)
99	1	Medium (8%)
65	35	High (14%)

Almost an entire floor underutilized

Where is all this going?

New research – Roomphonic Project



OLLSCOIL NA GAILLIMHE
UNIVERSITY OF GALWAY



SONITUS SYSTEMS



**Enterprise
Ireland**

1. Soundscape assessment using psychoacoustic sound quality metrics
2. Psychoacoustic sound quality metrics with impulsive sounds (i.e. sounds of very short duration $< 500\text{ms}$)
3. Dependency of the sound duration on the psychoacoustic sound quality metrics.
4. Modelling of the perceived annoyance (or pleasantness) using psychoacoustic sound quality metrics

Project roadmap - soundscape insights



Audio scene recognition

DATE yyyy-mm-dd	TIME hh:mm:ss	TRIGGER VALUE	CLASSIFICATION ⓘ
2022-08-17	11:30:32	81 dB(A)	Construction/Factory tools
2022-08-17	08:43:18	86 dB(A)	Vehicles
2022-08-09	12:28:38	100 dB(A)	Impact sound
2022-07-21	01:17:16	73 dB(A)	Natural sounds

Let your building tell you what is happening so you can react

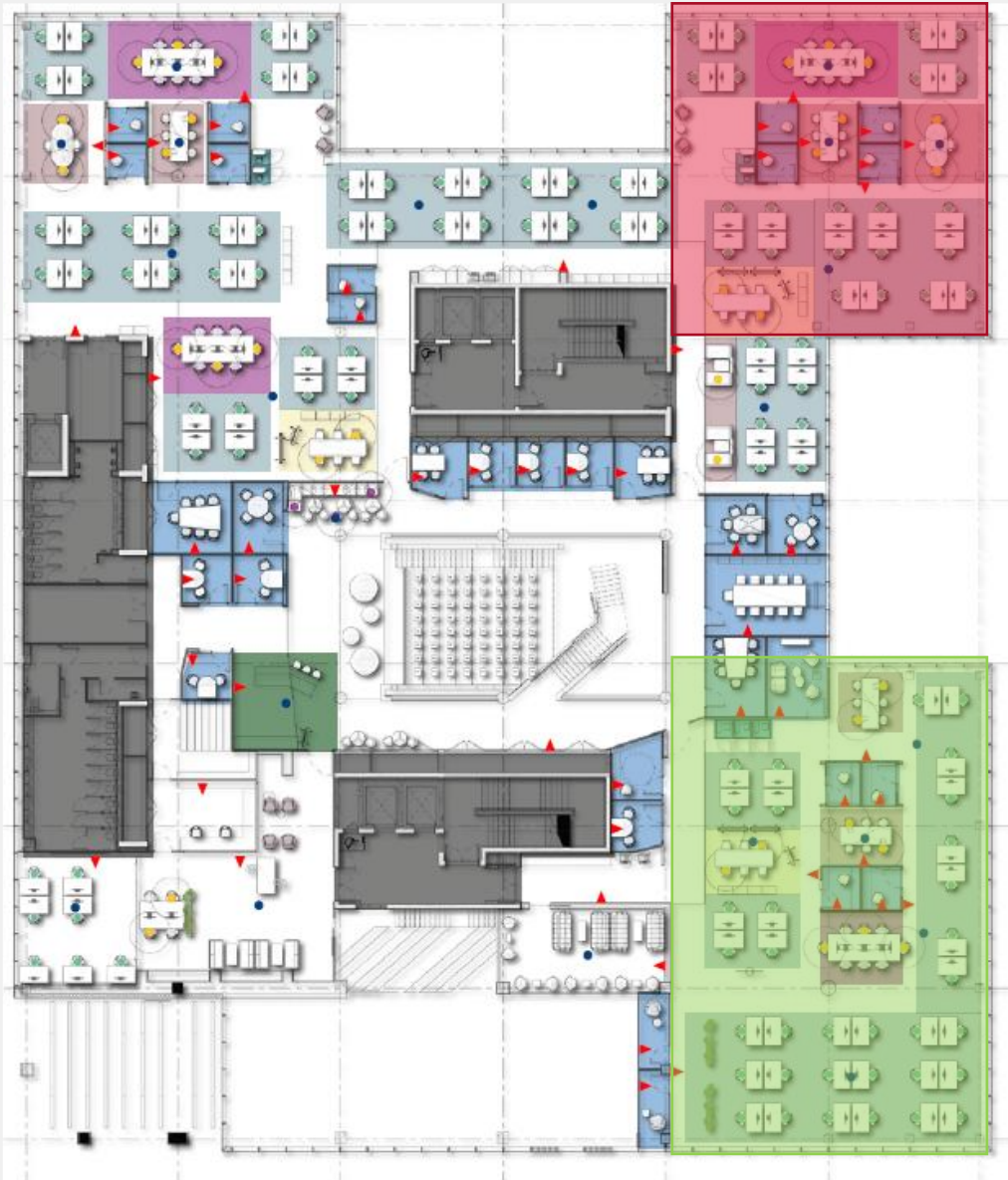
Project roadmap – performance insights

Indoor zoning tools for space management



Empower real estate teams to flex spaces and understand performance in context

Project roadmap – productivity insights



Psychoacoustics and productivity metrics

Can you improve your space to help your teams?

Combine acoustics with other data to understand distraction and focus e.g. CO2

Find the best performing spaces across your organization



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Thank you

Paul McDonald

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