

Design with impact

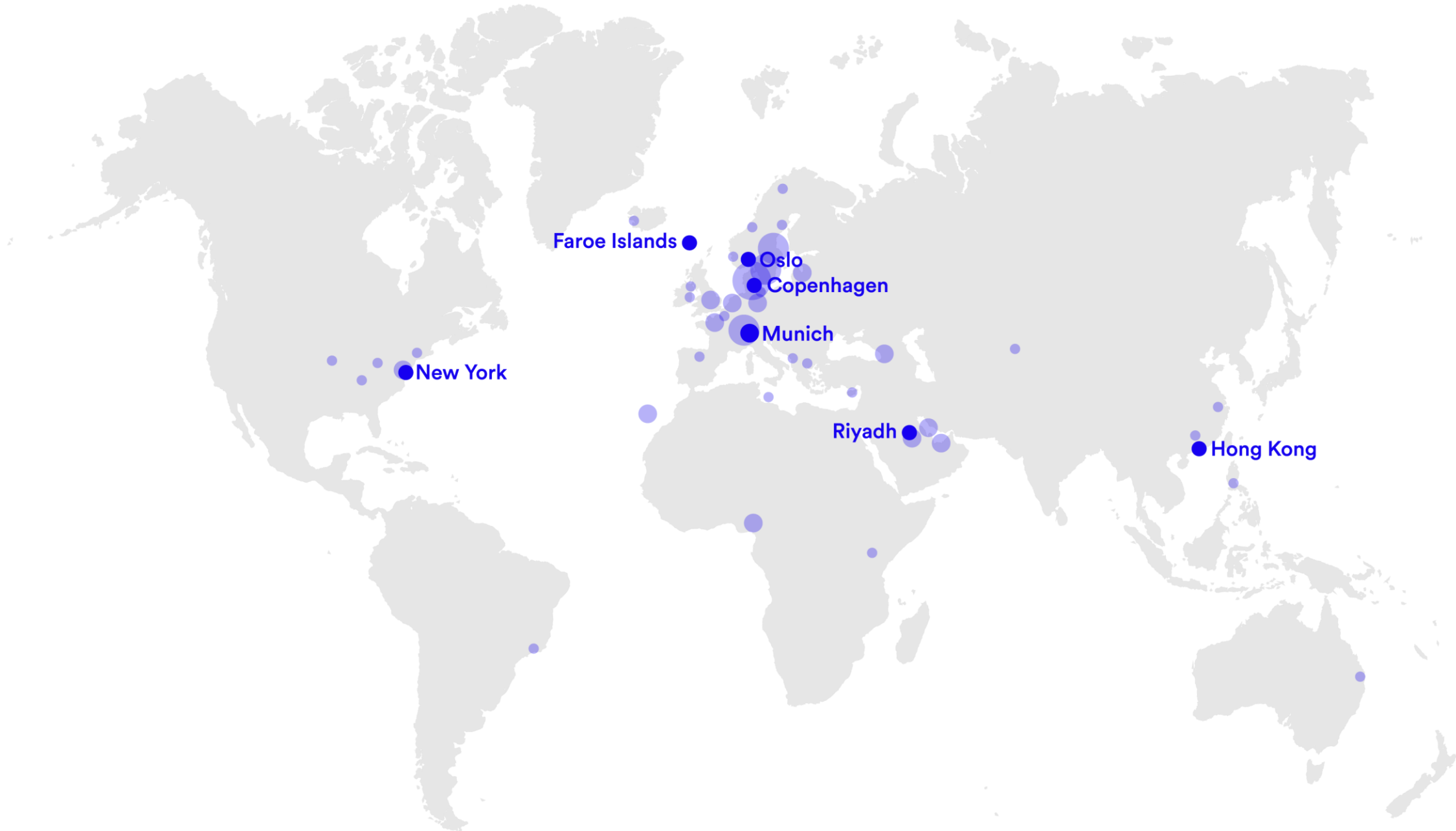
**Looking at the healthy
buildings of the future**

Jakob Strømmand-Andersen
Partner, Head of Sustainability
Engineering



7 offices
300 colleagues
32 nationalities
20 countries





From ideas





To built solutions

A person is shown in profile, looking at a computer monitor. The monitor displays a 3D architectural model of a city with a heatmap overlay, representing data analysis in design. The heatmap uses a color scale from blue (low) to red (high). The person's hand is visible near the bottom of the frame, suggesting interaction with the system. The background shows another monitor and a yellow grid pattern.

Knowledge-based design and design that gives knowledge

**By 2050, 68% of the
world's population will
live in cities.**

An aerial night photograph of a city, showing a dense grid of streets and buildings illuminated by warm orange and yellow lights. The lights create a complex pattern of glowing lines and blocks against the dark background of the city. The perspective is from directly above, looking down on the urban landscape.

**To keep up, we must build a new
city for 1.5 million people
each week.**



A Time of Complex Challenges

What is the future relevance of architects?

The Architect as the Master Sketcher

Photo ©Chicago History Museum by Arthur Siegel

Ludwig Mies van der Rohe
(1886 – 1969)

The Architect as the Conductor

Photo via www.totah-otai.de

Elbphilharmonie, Hamburg, Germany
by Herzog & de Meuron

Wicked Problems



Workshop, Copenhagen
Performing Arts Center World Trade Center



**Architecture is
fundamentally about
staging human interaction.**

Munich, Germany

Siemens Global HQ



Identity

Historic link to Munich

Visibility

Sustainable frontrunner
in an urban context

Urbanity

Modern and attractive
work place



Woven into the urban fabric



The site



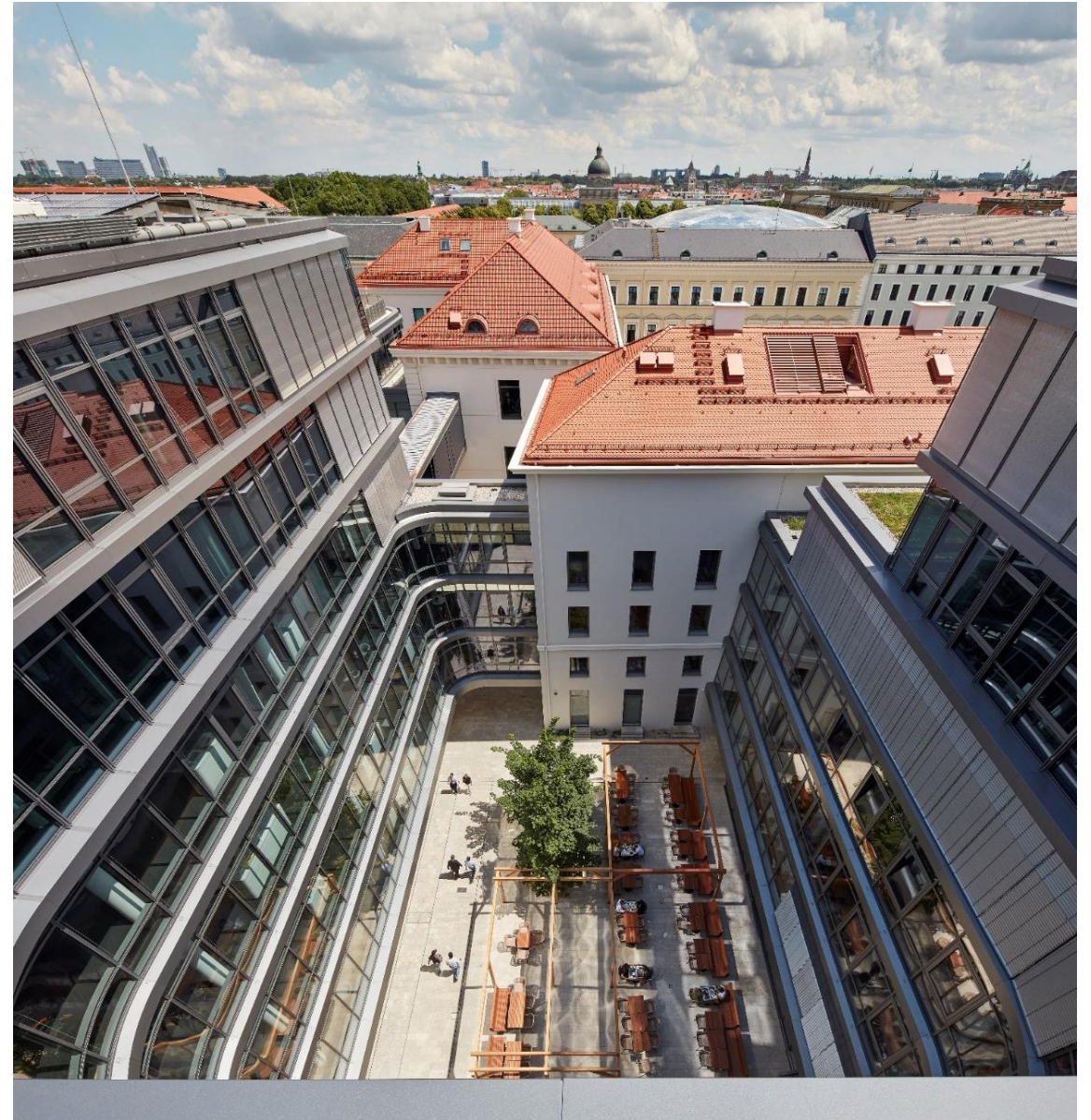
Inviting the public in



Structural optimization



A series of green court yards



3 different façade strategies

1: Discreet towards the protected Ludwig Ferdinand Palais



3 different façade strategies

2: Elegant and adaptable towards neighbour buildings



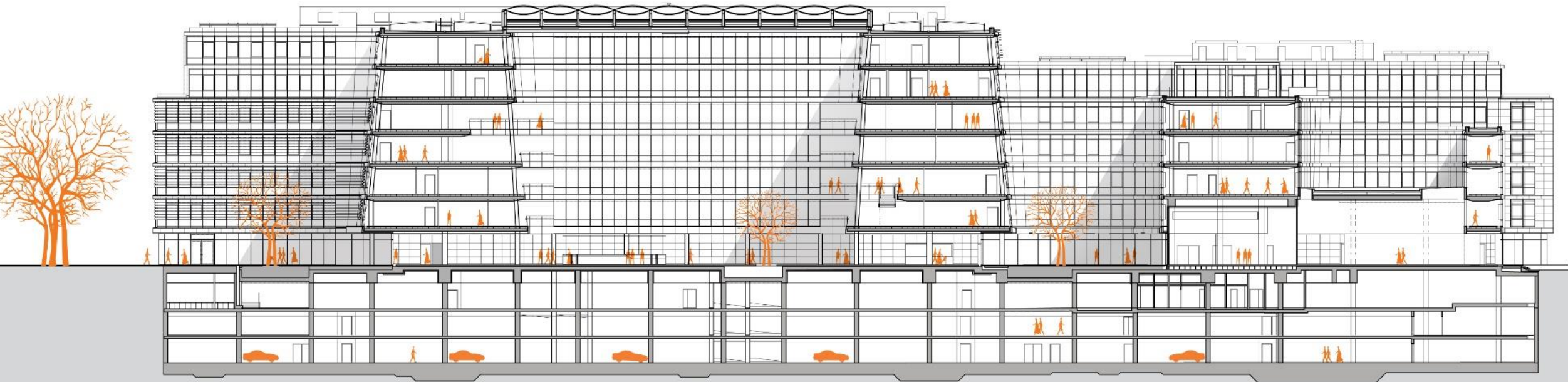
3 different façade strategies

**3: Significant and modern towards
the heavy traffic**



Sustainable by design

Tilted inner faced for inflow of daylight



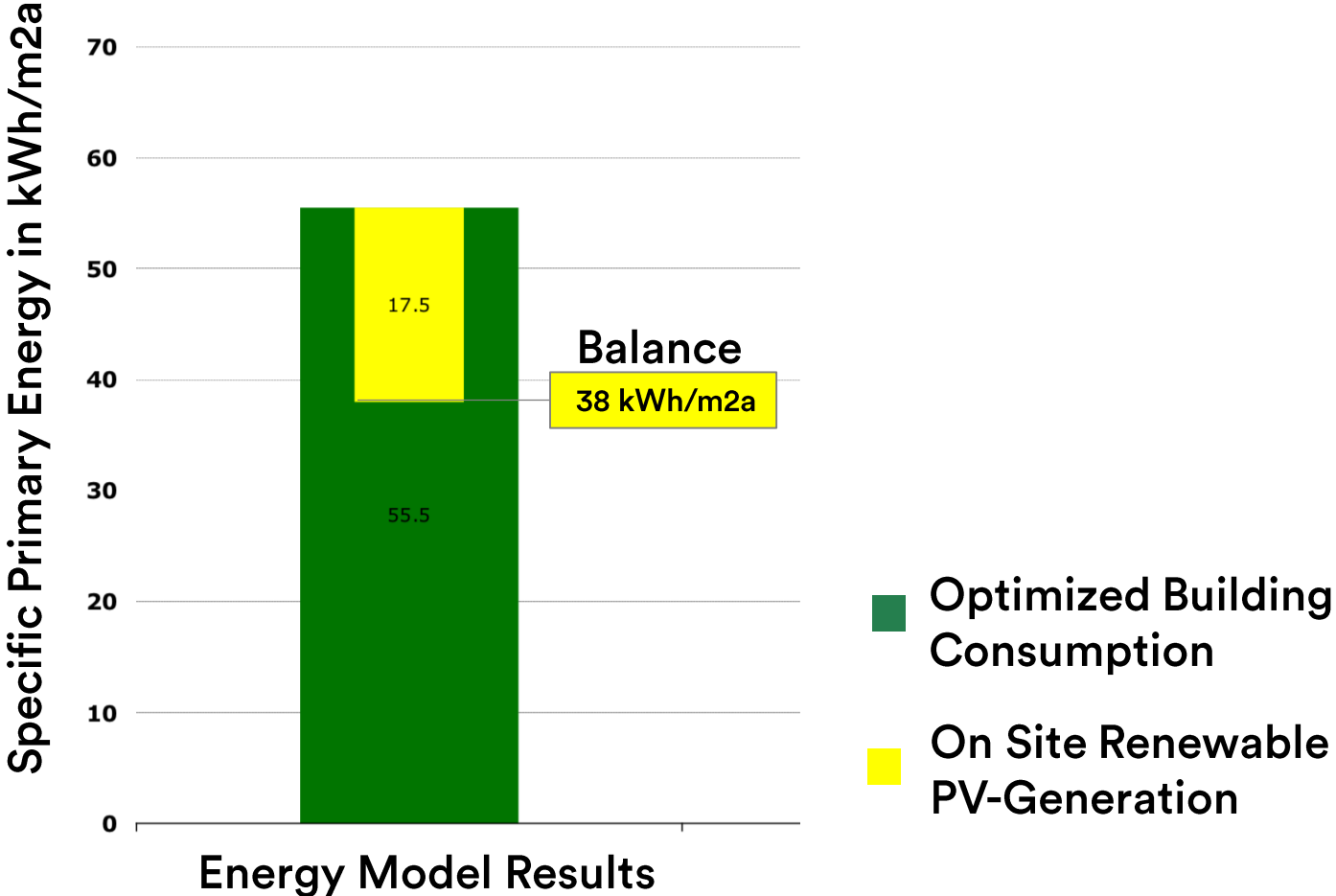
Sustainable by design

Solar Power Generation by Photovoltaic Roof System



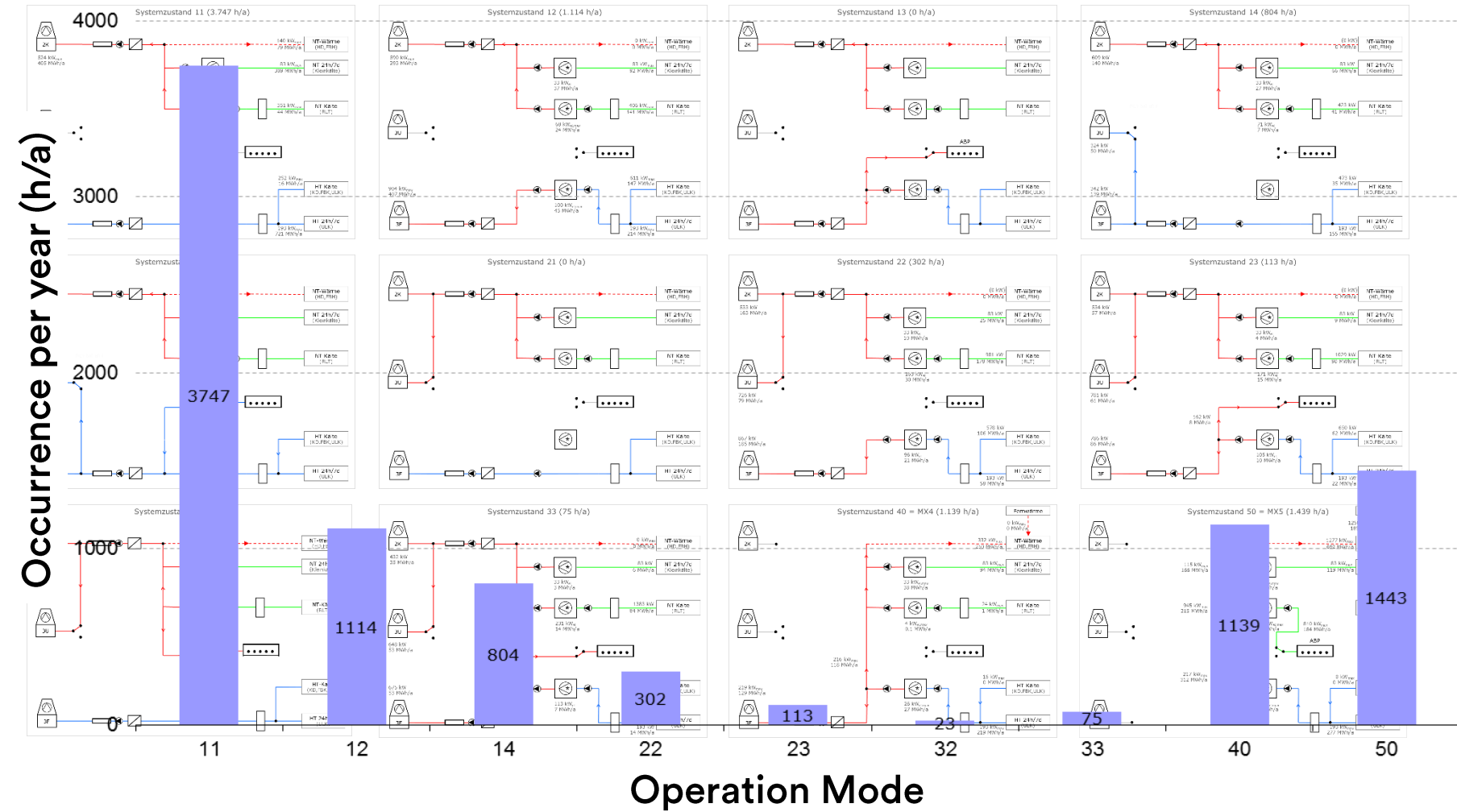
Modeling Results; Primary Energy Balance

Based on heated net floor area of 48.800 m²



System Simulation; Heating/Cooling System Analysis

Annual Breakdown og main System Operational Modes



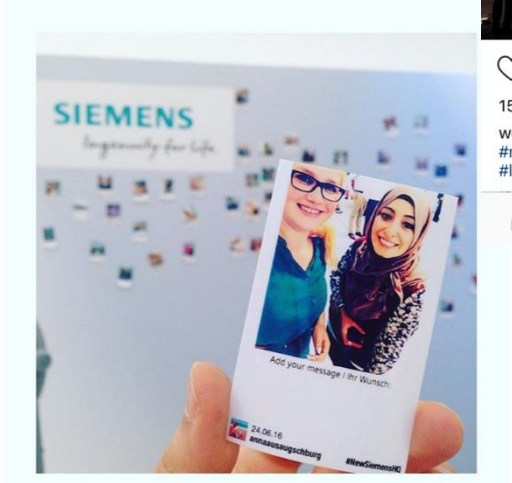
A social contribution to the city





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36 likes
adrianmalzer @siemens, das war ein Fest!
#sommerfest #siemens #ingenuity #summer #summervibes

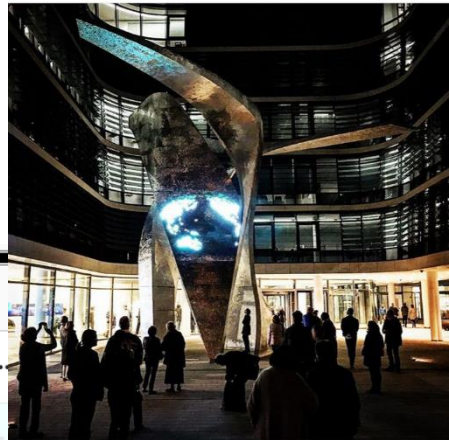
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56 likes
annamouchref #newsiemenshq 2 Anna's / 2 Tinkerbell airbrush tatts
annaausguschburg

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wev85 #Art #at #siemens #great #big #kunst #munich #perfect #likesforlikes #mustsee #langer

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11 likes
hubertus.schulenburg #newsiemenshq
24 JUNE 2016

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1,327 likes
siemens Over a year ago, we opened our new headquarters in Munich! Its architecture is set out to combine #sustainability and #efficiency with... more

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jessideringer #santa is coming to #work
6 DECEMBER 2016

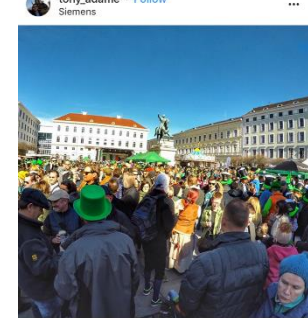
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14 likes
jessideringer #santa is coming to #work
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INPUT

The questions we ask

Dreams

Visions

Goals

-

Data

Measurements

ARCHITECTURE

OUTPUT

The effect we create

Effect on the individual
Effect on the culture/city
Effect on the environment



Research



Sustainability intern

PhD. Stud., Ethnology

Lead Designer Landscape Architect

PhD. Stud., Acoustics

Partner, Head of Sustainability Engineering, PhD

Senior Constructing Architect, Facade Specialist

Sustainability Engineers

Lead Sustainability Engineer, PhD

Architect/ Communications

Sustainability intern

Landscape Architect

Senior Architect

Architect/ Communications

Senior Sustainability Engineer, PhD

Lead Designer Landscape Architect

Partner DGNB International Consultant, Visiting Professor

Landscape architect Intern

Senior Architect, Material Specialist,

PhD. Stud., Façade Design

Senior Landscape Architect

Sustainability intern

PhD. Stud., Artificial Lighting

The urban canyon and building energy use: Urban density versus daylight and passive solar gains

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 Solar radiation
 Energy and Buildings

ABSTRACT

The link between urban density and building energy use is a complex balance between climatic factors and the spatial, material and use patterns of urban spaces and the buildings that constitute them. This study uses the concept of the urban canyon to investigate the ways that the energy performance of low-energy buildings in a north-European setting is affected by their context. This study uses a comprehensive suite of climate-based dynamic thermal and daylight simulations to describe how these primary factors on the passive energy properties of buildings are affected by urban use in urban density. It was found that the geometry of urban canyons has an impact on total energy consumption in the range of up to +30% for offices and +100% for housing, which shows that the geometry of urban canyons is a key factor in energy use in buildings. It was demonstrated how the reflectivity of urban canyon plays an important, previously underestimated role, which needs to be taken into account when designing low-energy buildings in dense cities. Energy optimisation of urban and building design requires a detailed understanding of the complex interplay between the temporal and spatial phenomena taking place, merging qualitative and quantitative considerations.

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1. Introduction

One of the most basic and fundamental questions in urban master planning and building regulations is how to secure common access to sun, light and fresh air, but for the owners of individual properties, it is often a question of getting the most of what is available. There is potential for repeatedly recurring conflict between public and private interest. Solar access and the right to light remain contested territory in any society, vital as they are to health, comfort and pleasure.

Traditional urban planning has sought to control the proportions of the street, because the basic geometry of building heights and distances between buildings regulates access to light and solar heat. Zoning laws and building regulations usually establish height-to-distance ratios that limit the overshadowing that buildings may cause for public spaces and other buildings. A similar geometric abstraction of urban space – the urban canyon [1] – has been used in urban climatology, to describe the way that urban spaces create special environmental conditions. It is a spatial archetype that allows us to integrate knowledge from several different specialised

fields of research. In geometric terms, the urban canyon is described as the height/width ratio of the space between adjacent buildings.

Cities develop over time, and the proportions of urban canyons have long lasting impacts on the future energy consumption for the heating, cooling and lighting of the buildings that define them and the environmental qualities of the streets, squares, courtyards or gardens that comprise them. Urban development is a rather slow process in most industrialised societies, but the impact of its conditions on building energy use multiply over the years – more than other processes that affect a building's performance over its lifetime. So, considering that one of the main challenges to architects and engineers in the next decades will be how to improve the energy performance of our buildings and cities, we need to improve our knowledge of both urban and building design through research on the dynamic interplay between climate, context and building energy use. The passive properties of buildings are likely to play a much more important role in the total energy consumption, as winter heat losses are reduced with better insulation, glazing and air tightness.

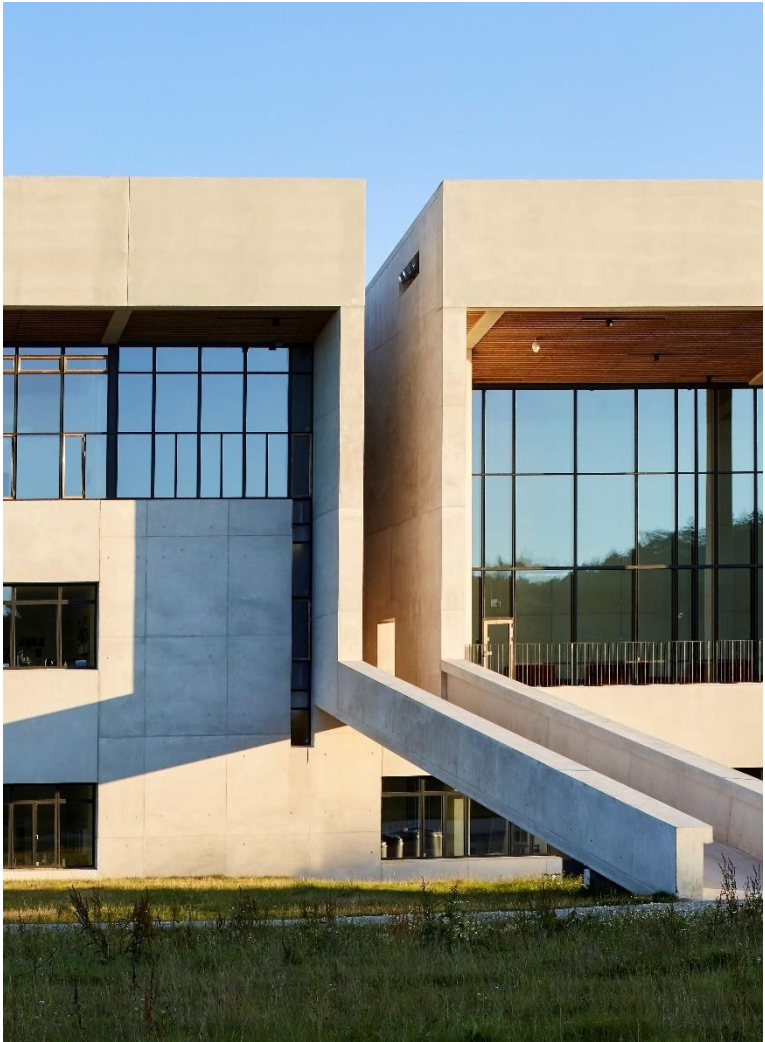
Urban densification is one strategy for sustainable development, focusing on energy savings through efficient transport systems, shared infrastructures and minimizing heat gains and losses that dominate energy budgets. It has been established that densification is a balancing act between these opportunities on the one hand, and ensuring solar access for low-energy buildings and urban

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DESIGN WITH KNOWLEDGE

New research in sustainable building
 Published by Henning Larsen Architects



Research

Design methods

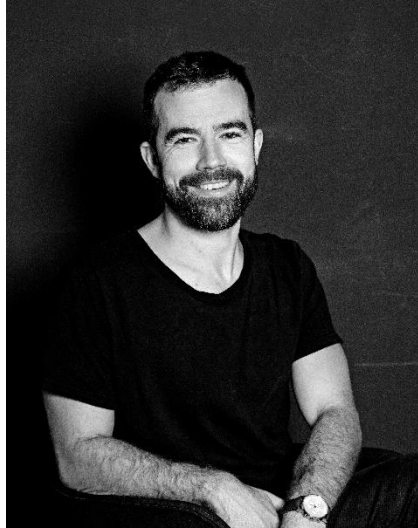
Projects

In-house Industrial PhDs Programs



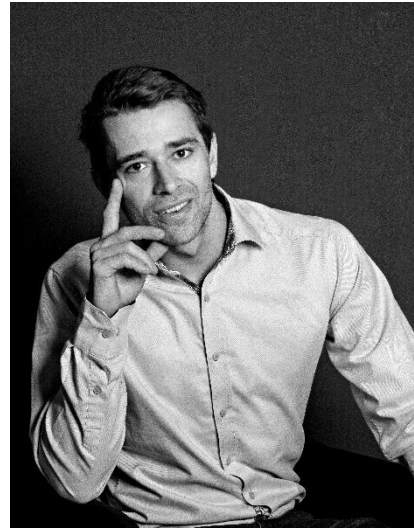
Imke Wies van Mils

PhD. Stud. Artificial Lighting



Pelle Munch-Petersen

PhD. Stud. Facade Design,
Architects



Krister Jens

PhD. Stud. Big Data



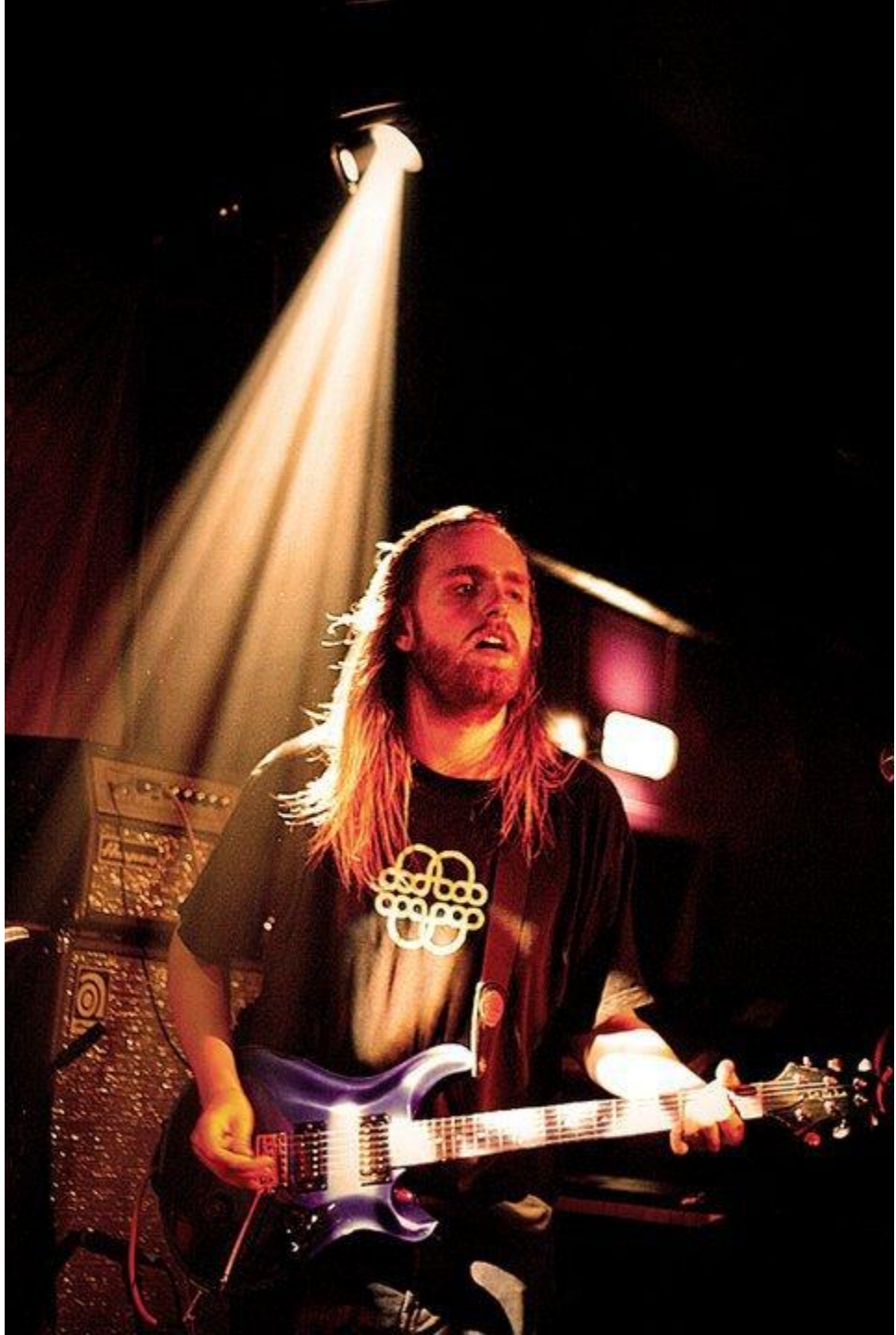
Drew Thilmany

Phd. Stud. Ethnology, MA
Applied Cultural Analysis



Finnur Pind

Phd. Stud. Acoustics, MSc.
Civil Engineer



Cases

Uppsala, Sweden

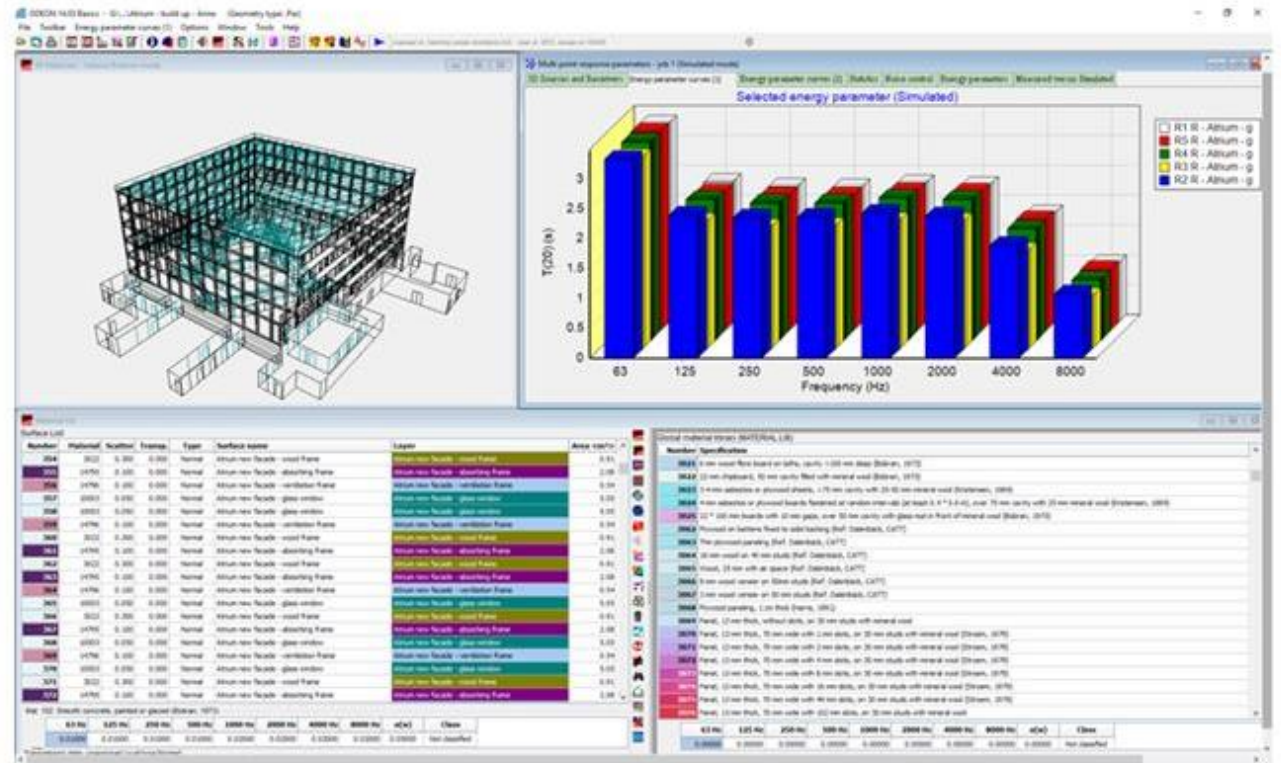
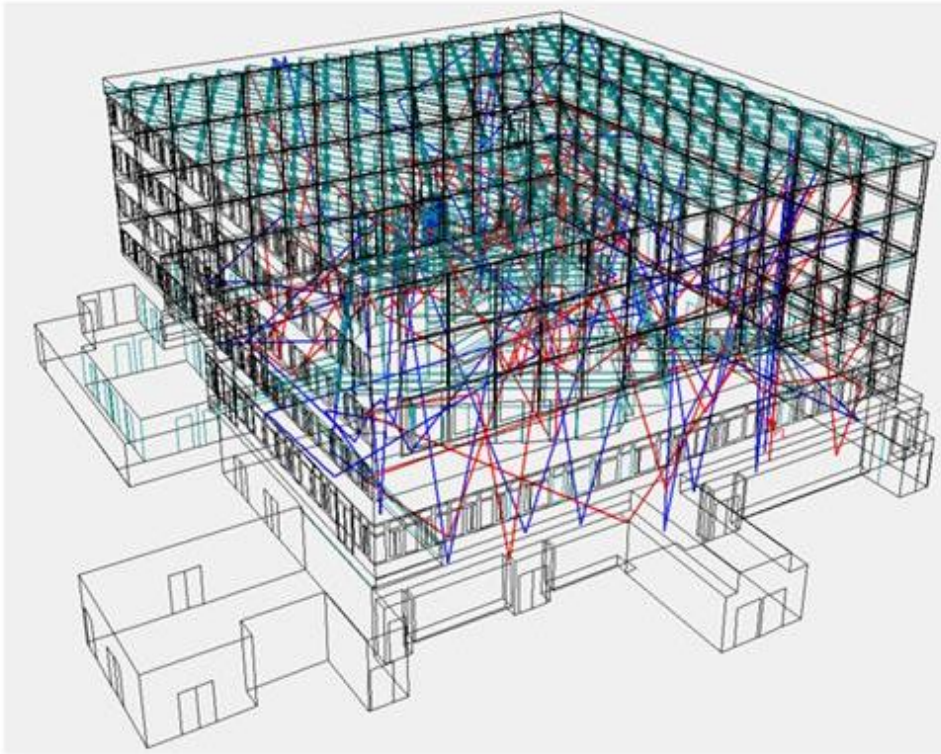
Uppsala City Hall



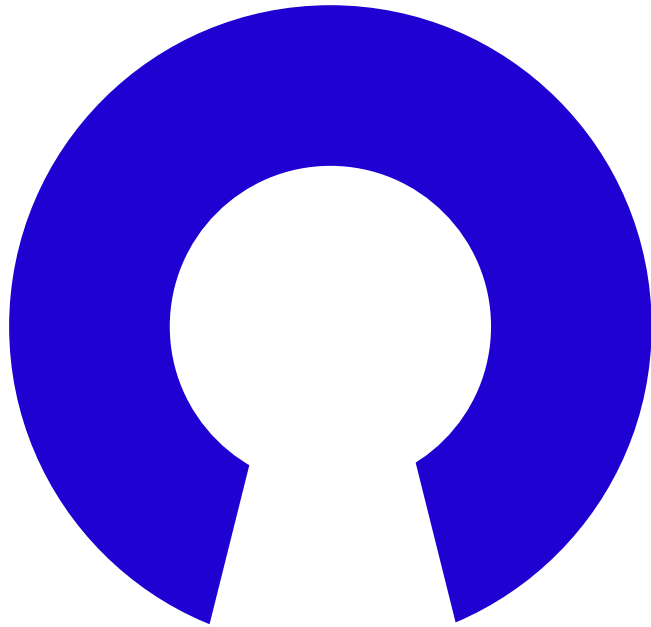




Research virtual acoustics

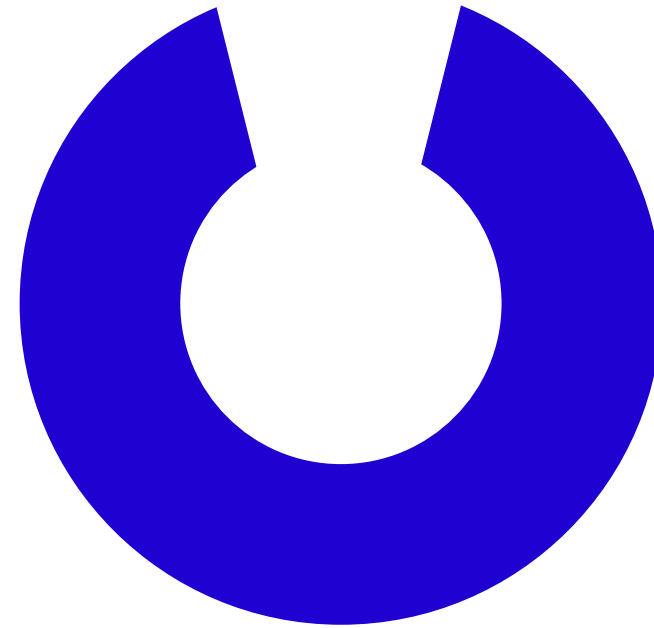


Research virtual acoustics



closed source

VS



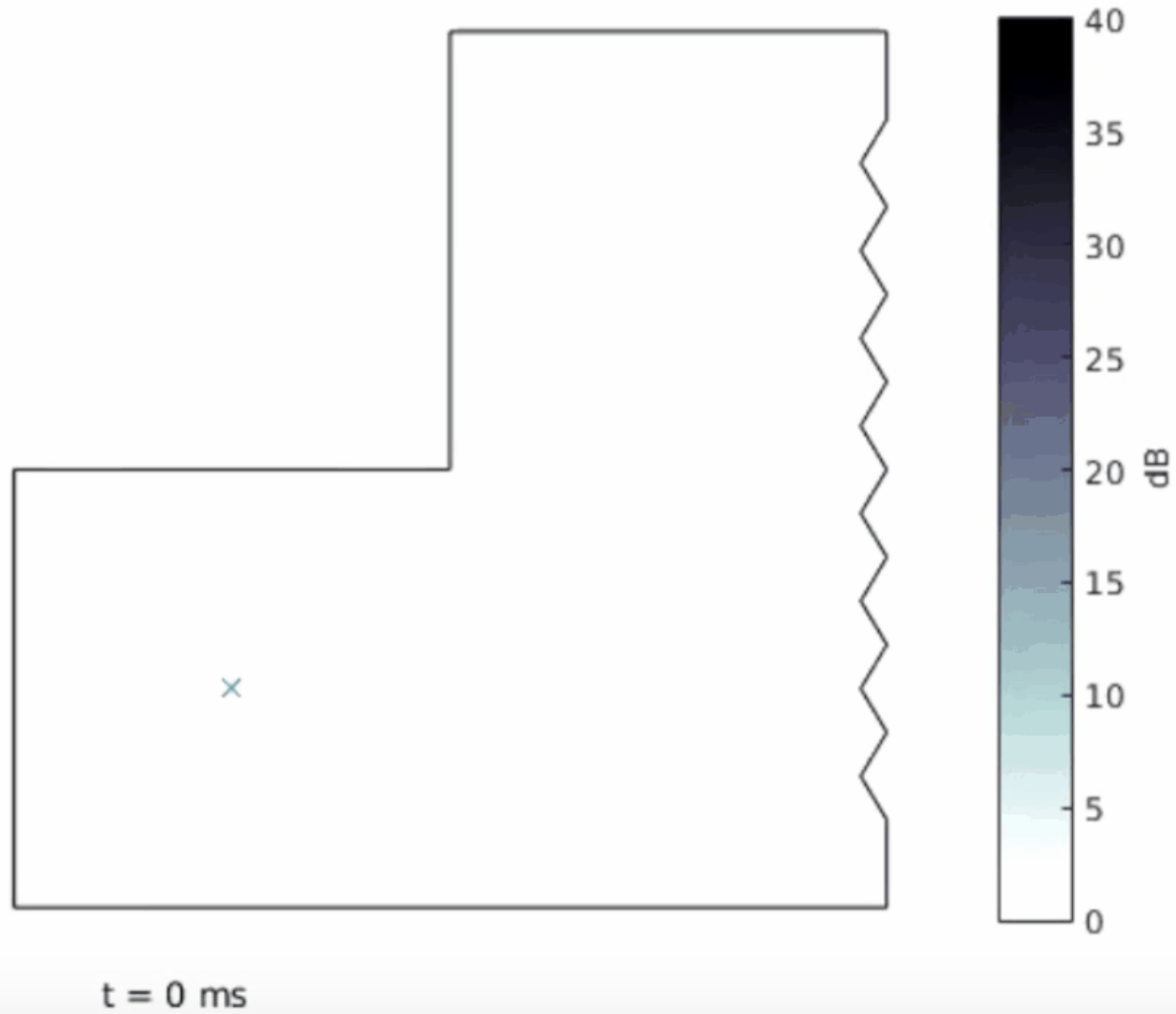
open source

Uppsala City Hall

Combining technologies



Uppsala City Hall



Uppsala City Hall

Virtual soundscapes and immersive audio

– new technologies to engage the user



Uppsala City Hall

```
public XYZ GetWallInfo(UIDocument uidoc, Document doc)...
#endregion

#region ROOM INFO
// having the room coordinates, it is possible to find which grid point
public void GetRoomInfo(UIDocument uidoc, Document doc)
{
    Reference roomReference = uidoc.Selection.PickObject(ObjectType.Element);
    Room roomElement = doc.GetElement(roomReference) as Room;
    Element roomPoint = doc.GetElement(roomReference);

    //ElementCollector sc = new ElementCollector();
    // calling collector for escape camera
    //Element roomFilter = sc.GetCameraByNameLambda(doc, "Room1");
    //Room roomElement = roomFilter as Room;

    // get the room position
    //LocationPoint roomLocation = roomPoint.Location as LocationPoint
    //XYZ roomPoint = roomLocation.Point;
    //Debug.WriteLine("Room Coordinates" + roomPoint.X + "," + roomPoint.Y);

    SpatialElementBoundaryOptions options = new SpatialElementBoundaryOptions();
    options.SpatialElementBoundaryLocation = SpatialElementBoundaryLocation.Center;
    string roomElementInfo = "";

    foreach (IList<BoundarySegment> boundSegList in roomElement.GetBoundarySegments())
    {
        foreach (BoundarySegment boundSeg in boundSegList)
        {
            ElementId eID = boundSeg.ElementId;
            Element e = doc.GetElement(eID);
            Wall wall = e as Wall;
            LocationCurve locationCurve = wall.Location as LocationCurve;
            Curve curve = locationCurve.Curve;

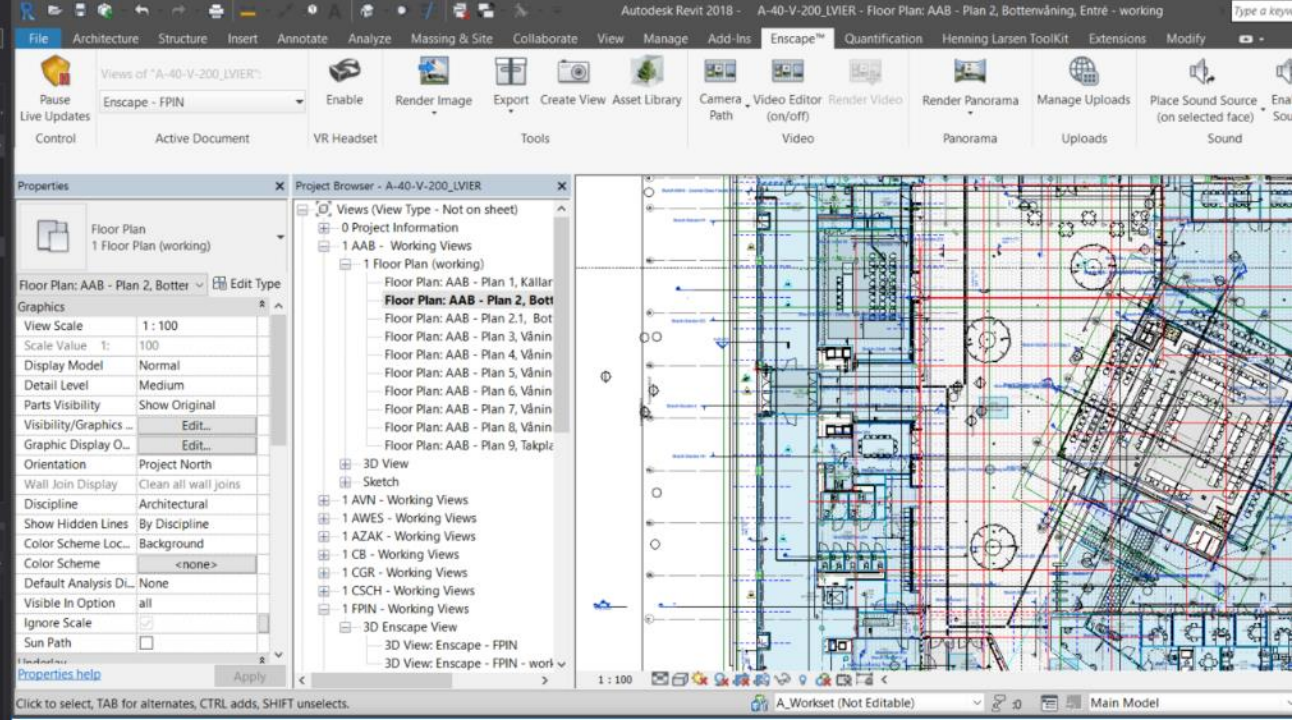
            Parameter wallParameter = wall.get_Parameter(BuiltInParameter.WALL_THICKNESS);
            double feet2Meter = 0.3048F; // convert feet to meter ratio
            double lengthOfWall = wallParameter.AsDouble() * feet2Meter;

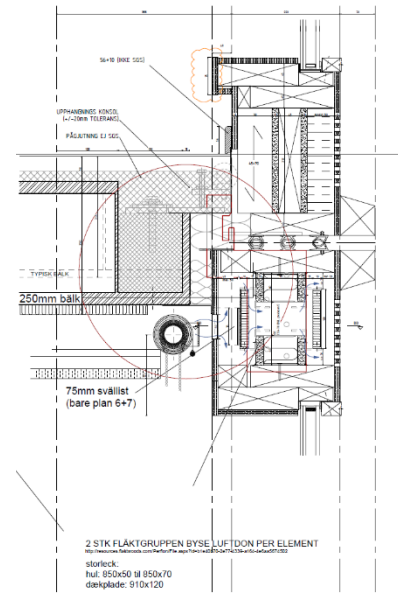
            roomElementInfo += e.Name + " " + curve.Length + "\n";
        }
    }

    TaskDialog.Show("Boundary Segment Elements", roomElementInfo);

    //return roomPoint;
}
#endregion

#region INTERPOLATION GRID CALCULATION
```



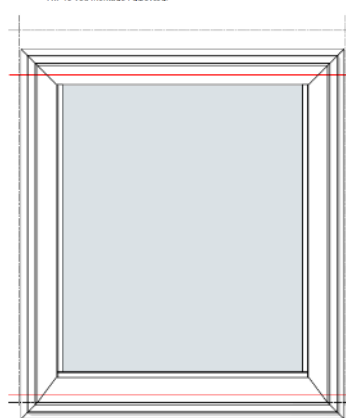


2 STK FLÄKTGRUPPEN BYSE LUFFTON PER ELEMENT

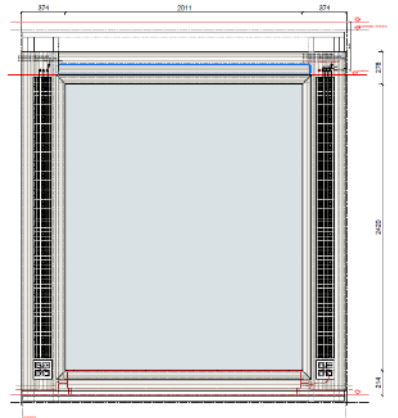
storlek: 850x500
 däckplade: 910x120

lufflöde per luffton: 70 l/s @ 15Pa
 *Lufflöden kommer ned, när man kombinerer med perforerat faner + stomme.

Reduktionsstal R2 i dB:
 Rw 40 ved montage i öppenväg.



Gatafasaden - uppställning mot gata (plan 4, 5, 6)



Gatafasaden - uppställning mot kontor (plan 4, 5, 6)



Uppsala City Hall

Outcome on KPI's and awards

**New window DFD and
acoustic absorptions
integrated**

**Higher performance, less
materials and reduced
construction cost**

**New software in virtual
acoustics simulation**



Aarhus, Denmark

Frederiksbjerg School





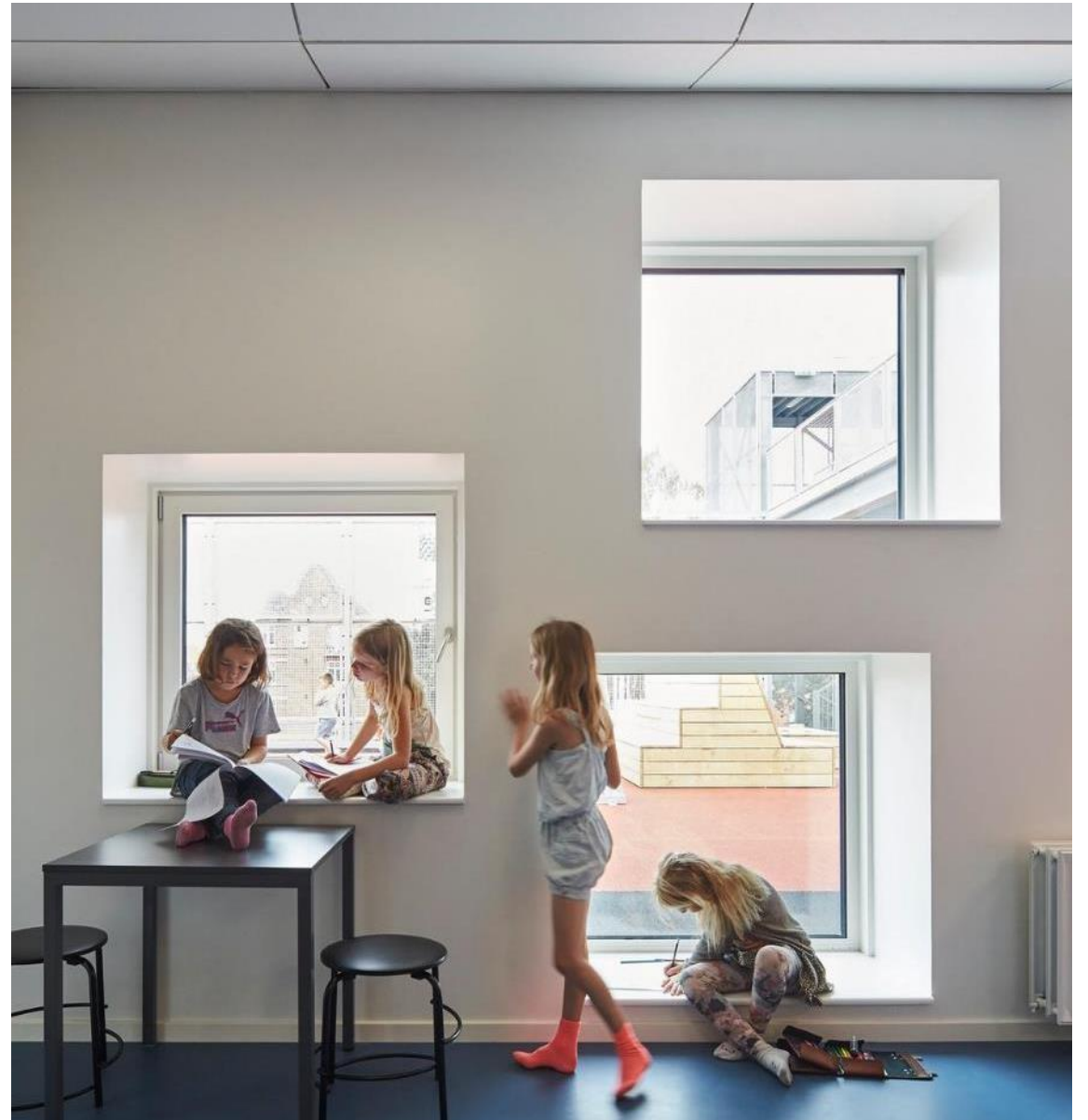
A new way of learning about...

Traditional lecture-based learning...



Collaborative group work...





Legislation / BR18

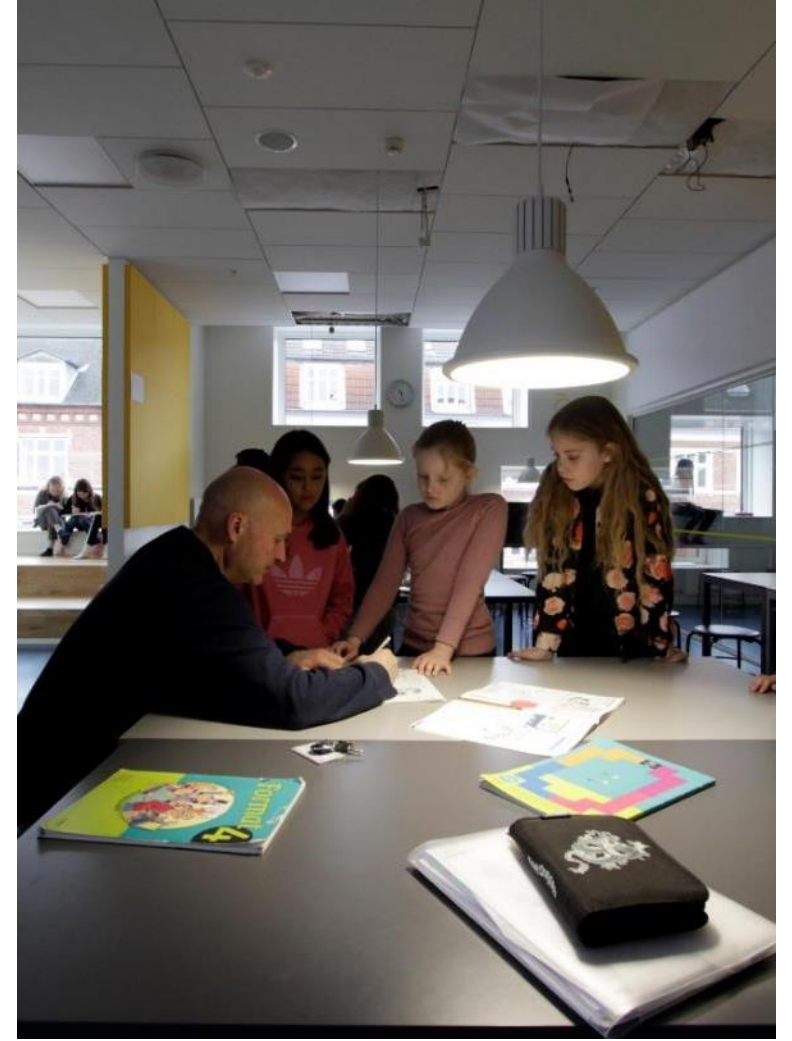


Det skal eftervises, at det elektriske belysningsanlæg opfylder bygningsreglementets krav for belysningsstyrke, jf. DS/EN 12464-1, *Lys og Belysning - Belysning ved arbejdspladser – Del 1: Indendørs arbejdspladser*.
For nogle arbejdspladser er kravene til belysningsstyrke yderligere specificeret i det nationale annek DS/EN 12464-1 DK NA. Eksempler på krav til middelbelysningsstyrke og regelmæssighed er givet i tabel 3. Regelmæssigheden af belysningen, U_0 , defineres som minimums belysningsstyrken, E_{min} , i forhold til middelbelysningsstyrken, E_{mid} .

De tekniske krav til belysningen skal kunne opfyldes i hele anlæggets levetid.

Tabel 3. Eksempler på krav til belysningsstyrke ved udvalgte arbejdspladser, jf. DS/EN 12464-1 og DS/EN 12464-1 DK NA.

Sted	Middelbelysningsstyrke på arbejdsplanet, E_{mid}	Regelmæssighed, U_0
Gange og trapper	100 lux	0,40
Kontorarbejde - Opgaveområde (på synsobjektet) - I nærområdet (over 1/4 m fra synsobjektet)	500 lux 300 lux	0,60 0,40
Børnehaver og vuggestuer	300 lux	0,40 0,60 (koncentrationsleg)
Undervisningslokaler	300 lux	0,6



Combining the audio and visual human experience

New Research in Light, Acoustics and Learning



Experimenting with mood lighting

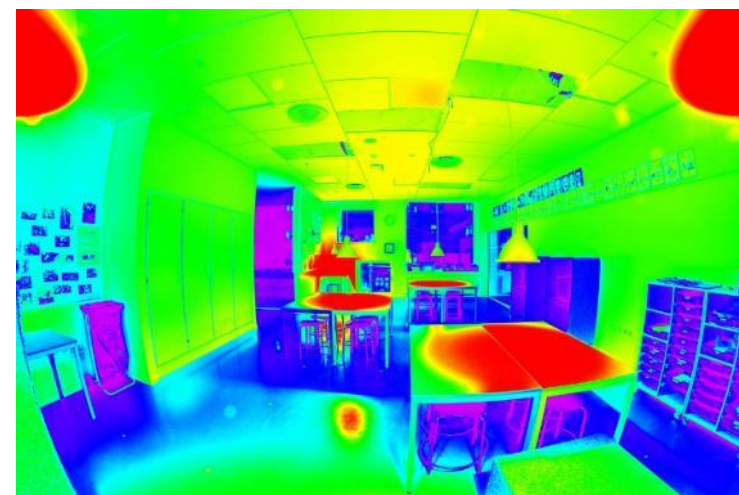
Normal

Ambient Lighting



Experiment

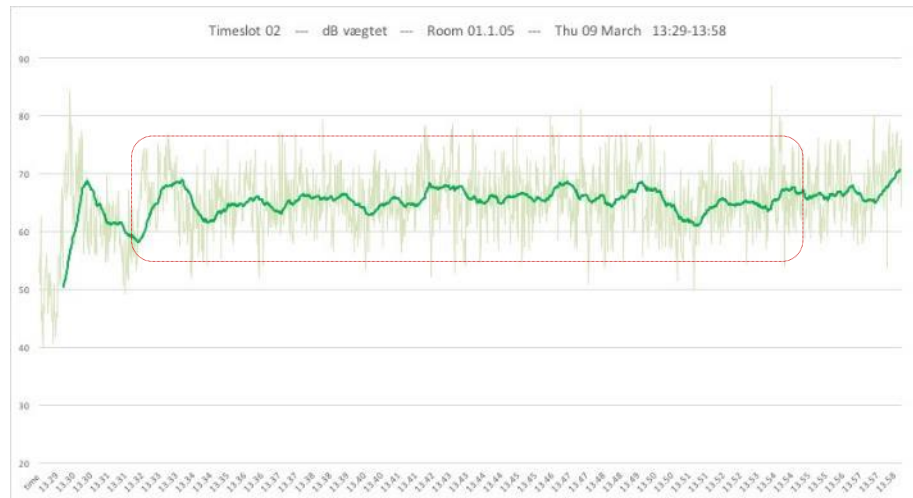
Focused lighting



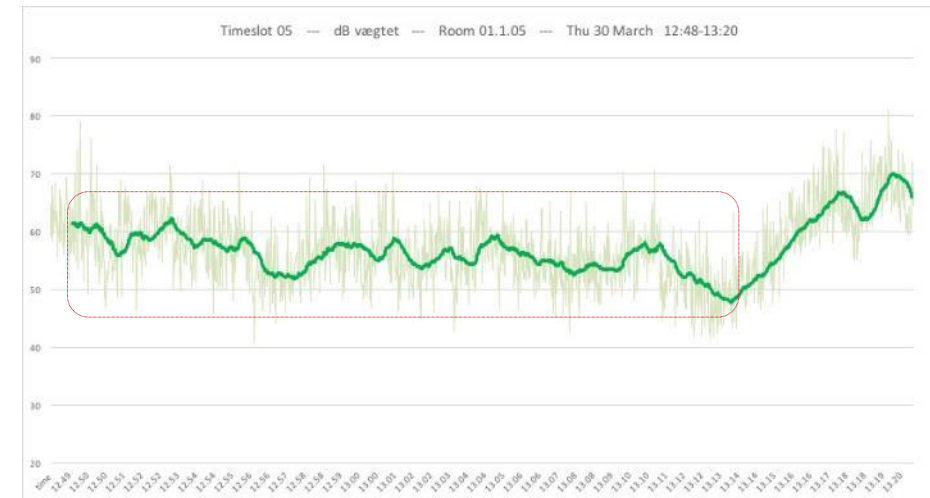
Focused light



Default, traditional ceiling lighting (video snapshot)



Pendant lighting activated (video snapshot)



Findings:

Our data shows an average reduction of 2–8 dB

- 1 dB: Noticeable with special equipment in a soundproof room
- 2-3 dB: Noticeable in an 'average environment' (though perhaps only when asked)
- **4-6 dB: Very noticeable in an average environment (students will hear the difference)**
- 7-8 dB: Significant, a noteworthy reduction
- 10 dB: 50 percent reduction, extremely audible

Aarhus, Denmark

Outcome on KPI's and awards

Calm for students

More comfortable

Lowered electricity use (35% reduction)

Less noise, on average - 8 dB(A)



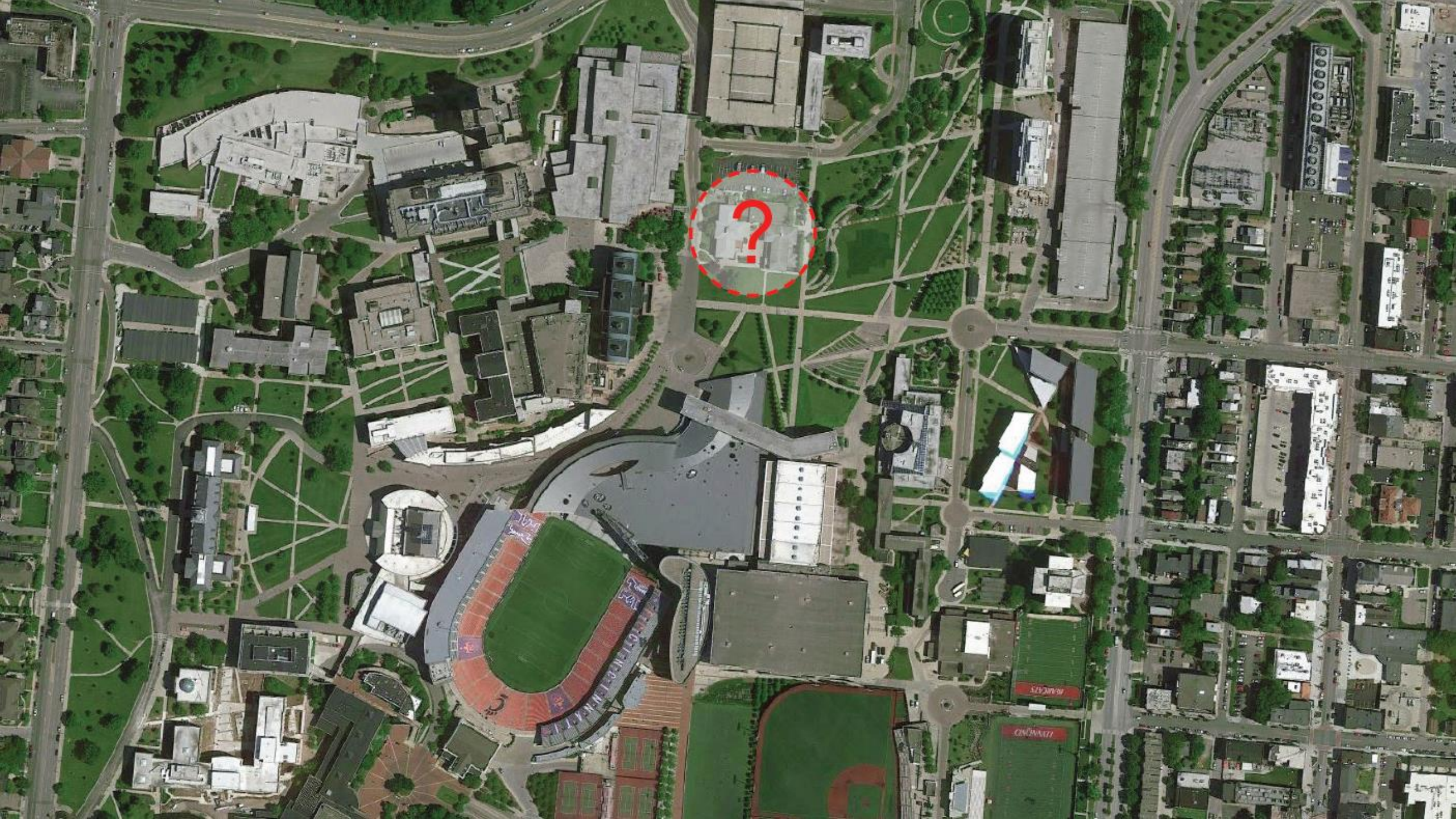
Carl H. Lindner College of Business

Location
Cincinnati, Ohio, USA

Gross floor area
22,500 sqm

Status
Under opførelse





Young adults are the loneliest generation in America.

**Lonely millennials twice as
likely to experience depression
or anxiety**

29.3% of UC students felt so depressed that it was difficult to function. (2016)



An architectural rendering of a modern, multi-story building interior. The space is characterized by a central atrium with a glass facade, allowing natural light to flood the space. The building features multiple levels with white walls and ceilings, and large glass windows. People are shown on various levels, including a mezzanine and a ground floor, illustrating a multi-level, inclusive design. The text "First design idea - Scandinavian approach to inclusivity" is overlaid in blue on the central part of the image.

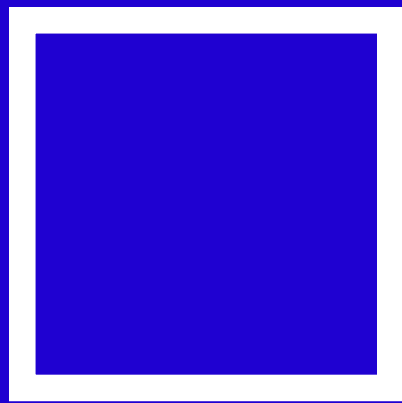
**First design idea
- Scandinavian approach to
inclusivity**

“How can we ensure new kinds of environments don’t become empty, unused spaces?”

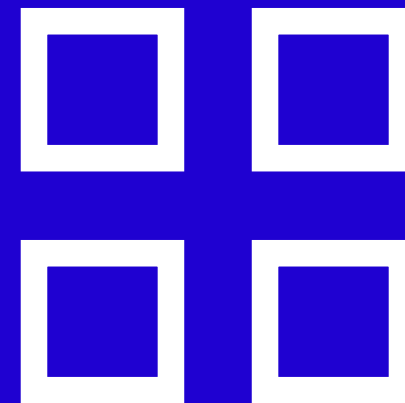
Drew Thilmany, Henning Larsen
Ph.d. stud., Anthropology



Inclusivity has a scale

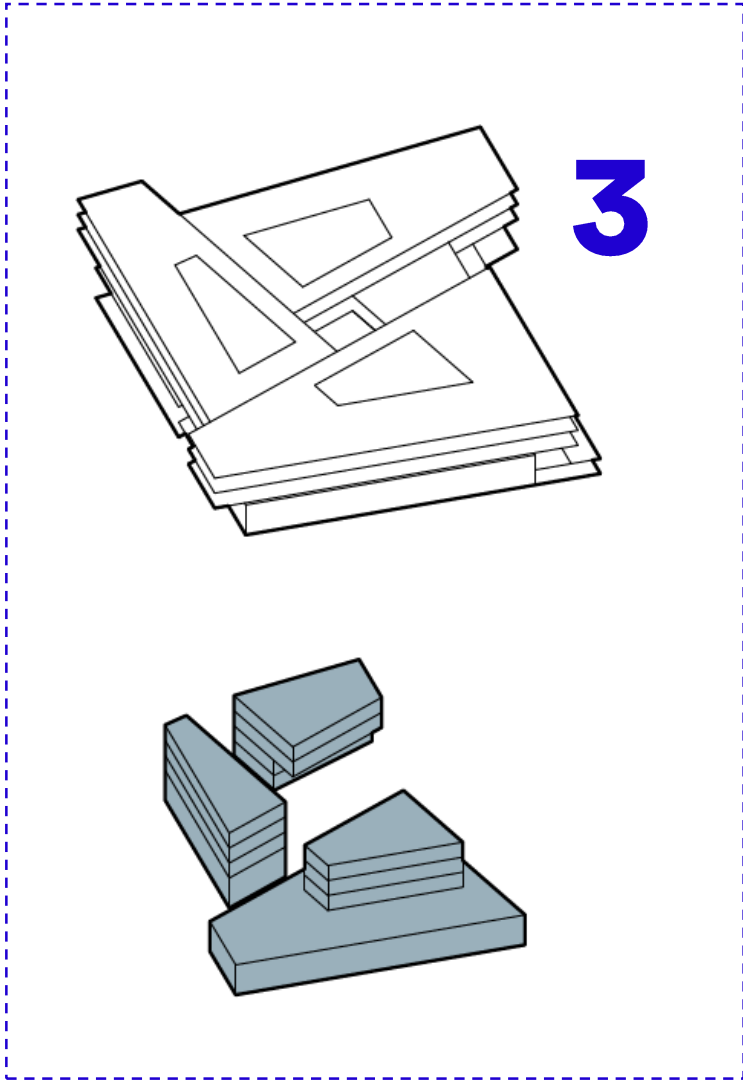
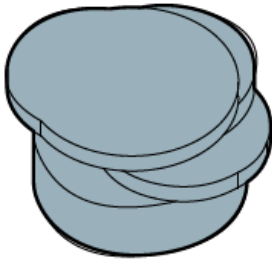
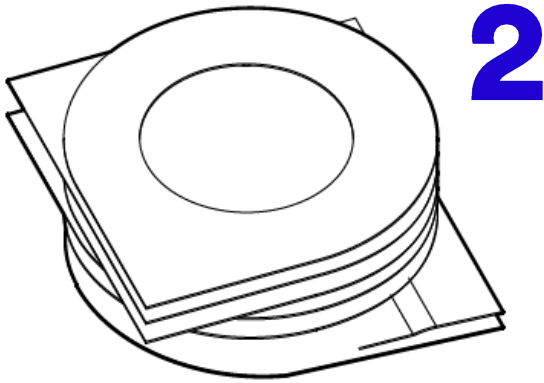
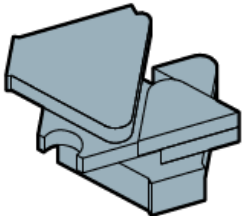
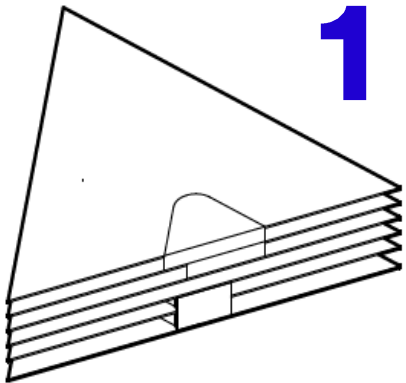


Anonymity (DK)



Recognition (US)

Design development





Turner

University of

CINCINNATI



Why to go Team
Proud to be a part of this
great day
Great team
a team

2020-2021
9/11

Robert
D. Pennington

Longball

2020-2021



**How can we document
the effect?**

Circulation spaces

Transforming the circulation spaces into social interaction spaces

Before



Future



vs.

CIRCULATION SPACES OLD VERSUS NEW

OLD BUILDING



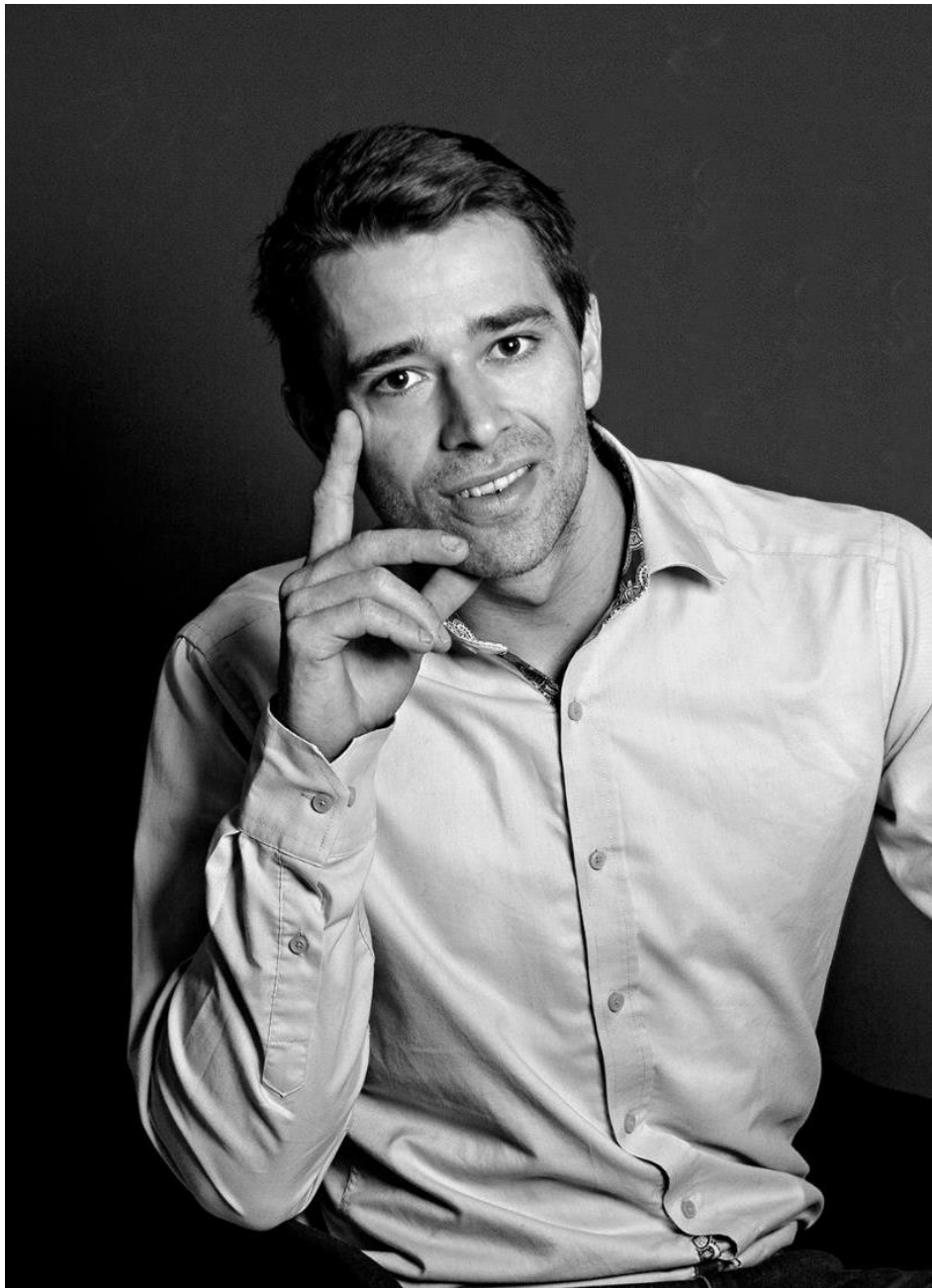
NEW BUILDING

18% OF ENTIRE
BUILDING

OF WHICH
60% ARE
PUBLICLY
ACCESSIBLE

25% OF ENTIRE
BUILDING

OF WHICH
73% ARE
PUBLICLY
ACCESSIBLE







Where do we measure ?



Building Typologies

- Functions and intended designs

Physical Environment

- Layout and ratios
- Design elements

Flows & Occupancy

- Behavioral patterns

Indoor Climate

- Noise and Light
- Temperature

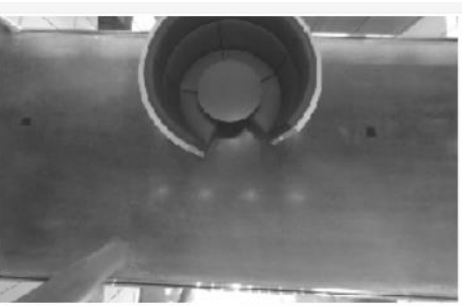
Usage & Activities

- Optional vs. necessary

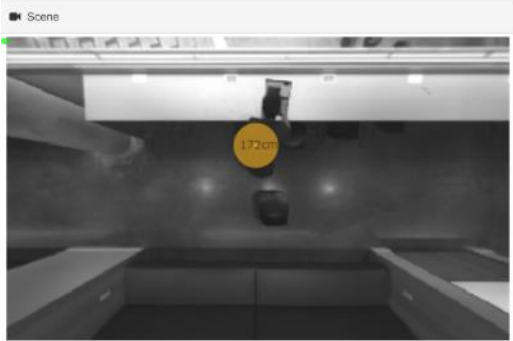
Where do we measure ?



video tracking traces Live maps path start/stop

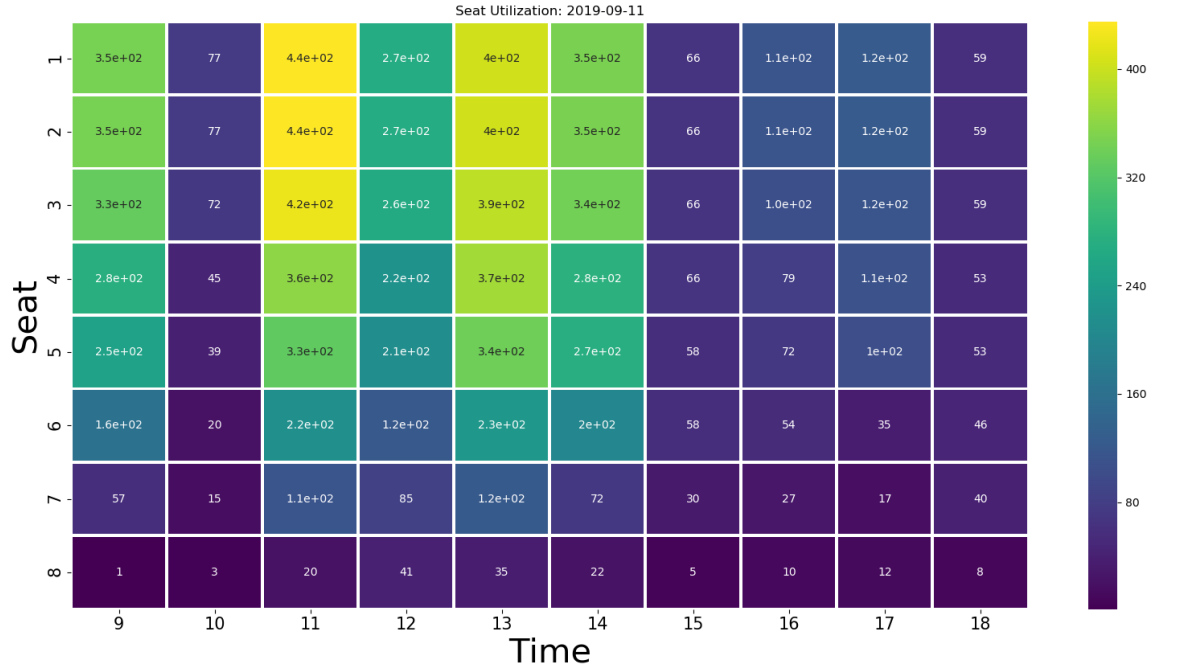


video tracking traces Live maps path start/stop

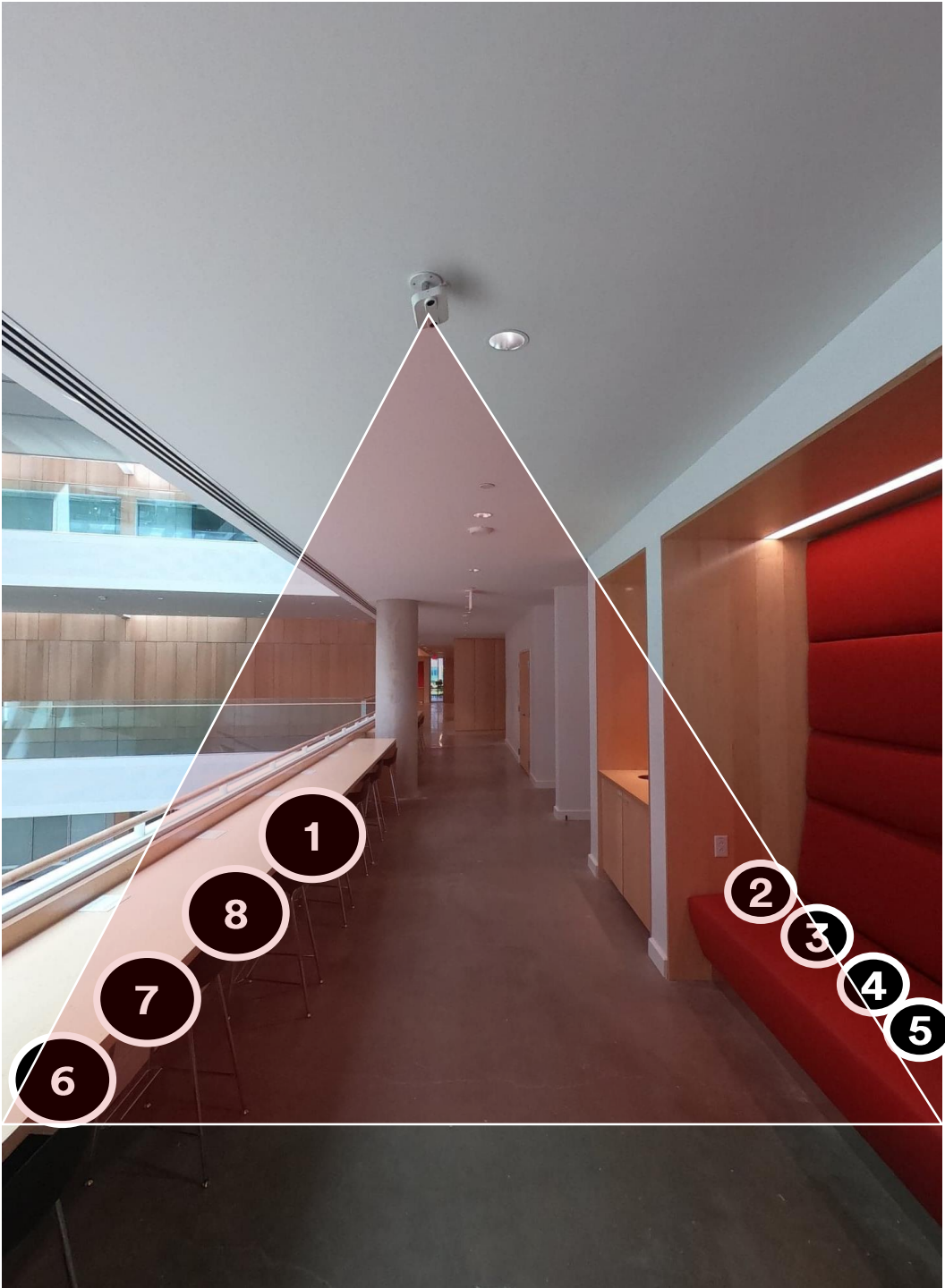


video tracking traces Live maps path start/stop

WALL AND WORK SEAT-UTILIZATION IN TIME



PEAKHOURS ONLY IN THE MORNINGS / EARLY AFTERNOONS



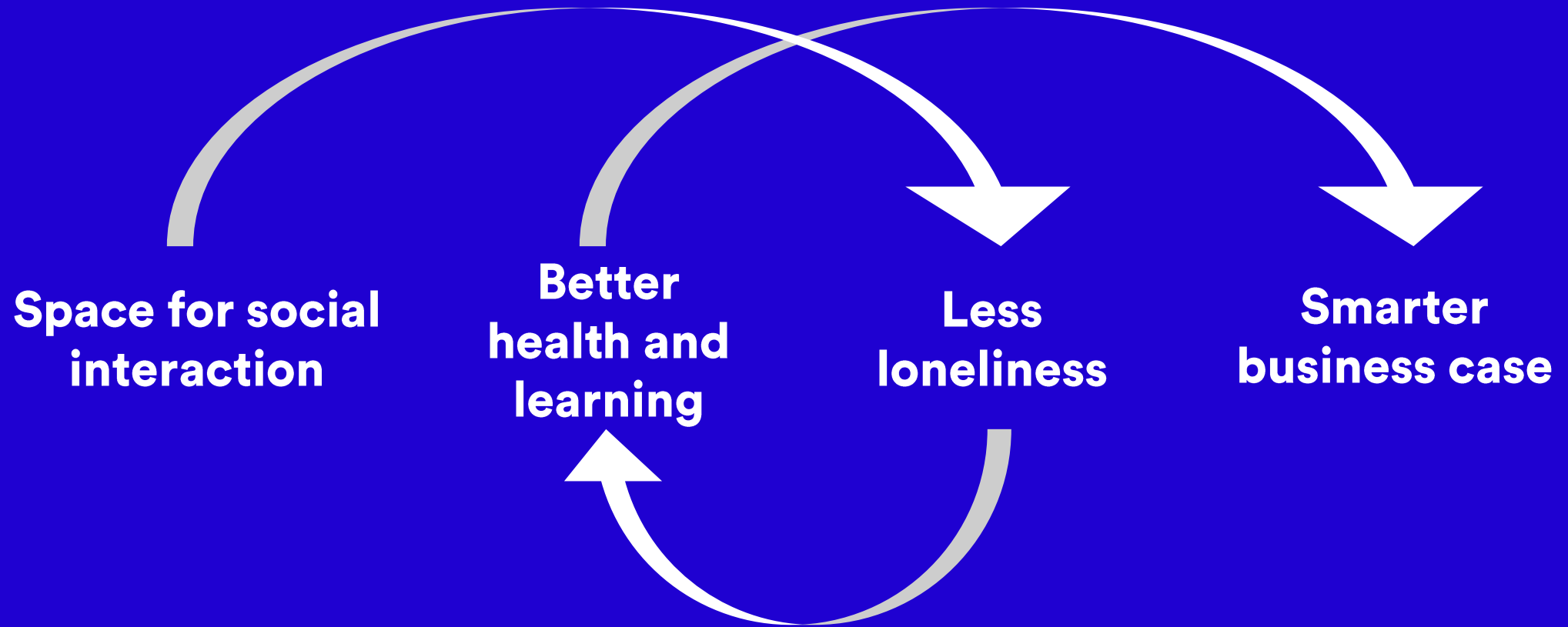




UP NEXT:

- **Deeper use and activity analysis of the functions**
- **Behavior and Wellbeing; stress levels**
- **Starbucks Sales Data**
- **Crime and Traffic**
- **Dropout rates**





“We shape our buildings and afterwards our buildings shape us.”

Winston Churchill

**Henning
Larsen** —

**Thank
you**

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