



# Fremtidens Byggeri



**Partner**  
**Jacob Strømann Andersen**  
**Henning Larsen**



# Design med viden

Fremtidens øjne på  
fremtidens byggeri



Jakob Strømann-Andersen

Partner, Head of Sustainability Engineering

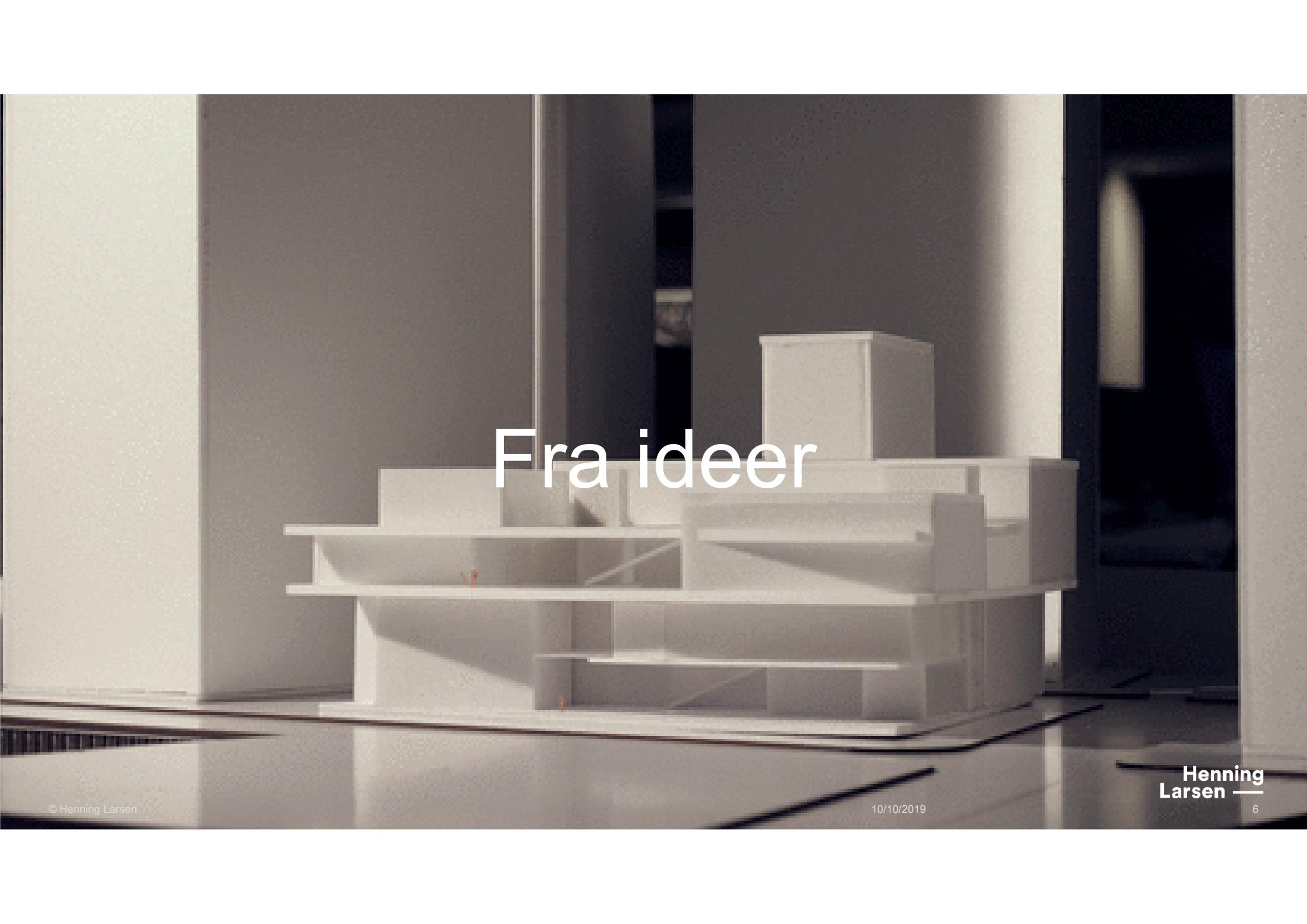
PhD, MSc. Arch. Eng.

DGNB Auditor, LEED AP, WELL AP









# Fra ideer





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

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

# A Time of Complex Challenges



Washington, US

Munich, Germany

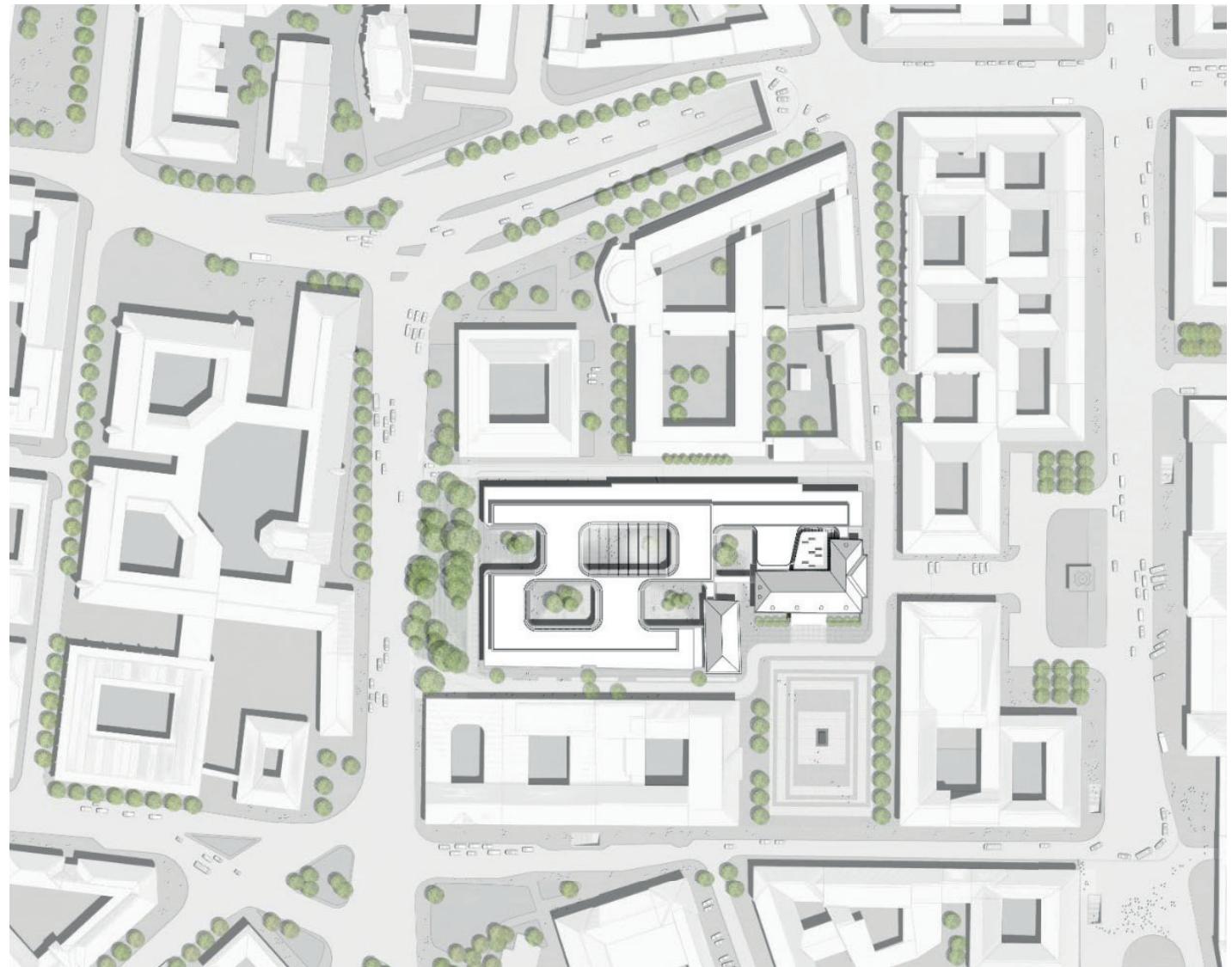
# Siemens Global HQ



**Identity**  
Historic link to Munich

**Visibility**  
Sustainable frontrunner  
in an urban context

**Urbanity**  
Modern and attractive  
work place



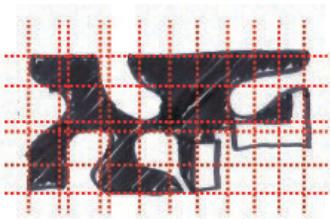
## Woven into the urban fabric



The site



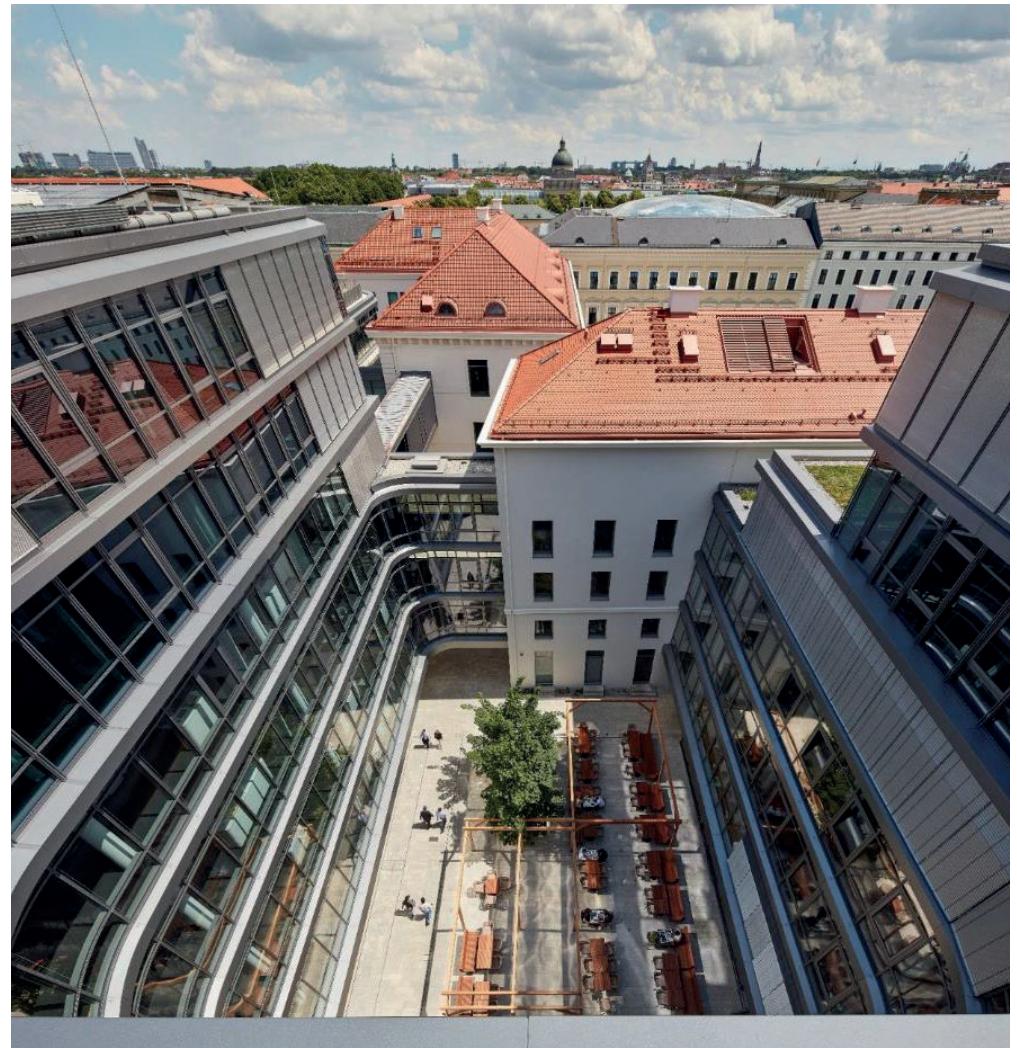
Inviting the public in



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

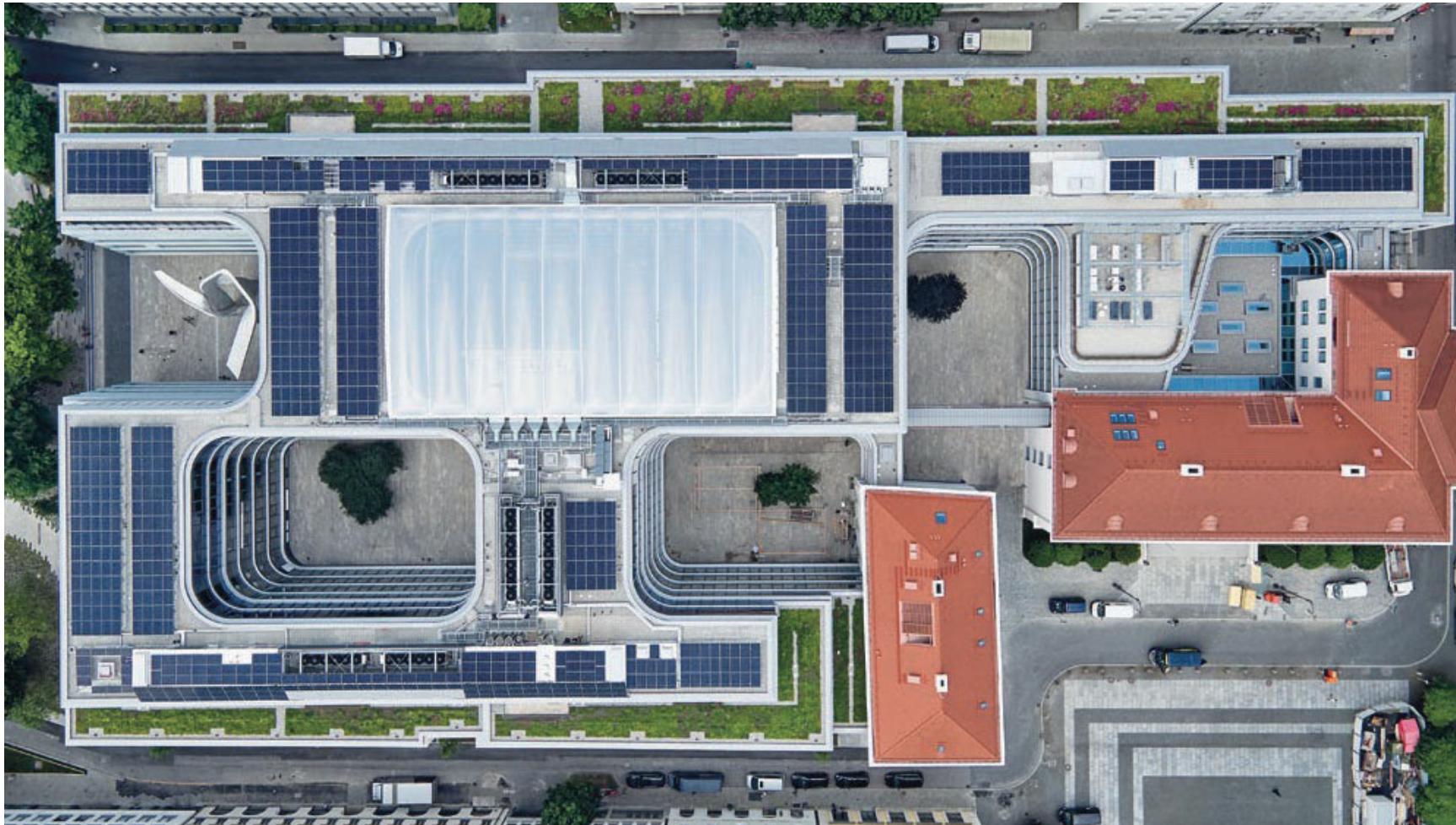


3 different façade strategies

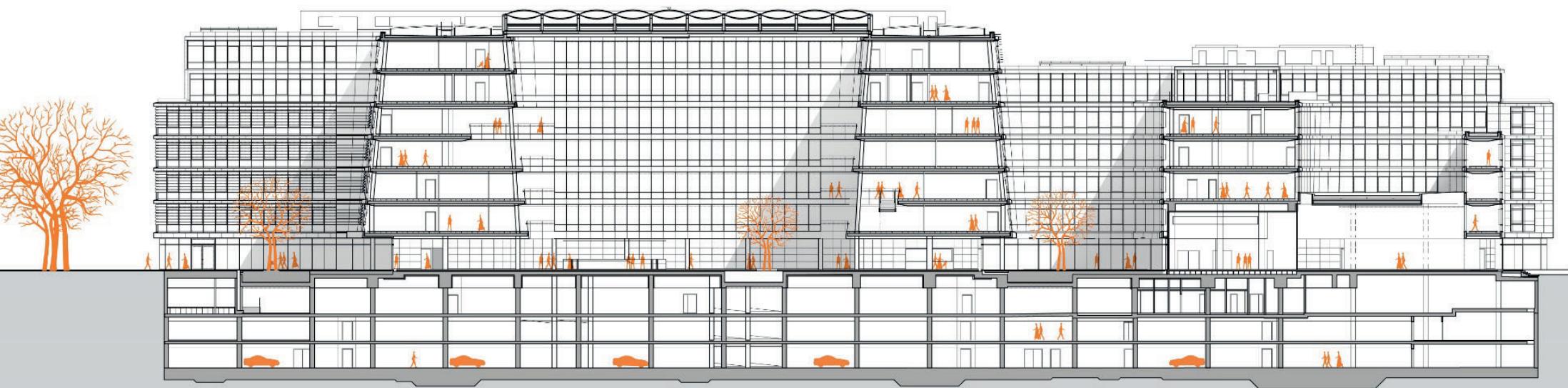
3: Significant and modern towards  
the heavy traffic



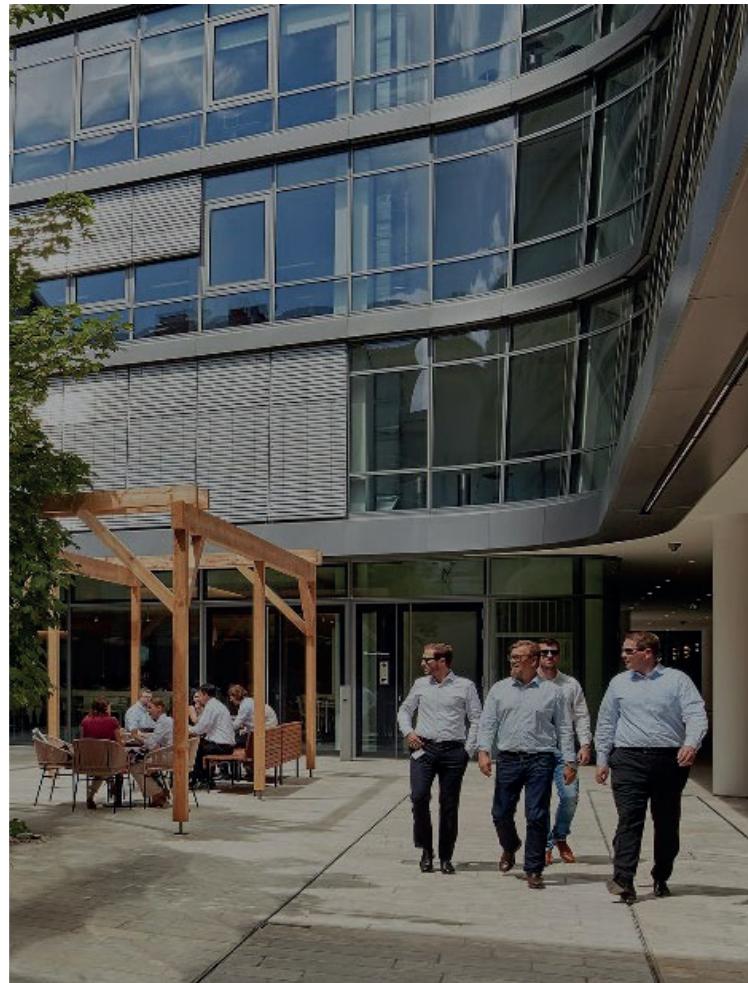
Sustainable by design  
Solar Power Generation by Photovoltaic Roof System



Sustainable by design  
Tilted inner faced for inflow of daylight



## A social contribution to the city





## INPUT

De spørgsmål vi stiller

- Drømme
- Visioner
- (Effekt)mål
- Fælles fortælling
- Data
- Målinger

## Arkitektur

## IMPACT

Den effekt vi skaber

- Effekten på brugerne
- Effekten på byen/samfundet
- Effekten på miljøet/naturen



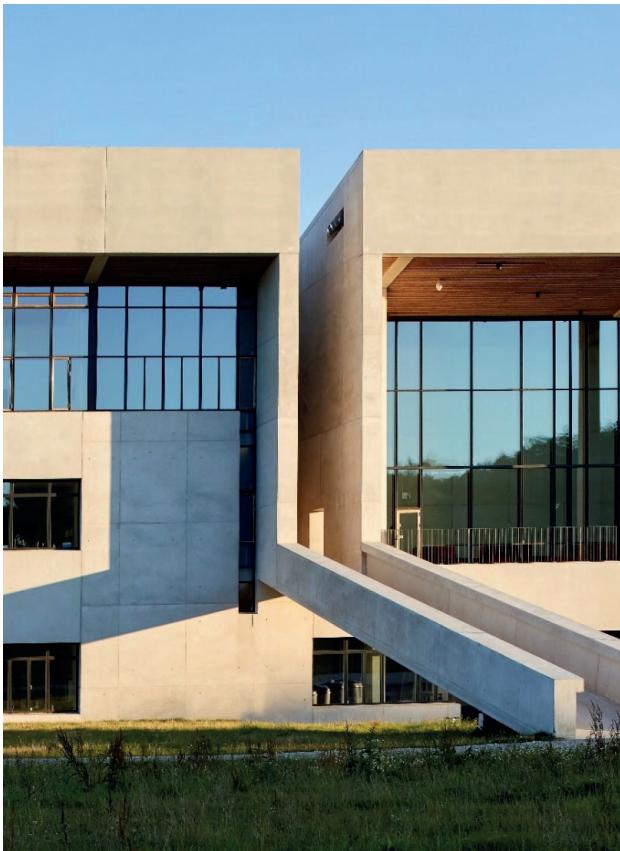












## Projects

**DESIGN WITH KNOWLEDGE**

New research in sustainable building  
Published by Henning Larsen Architects

## Design methods

Energy and Buildings 43 (2011) 2013–2020  
Contents lists available at ScienceDirect  
**Energy and Buildings**  
journal homepage: [www.elsevier.com/locate/enbuild](http://www.elsevier.com/locate/enbuild)

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

J. Stremann-Andersen<sup>a,\*</sup>, P.A. Sattrup<sup>b</sup>

<sup>a</sup> Department of Civil Engineering, Technical University of Denmark, Bygning Building 110, 2800 Kgs. Lyngby, Denmark

<sup>b</sup> Institute of Building Technology, Royal Danish Academy of Fine Arts School of Architecture, Philip de Gargue Allé 10, 1468 Copenhagen K, Denmark

#### ARTICLE INFO

Article history  
Received 8 September 2010  
Received in revised form 30 March 2011  
Accepted 10 April 2011

Keywords:  
Urban density  
Building form  
Daylight  
Solar radiation  
Intergenerational design

#### ABSTRACT

The link between urban density and building energy use is a complex balance between climatic factors and building form, material and use, outcome of urban form and the buildings that surround 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 determine the relative primary factor on the passive energy properties of buildings as affected by variations in urban density. It was found that the geometry of urban canyons has an impact on total energy consumption in the range spaces (the streets, squares and yards) surrounding buildings. The geometry of urban canyons is a key factor in energy efficient cities. It was demonstrated how the effects of various urban plans are important, previously under-estimated role, which needs to be taken into account when designing low-energy buildings in dense cities. Energy optimization of urban and building designs requires a detailed understanding of the complex interplay between the temporal and spatial phenomena taking place, merging qualitative and quantitative considerations.

© 2011 Elsevier B.V. All rights reserved.

#### 1. Introduction

One of the most basic and fundamental questions in urban master planning and building regulations is how to secure citizens 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. This paper presents a study of the relationship between urban planning 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 proportion of the street, because the main problem of urban canyons and districts between buildings is relative access to light and natural 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 planning to describe the way buildings affect the microclimate in special environmental conditions. It is a spatial archetype that allows us to integrate knowledge from several different specialised

\* Corresponding author. Tel.: +45 4673 1860; fax: +45 4673 1700.  
E-mail address: [joseph@ruc.dk](mailto:joseph@ruc.dk); [jstremann-andersen@ruc.dk](mailto:jstremann-andersen@ruc.dk).

0378-7788 - see front matter © 2011 Elsevier B.V. All rights reserved.  
doi:10.1016/j.enbuild.2011.04.007

146 | DESIGN WITH KNOWLEDGE | RESEARCH ARTICLES

## Research

# Hvorfor forsker vi?



Fordi vi leder efter løsninger, der kan kvalificere vores arkitektur og skabe højest muligt næringsindhold for brugerne i vores bygninger og byer.

Det handler ikke om, hvordan bygninger  
og bymiljøer ser ud, men hvad de kan

# Forskning

# In-house Industrial PhDs Programs



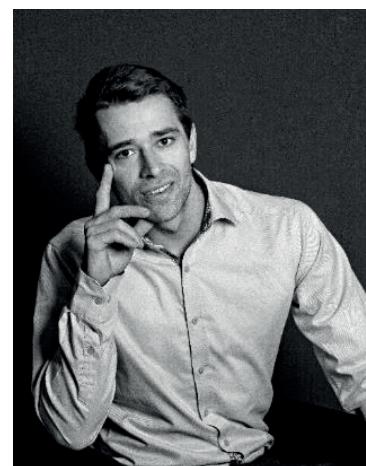
Imke Wies van Mils

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

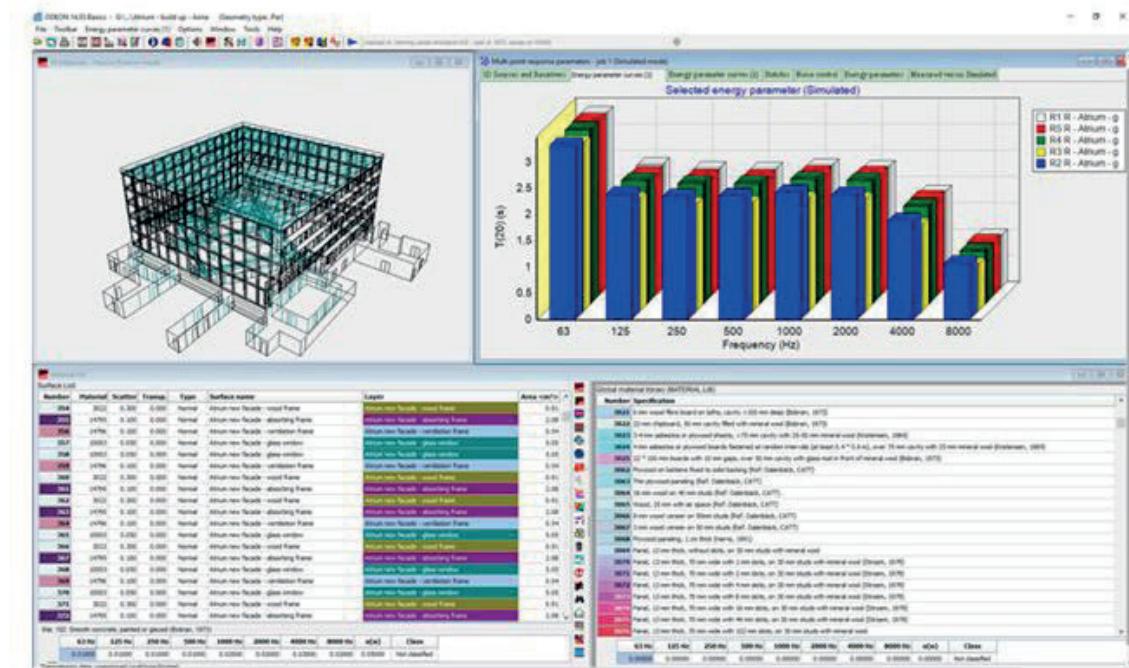
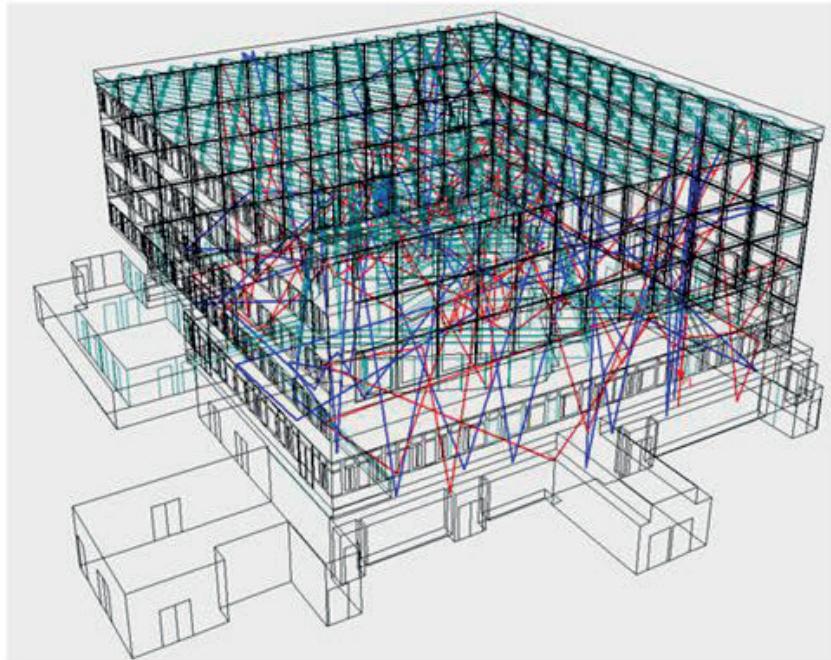






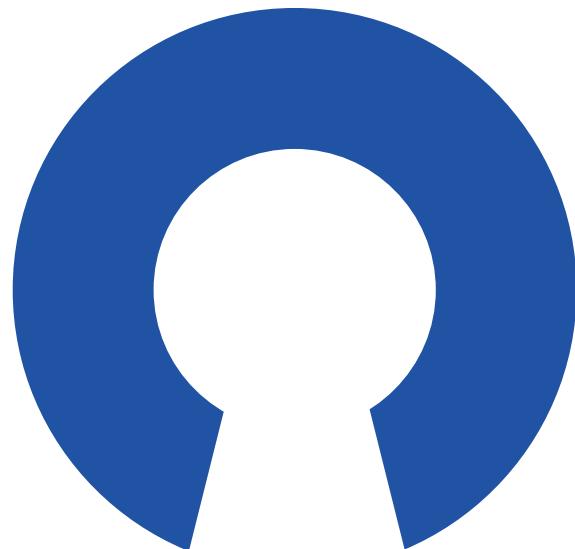
Uppsala City Hall

# Research virtual acoustics



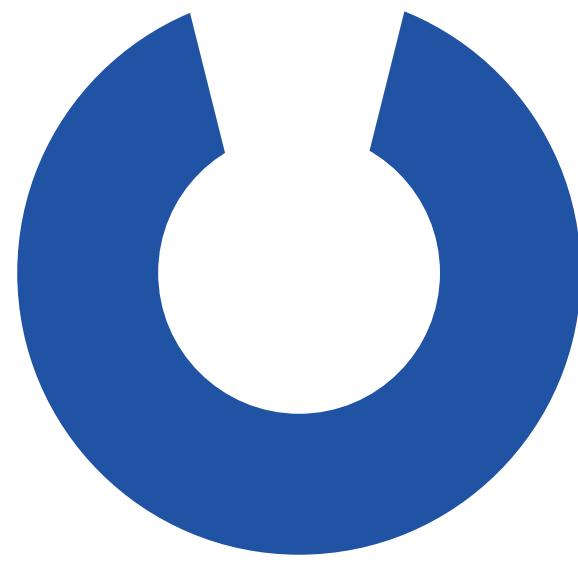
Uppsala City Hall

# Research virtual acoustics



closed source

VS



open source

Uppsala City Hall

# Combining technologies

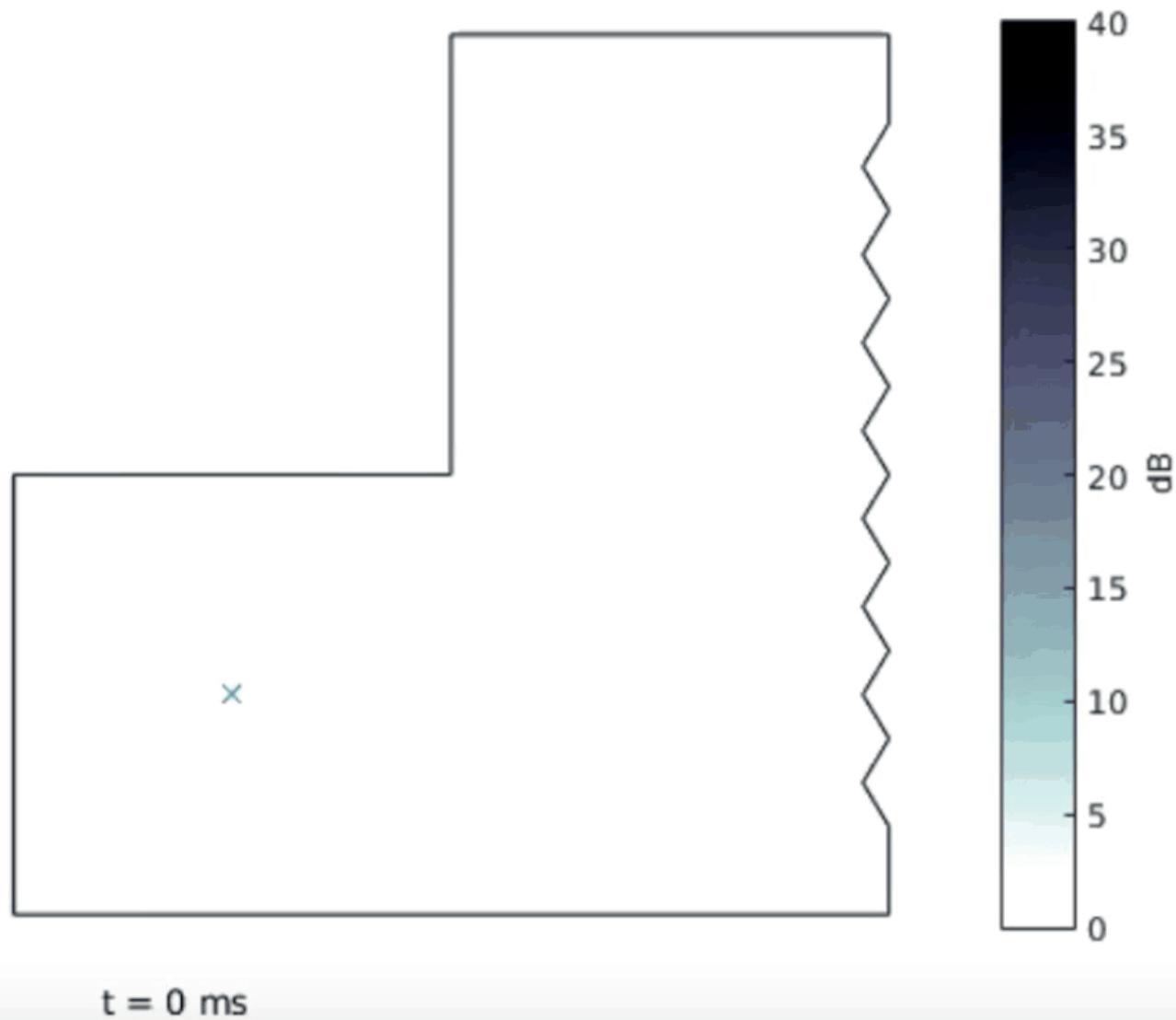


Marine and Offshore CFD Simulation



VR in gaming industry

## 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)
{
    #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;
        ElementPoint 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 + "," + roomPoint.Z);

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

        foreach (IBoundarySegment 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.RBS_WALL_LENGTH);
                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
}

```

Code Editor (Left): C# code for an add-in associated with Uppsala City Hall. The code implements a command to get wall information based on room coordinates.

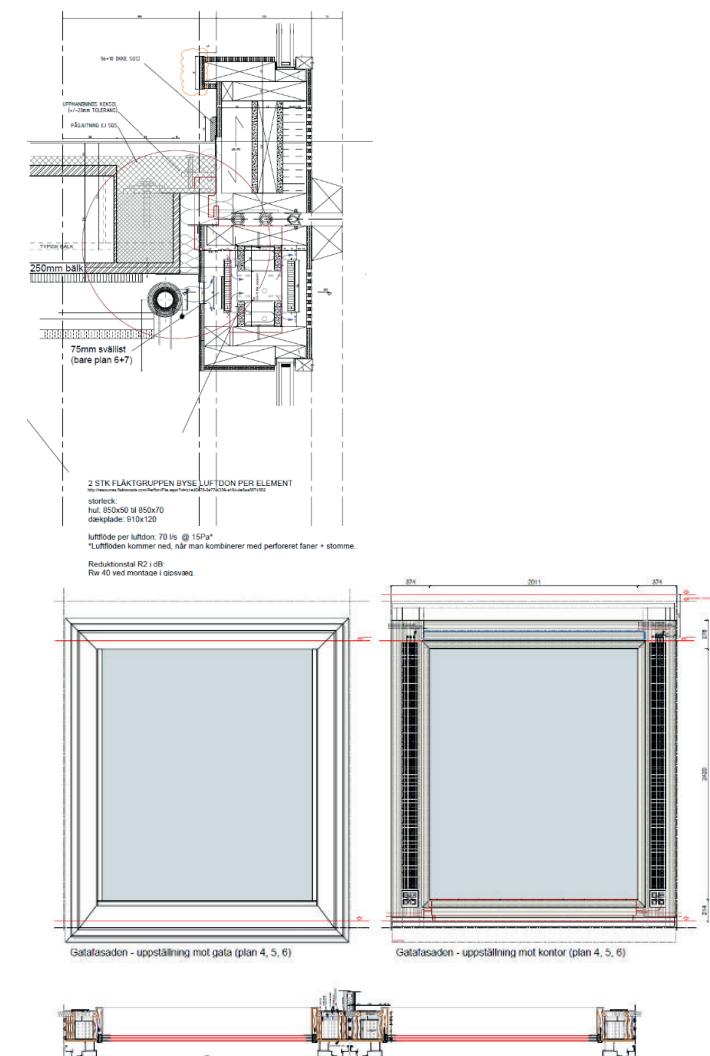
Solution Explorer (Top Left): Shows the project structure for 'HL\_Tools' with files like HL\_Tools.cs, HL\_Tools.h, and HL\_Tools.sln.

Properties (Top Center): Set to 'Floor Plan' view type. View Scale is 1:100. Discipline is set to 'Architectural'. Other settings include Normal display model, Medium detail level, and Show Original parts visibility.

Project Browser (Top Right): Lists working views for the floor plan, including 'Floor Plan: AAB - Plan 1, Källar', 'Floor Plan: AAB - Plan 2, Bott', and 'Floor Plan: AAB - Plan 3, Välin'.

Autodesk Revit 2018 Viewport (Bottom): Displays a 3D rendering of the interior of Uppsala City Hall, showing a modern architectural design with glass walls, wooden panels, and greenery. A character is visible in the background.

Autodesk Revit 2018 Top Bar: Includes tabs for File, Architecture, Structure, Insert, Annotate, Analyze, Massing & Site, Collaborate, View, Manage, Add-Ins, Escape, Quantification, Henning Larsen Toolkit, Extensions, Modify, and more.







Aarhus, Denmark

# Frederiksberg School



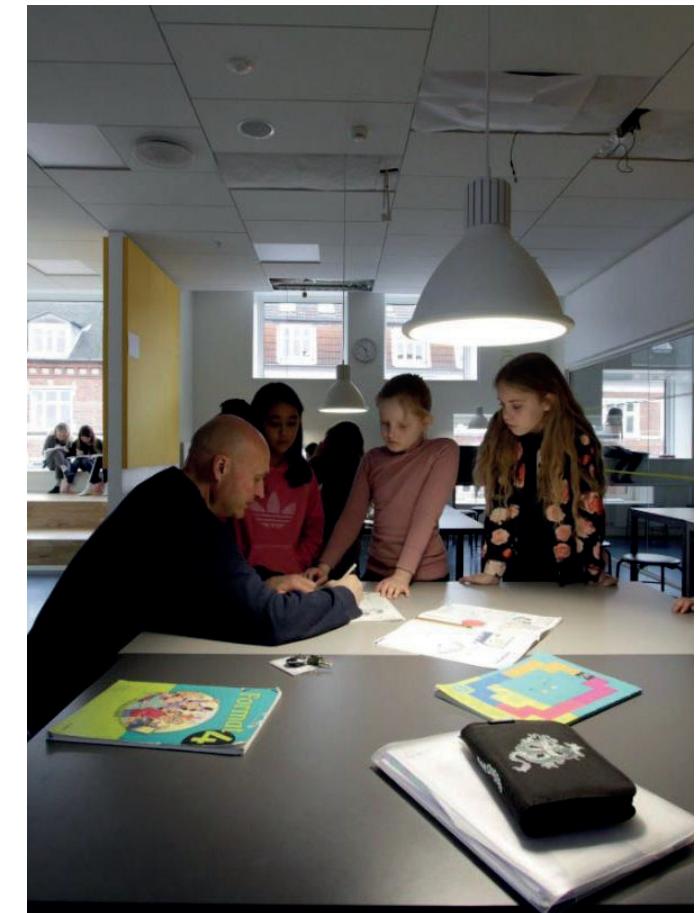


Frederiksbjerg School

# A new way of learning about...







Combining the audio and visual human experience

# New Research in Light, Acoustics and Learning



70 – 90 dB (annoying)



40 – 60 dB (quiet)

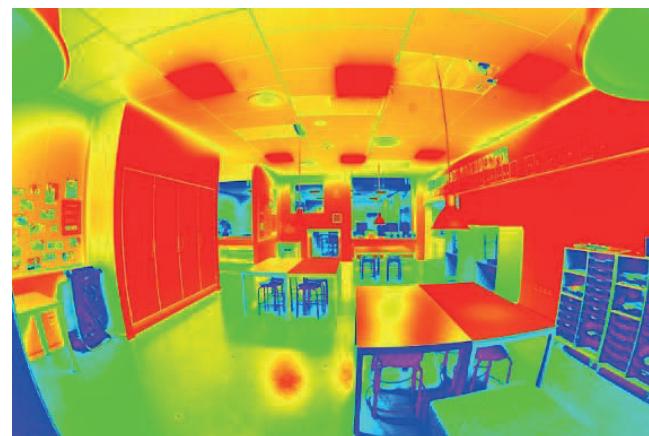


# Experimenting with mood lighting

Normal  
Ambient Lighting



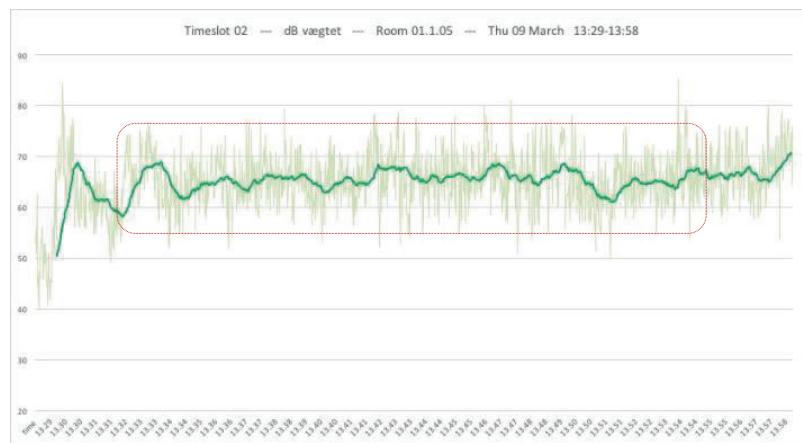
Experiment  
Focused lighting



## Default, traditional ceiling lighting (video snapshot)



## Pendant lighting activated (video snapshot)



# Findings

Vores data peger på et fald på mellem 2 – 8 dB

- 1 dB: Mærkbart med særligt udstyr i et lydtæt rum
- 2-3 dB: Mærkbart i et “normalt miljø” (men måske bemærker du det kun, når adspurgt)
- **4-6 dB: Meget mærkbart i “normalt miljø” (elever vil mærke forskellen)**
- 7-8 dB: Signifikant. Det vil være meget tydeligt.
- 10 dB: 50% forandring, der er meget hørlig

**64 dB**



**58 dB**



**64 dB**



**58 dB**



# Samlet resultat:

- Ro på børnene
- Hyggelige
- 35% lavere energiforbrug til el
- Mindre støj - op til 8 dB(A)
- Ny forretning

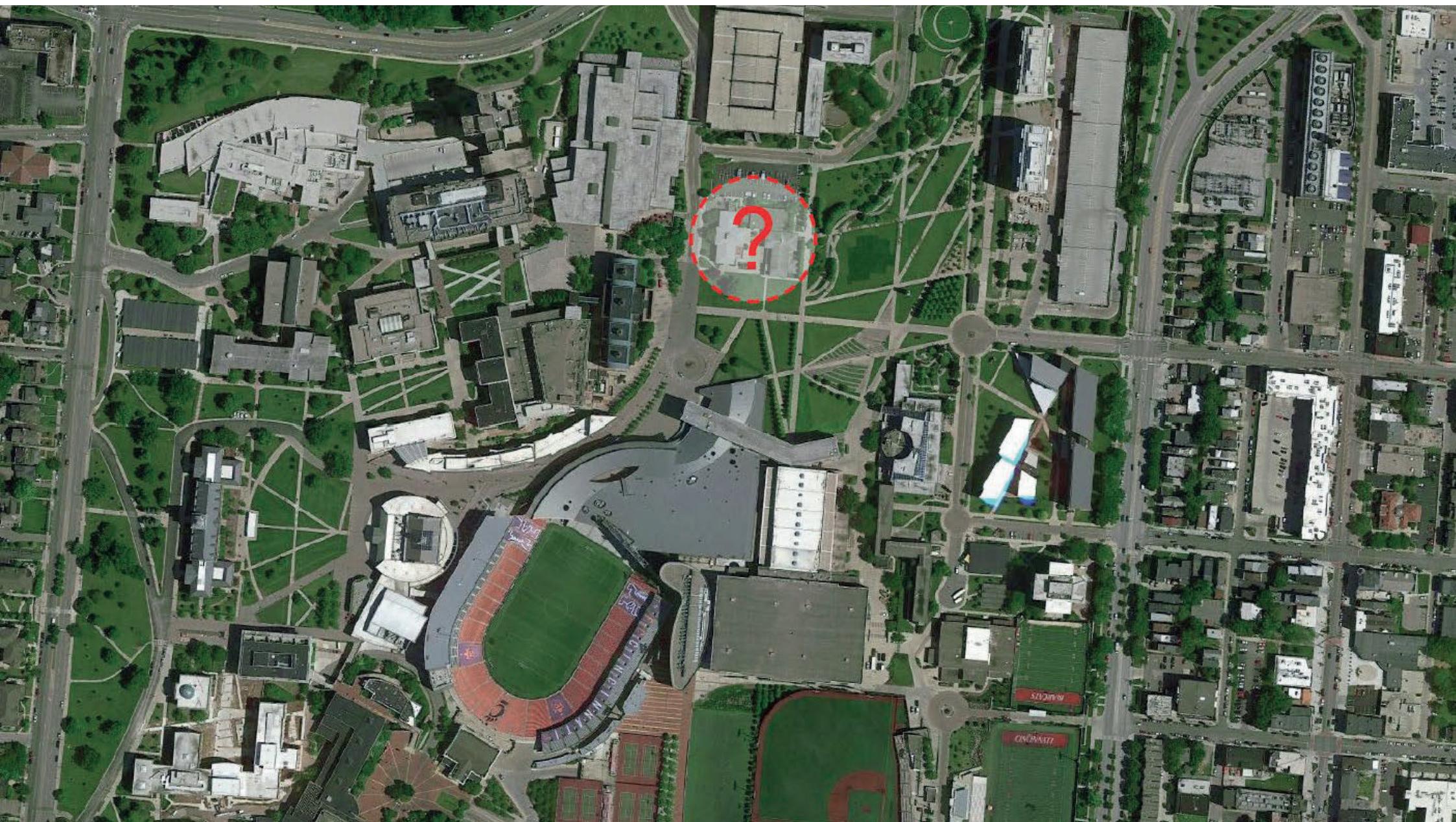
# **Carl H. Lindner College of Business**

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)**







“You don’t know what inclusivity means to us.”

**David Szymanski**  
Dean, Lindner College of Business  
University of Cincinnati

“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)

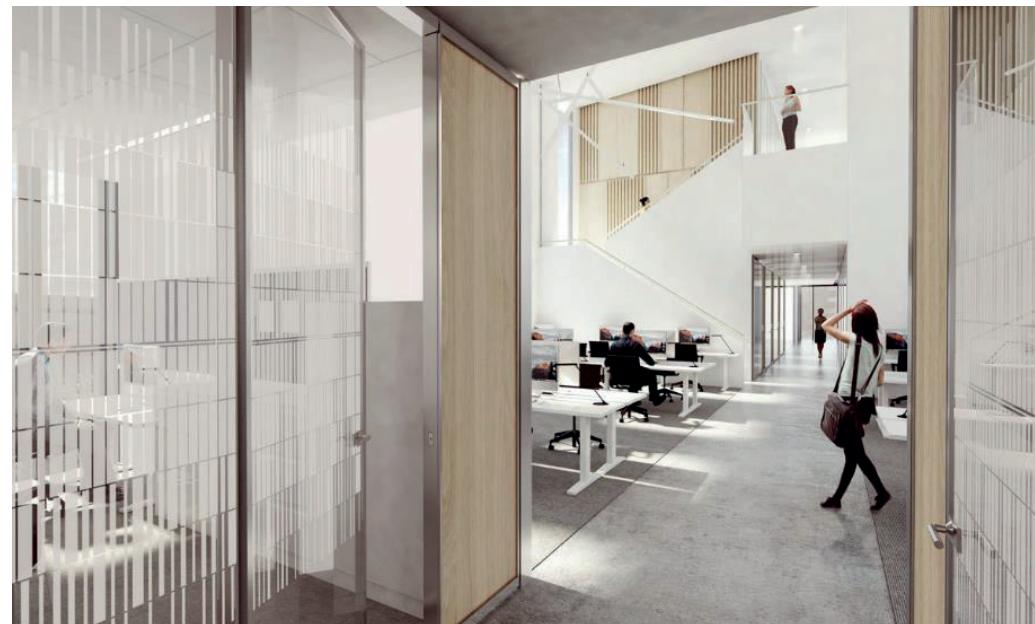
Circulation spaces

## Transforming the circulation spaces into social interaction spaces

Before



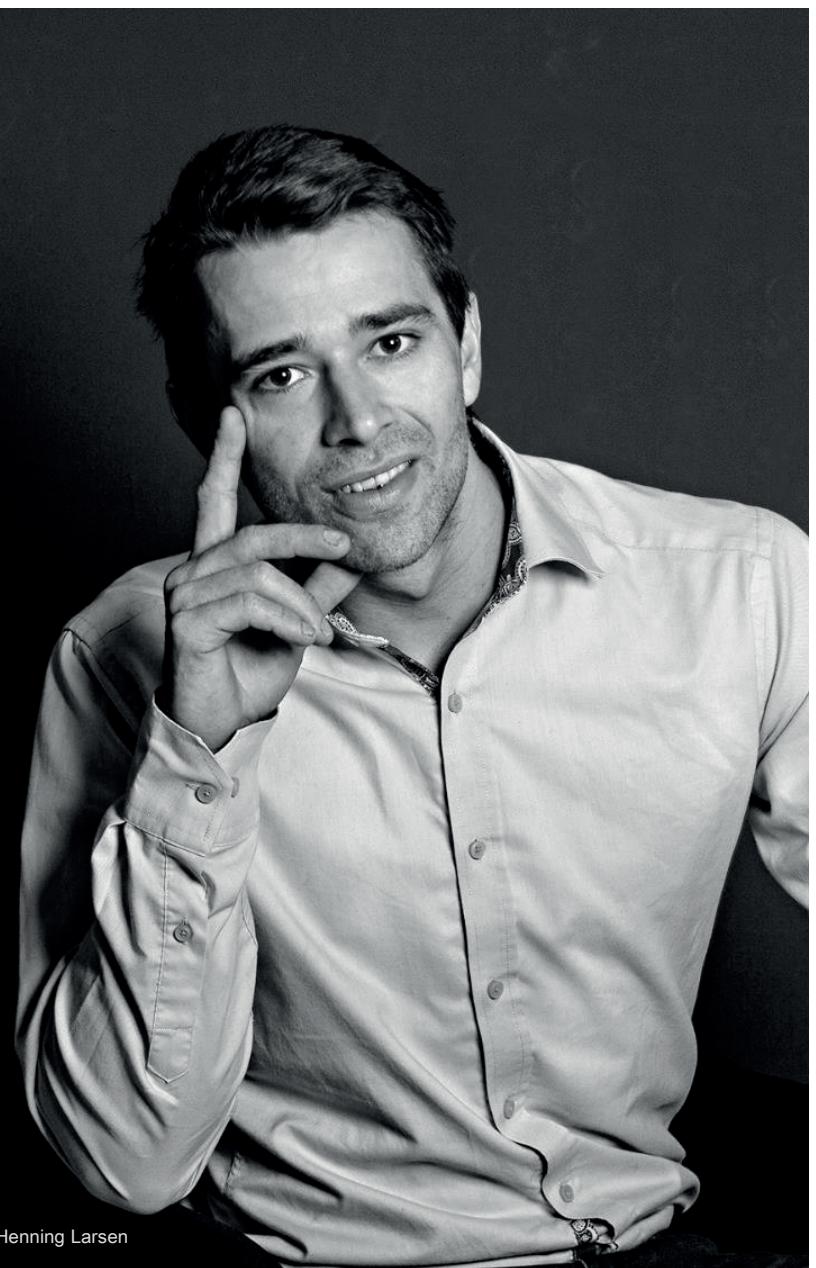
Future



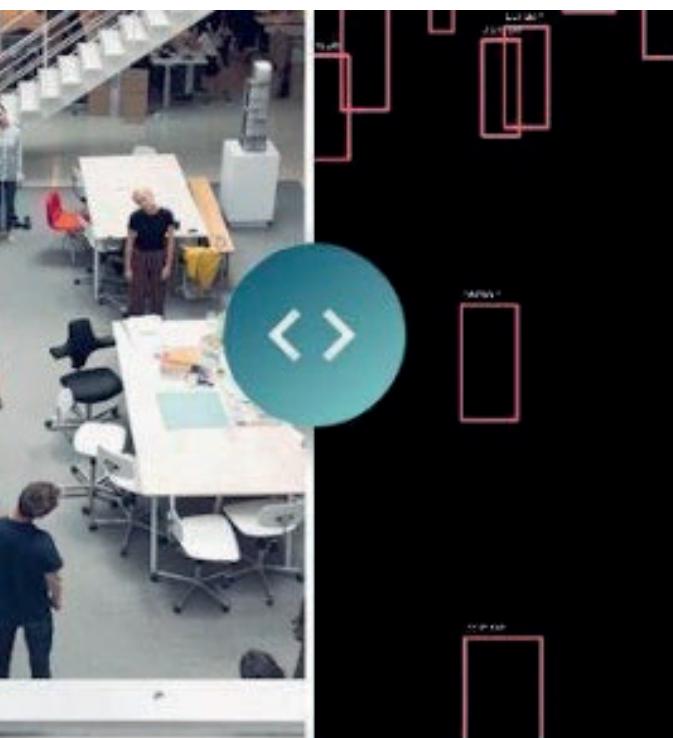
vs.

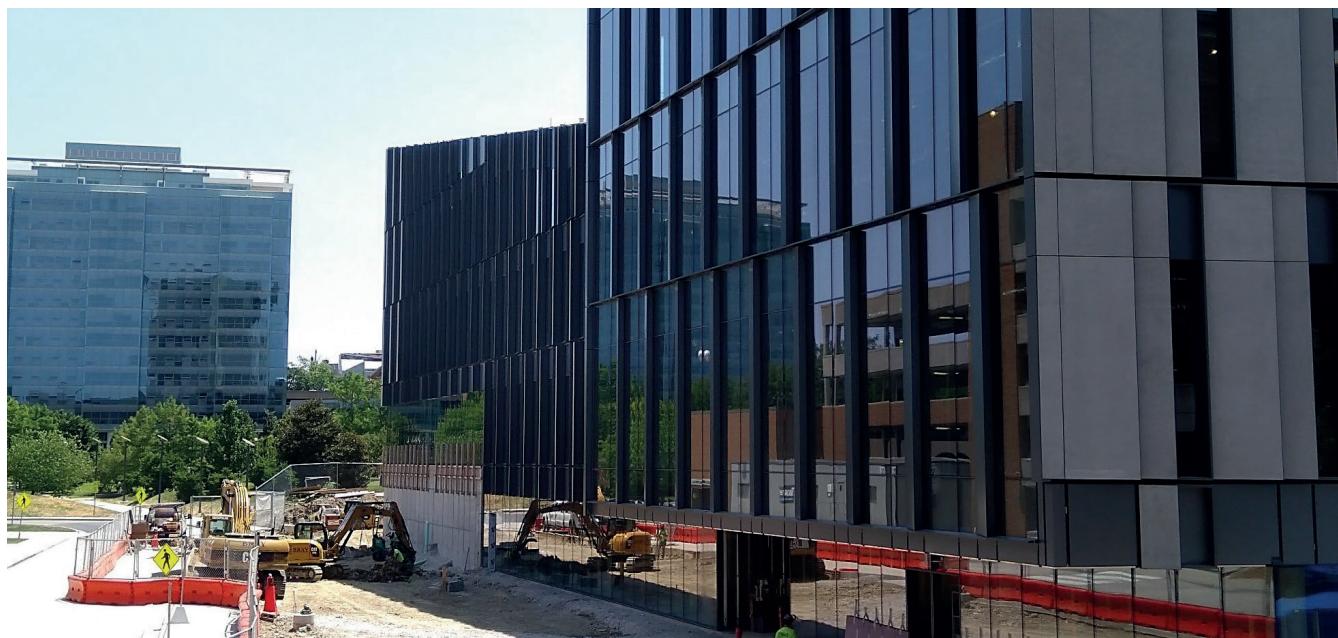
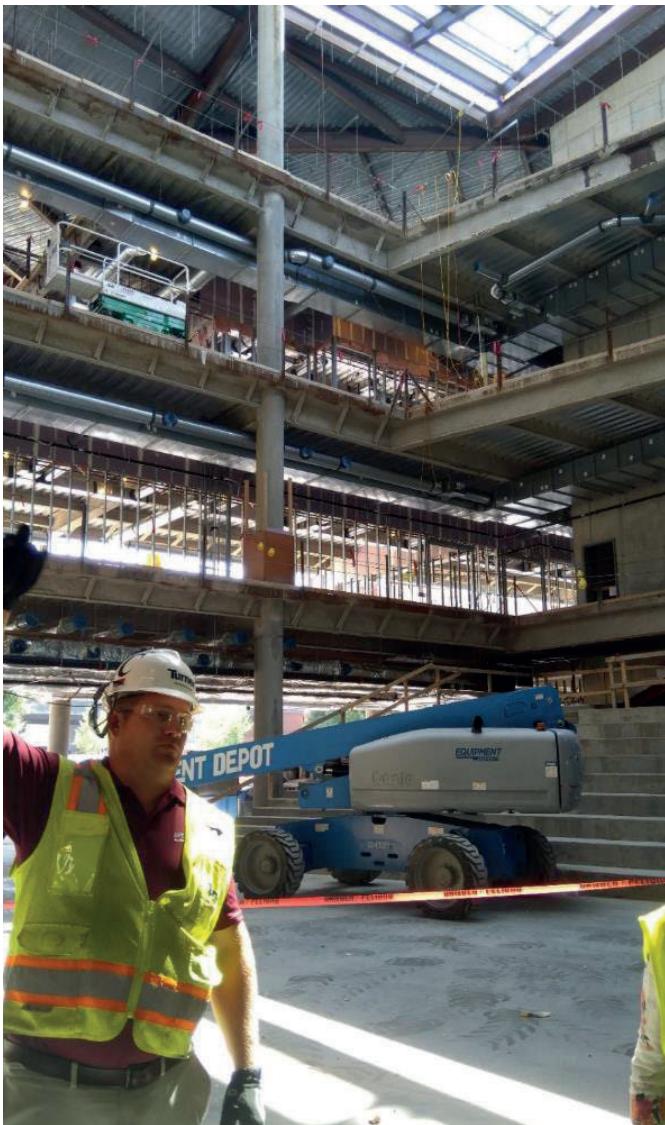


# How can we document the effect?



© Henning Larsen







# Where do we measure ?



## Building Typologies

- Functions and intended designs

## Physical Environment

- Layout and ratios
- Design elements

## Flows & Occupancy

- Behavioral patterns

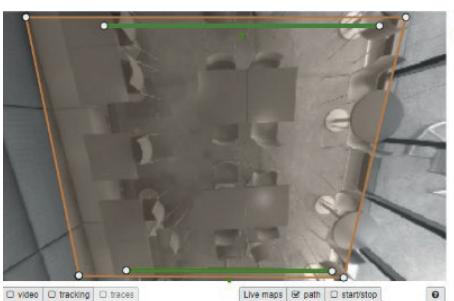
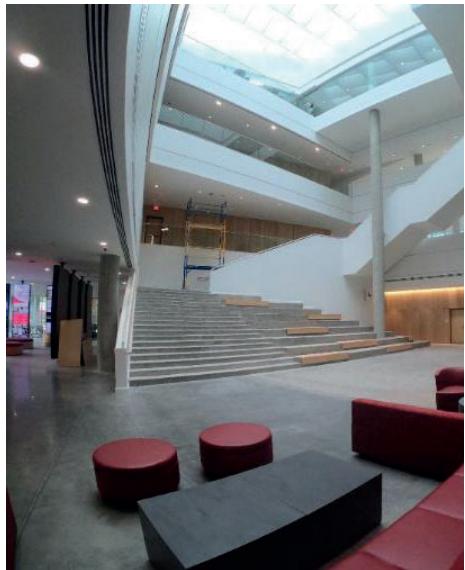
## Indoor Climate

- Noise and Light
- Temperature

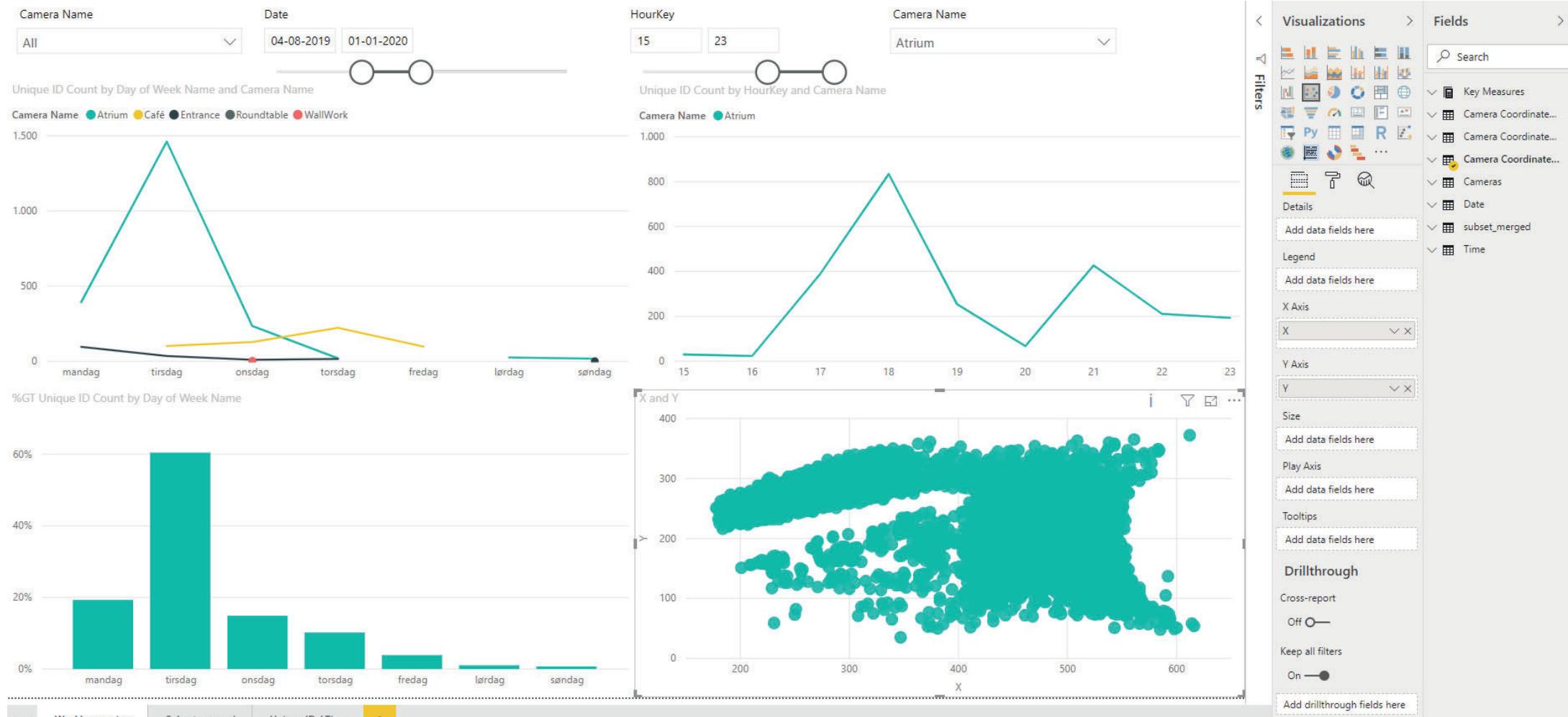
## Usage & Activities

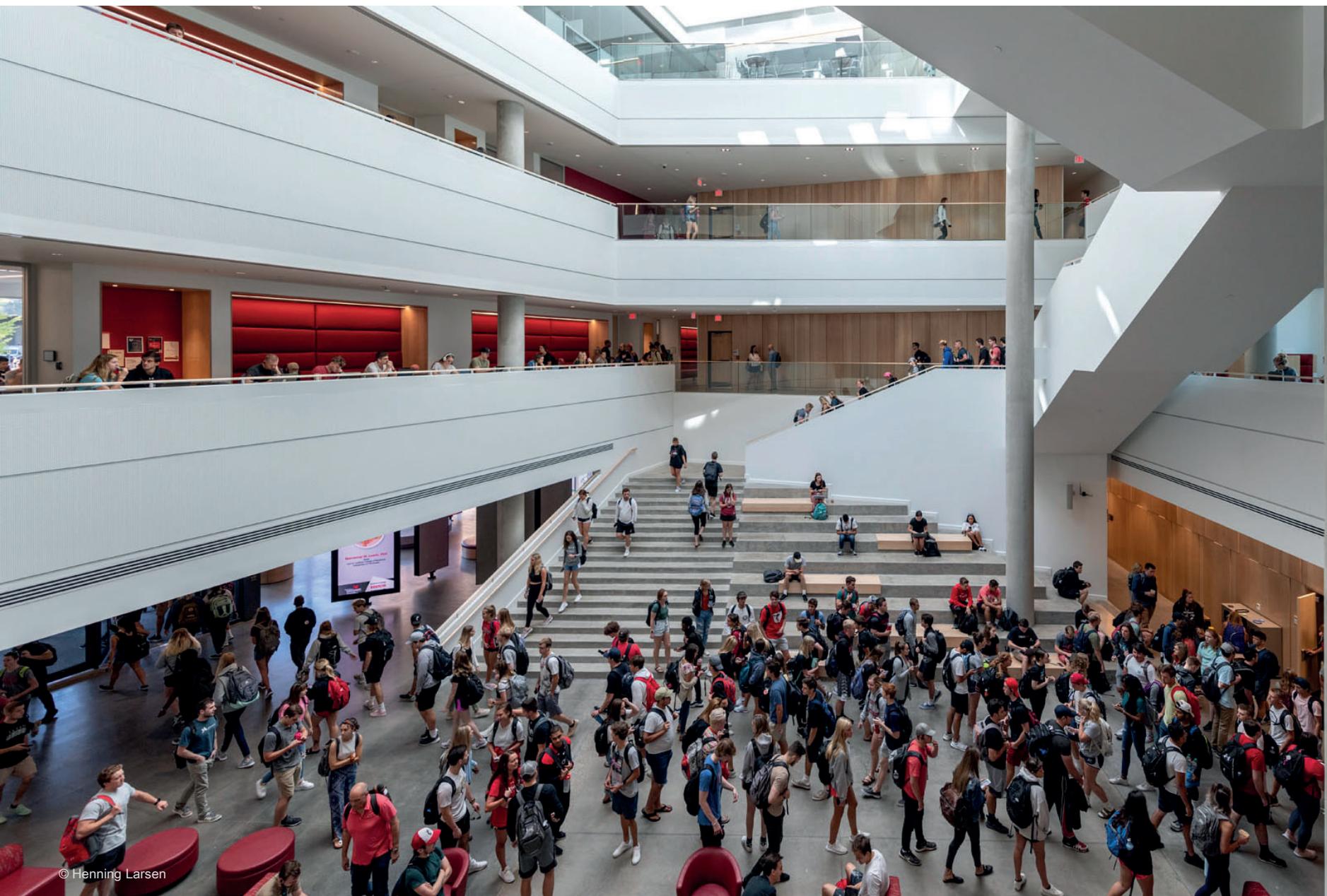
- Optional vs. necessary

# Where do we measure ?



# Dashboards



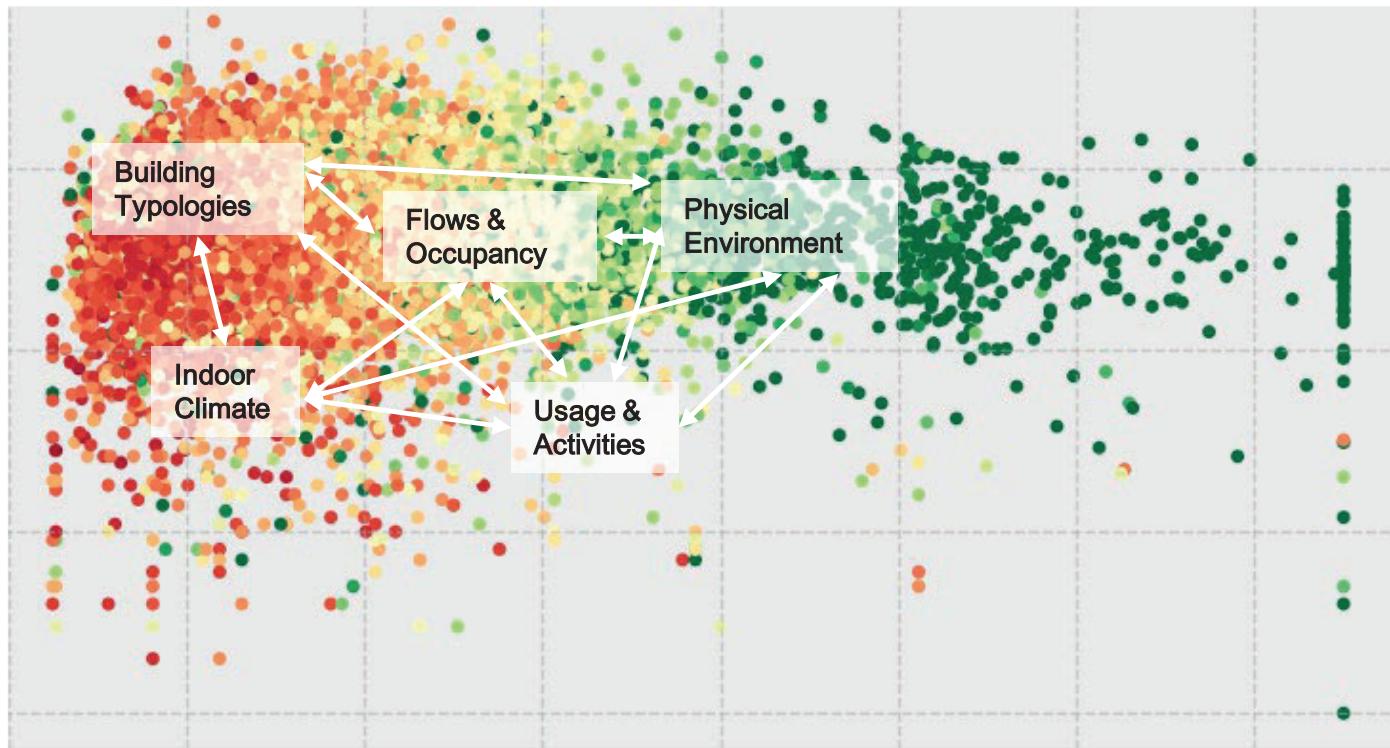


© Henning Larsen

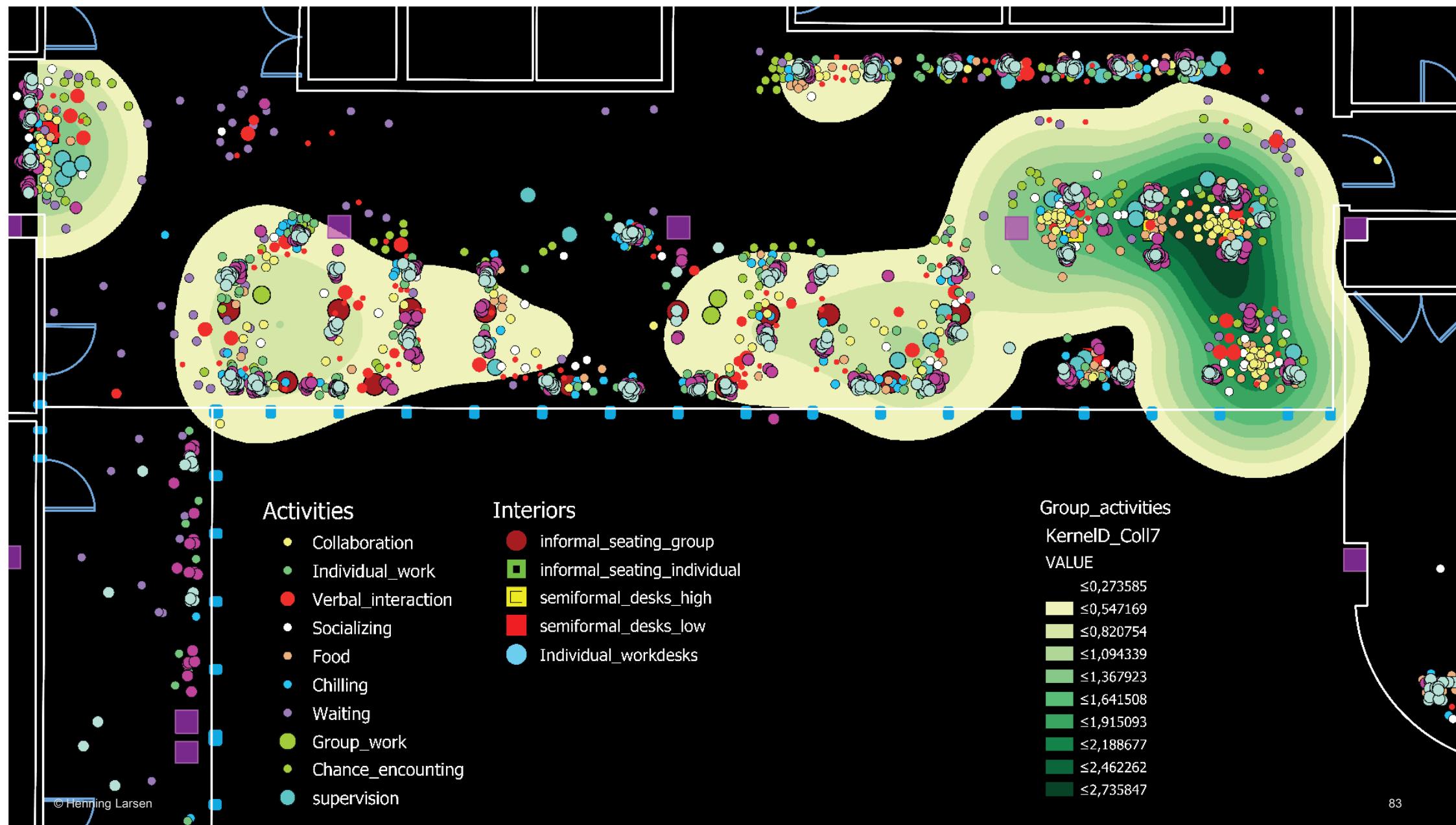
# Clustering and Classification

The clustering algorithms: Create heat maps of users and activities in the different building functions.

The classification algorithms: Identify and predict correlations between users and space conditions.

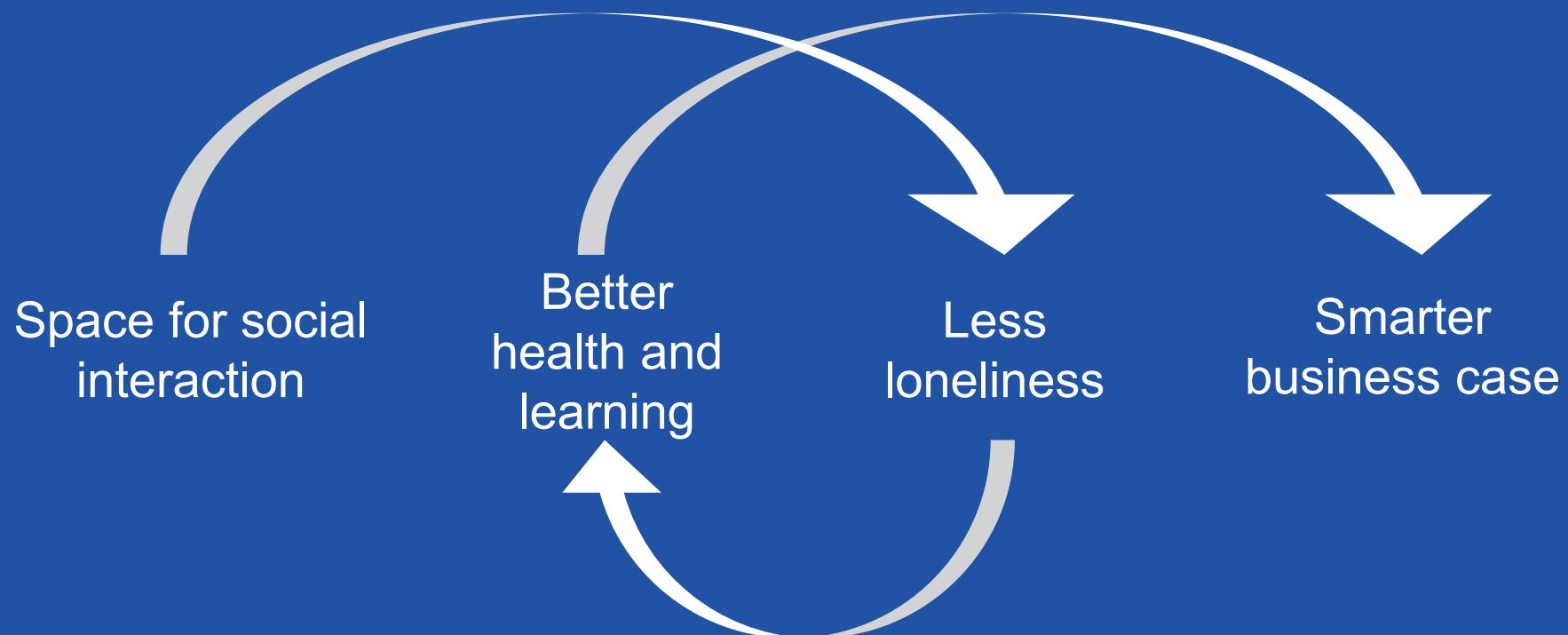


Source: [https://files.realpython.com/media/gridspec\\_ex.9bce5a0726e9.png](https://files.realpython.com/media/gridspec_ex.9bce5a0726e9.png)









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

Winston Churchill

# Tak!

JSTR@henninglarsen.com

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

