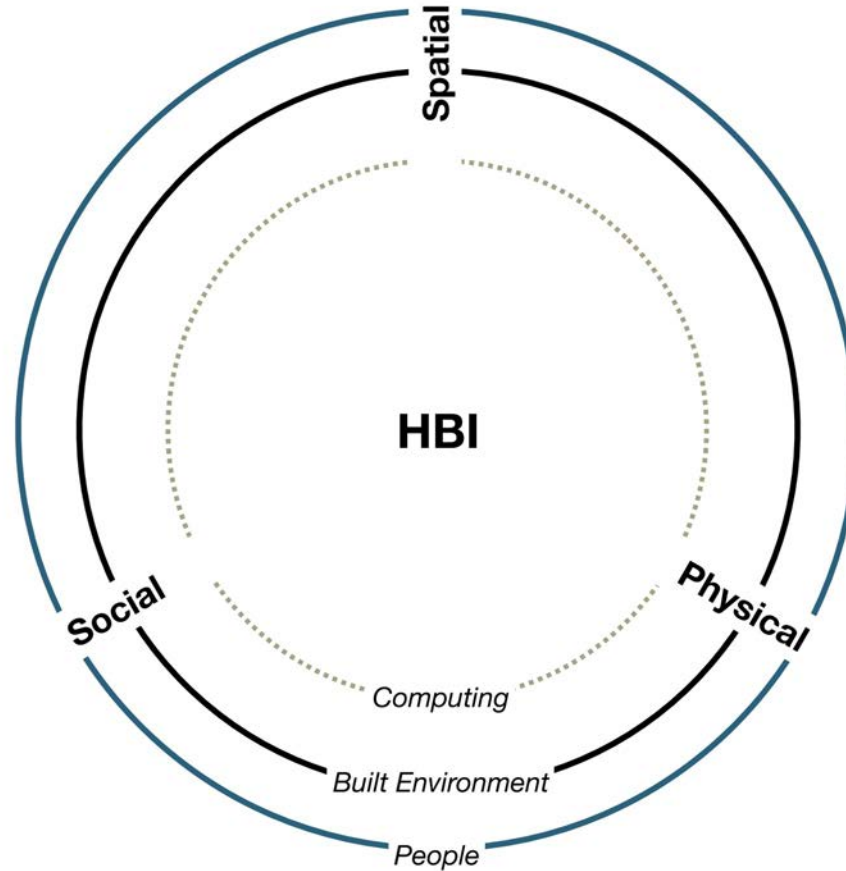




Co-Designing Multisensory Biophilic Learning Spaces

Shruti Rao, Hamed Alavi

Our research: HBI

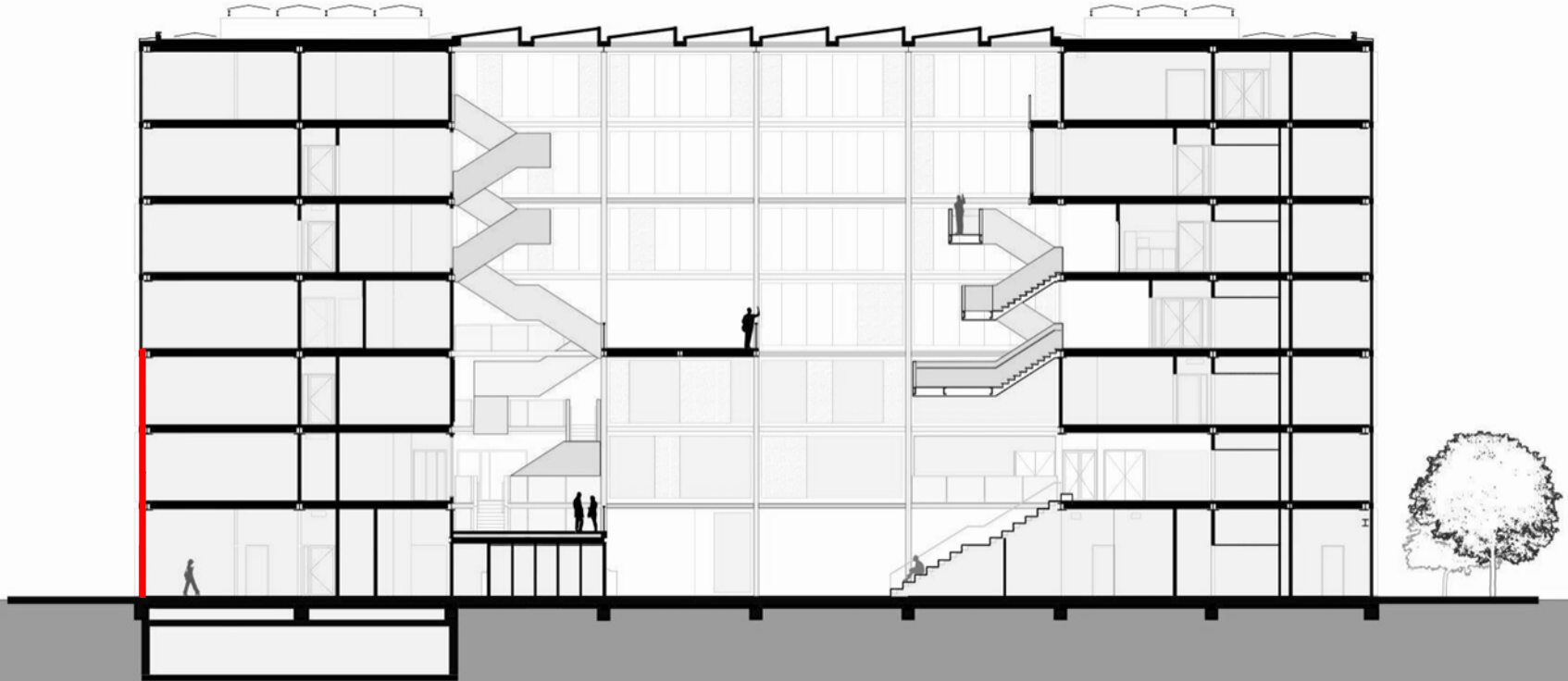




LAB42: An Existing Smart Building

We conducted a three-part study with our focus on **student experiences.**

1. Survey (n=256)



$n=256$ across March & June

Could you describe how **comfortable** you feel in this space?

Please consider temperature, noise, light, air quality, or any other factors that you feel may be impacting your comfort.

How would you describe your **feelings** and **emotions** in this space, at this moment?

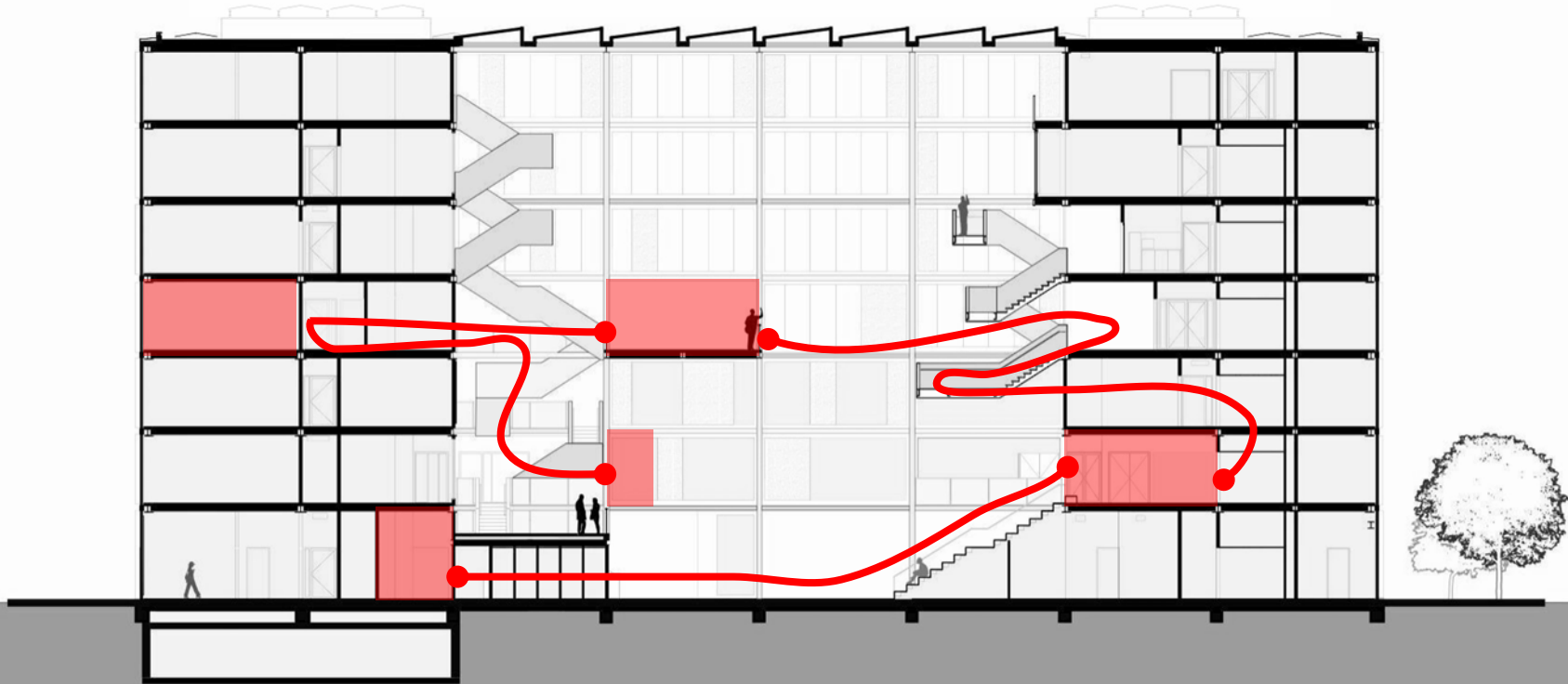


Quiet Study Space



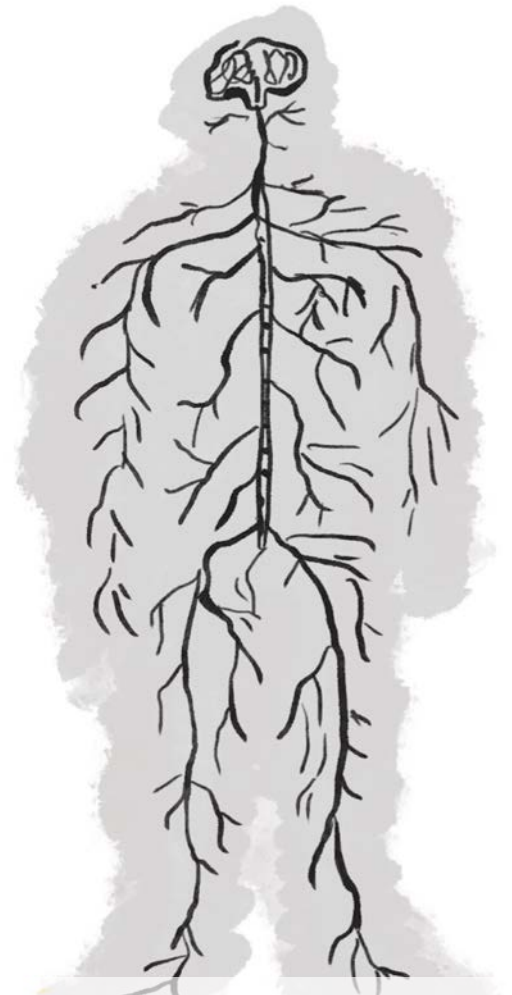
Relaxation Space

2. Building Walk (N=14)



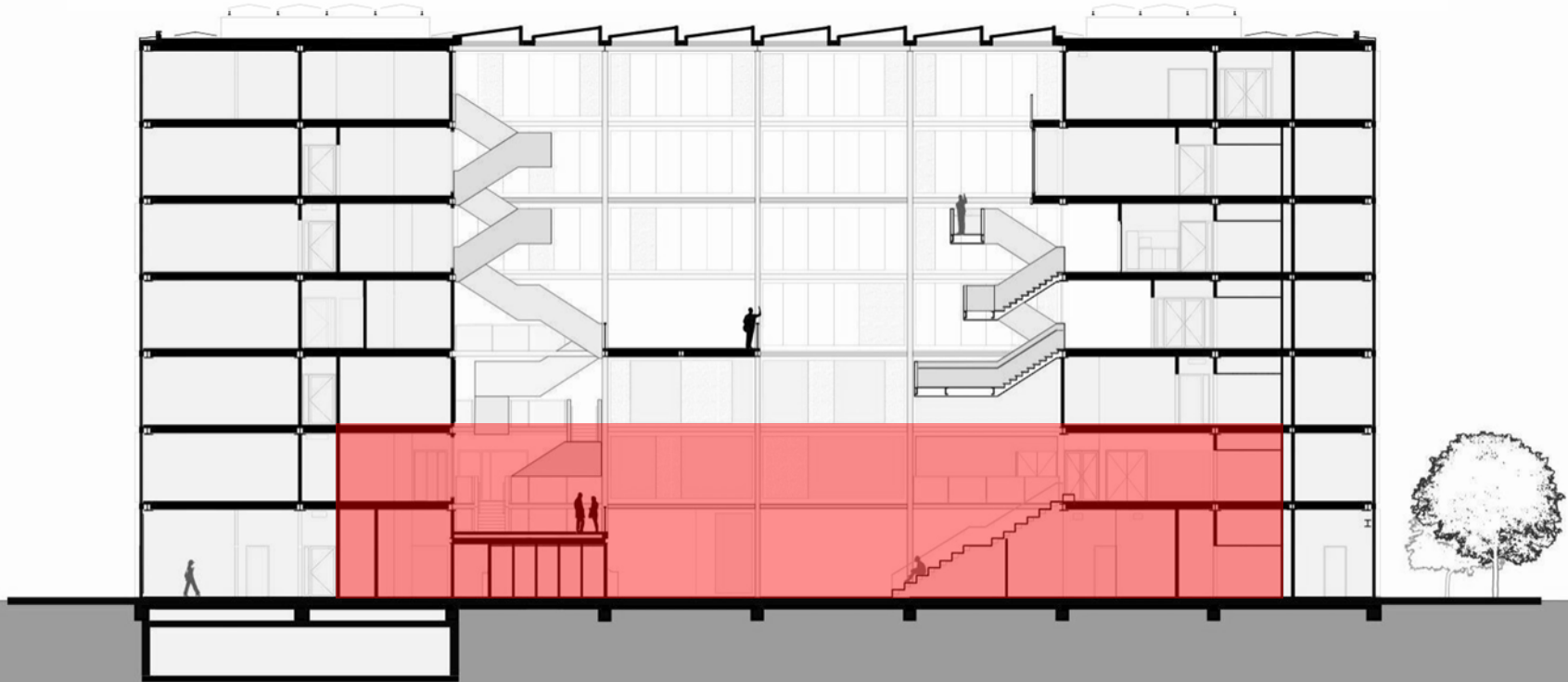


Building Walk Session



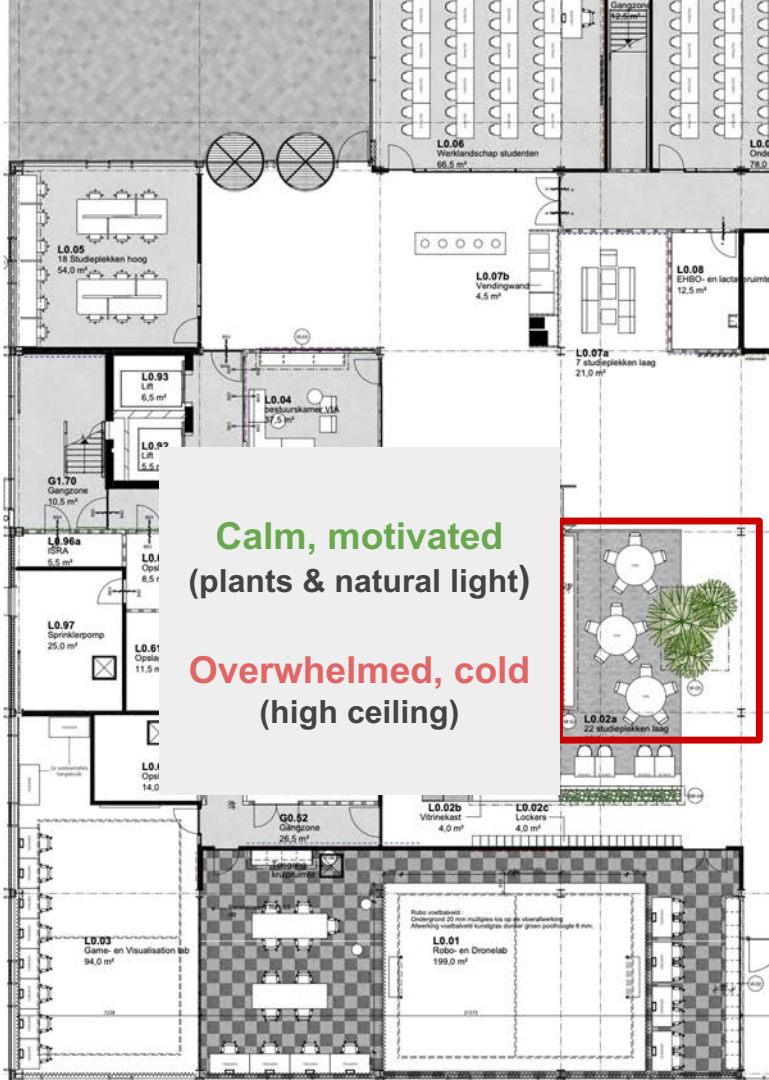
A body map

3. Environment Data* (~12 days)



* Masters' thesis project

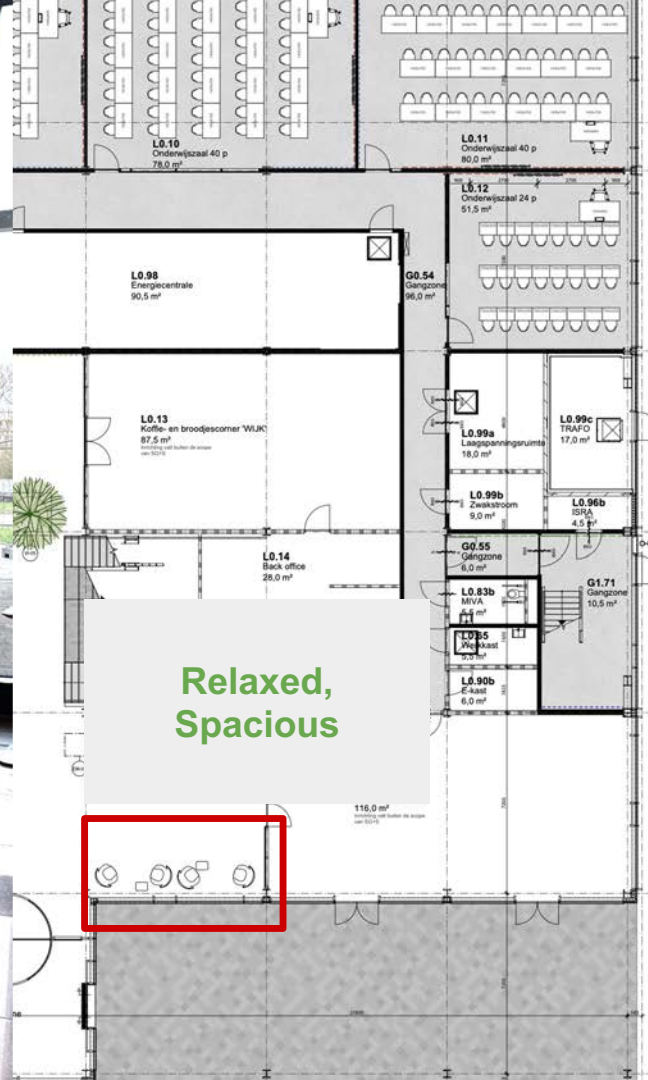
Overview of Emotion & Comfort at LAB42



Calm, motivated
(plants & natural light)

Overwhelmed, cold
(high ceiling)

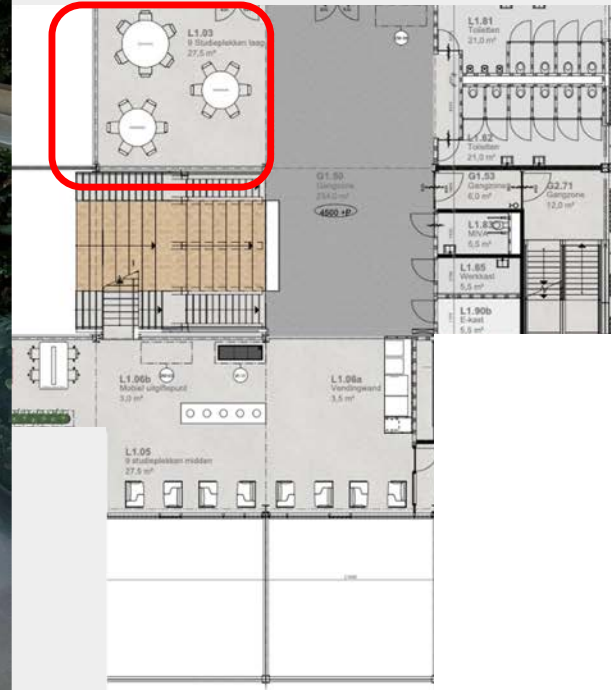






Tranquil, happy, & calm
(Plant wall)

Anxious; disturbed
(openness above, noise)





Relaxed, happy, & calm
(light from window; colour
green)

Annoyed from noise

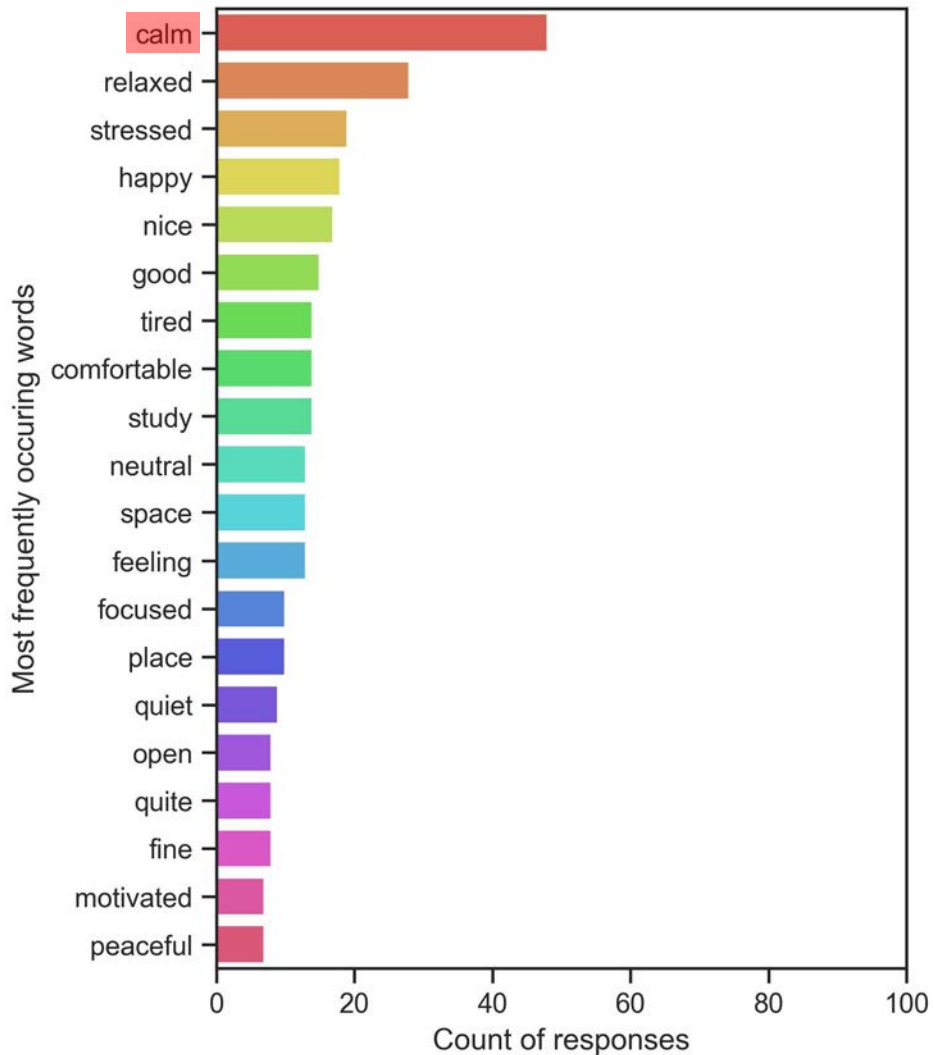
Sentiment Analysis: Emotions At LAB42

“Stressed about my exams but I am happy in this room. It’s energising but with a cool calm aesthetic.”

“Frustrated that on a sunny day the blinds closed automatically. In general the building is too dark for such an open-space location. During the day there is too much artificial lighting. It makes me feel like natural resources such as sunlight are not being used.”

Key Finding 1:

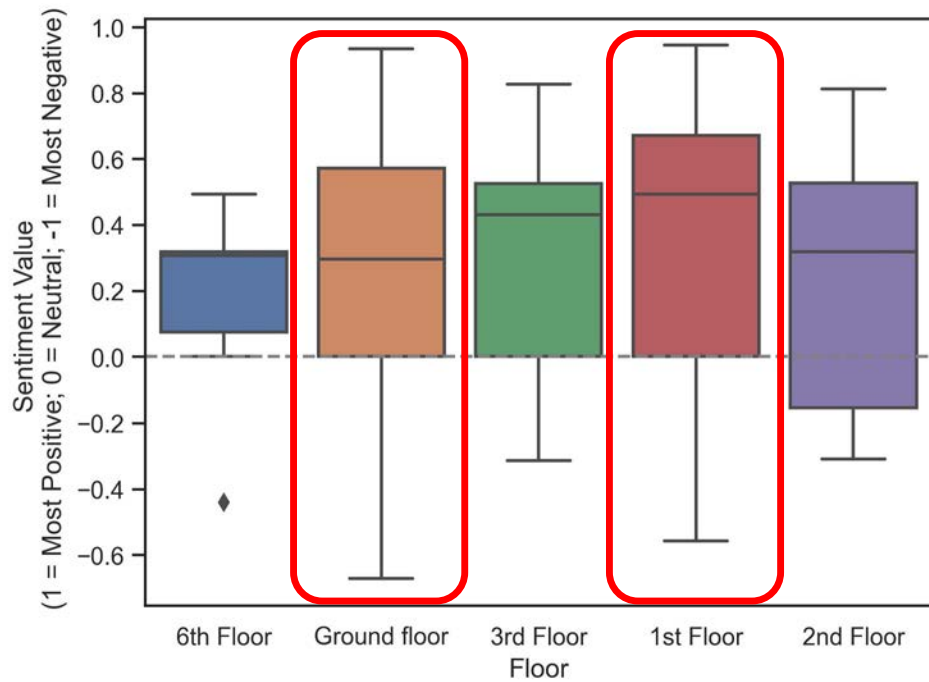
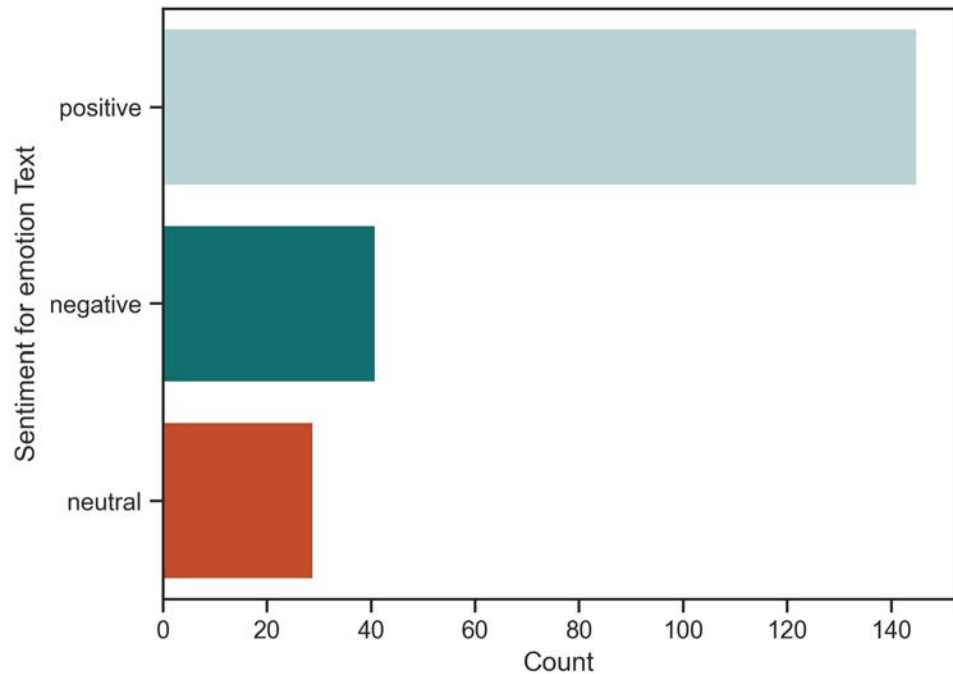
LAB42 is *“Calm”* [1]



[1] Same survey in 904 reveals different results.

Sentiment Analysis: Emotions At LAB42

Highly positive sentiments overall.



Key Finding 1:

Calm is expressed as combined effect of *natural light* + *access to greenery*.

Finding 2:

Natural light's positive effect is pronounced for **group learning activities**^[2].

Biophilia: The Underlying Theme

Next Steps:

1. Co-designing with architects the future of multi-sensory, biophilic learning spaces.
2. Test the prototypes with students using augmented reality (AR) and mixed reality (MR).

An Example Project: Indoor Air Quality Data Awareness

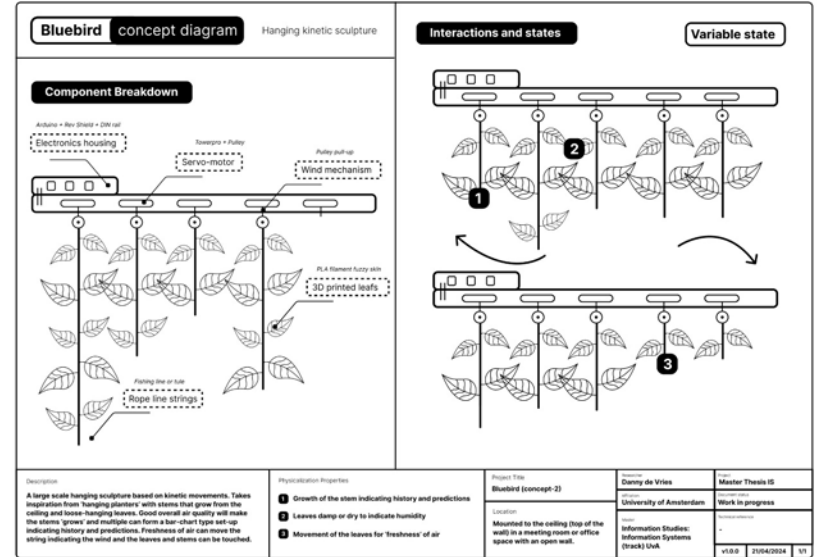
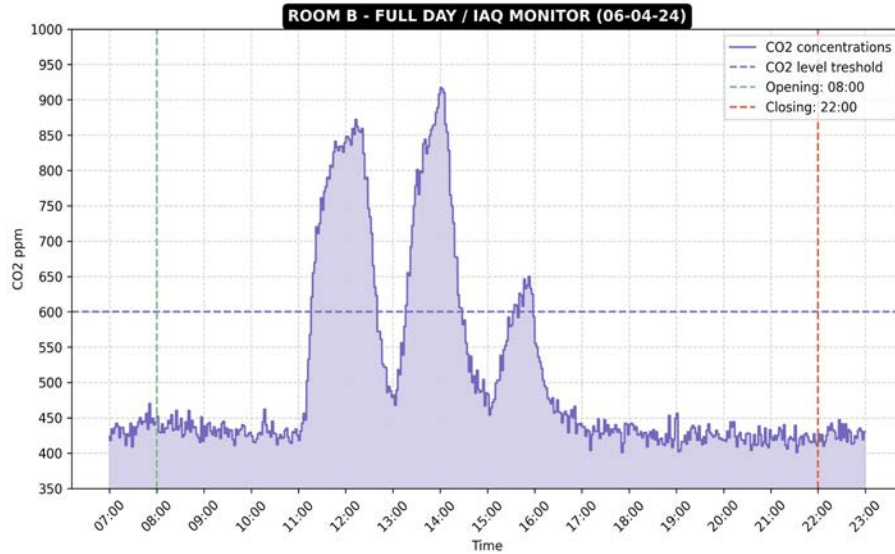


Figure 1. Left is a CO2 measurement in a UvA meeting room (a modern building inaugurated in 2022). As can be seen, during the day of recording, in two out of three meetings, the level of CO2 concentration in the room quickly passed 600 ppm (recognized as the optimal value). The figure on the right demonstrates the current design of the prototype. The design is inspired by biomimicry concepts. It offers a physical demonstration of the data installed on a meeting room wall similar to a hanging artwork. Small robotic motors control the height of each dangling string of leaves (natural or 3d printed) color-coded to visualize the past, present, and future values of CO2. It reacts to the user's action (opening a window) by subtly shaking the leaves, mimicking the effect of a gust of wind.