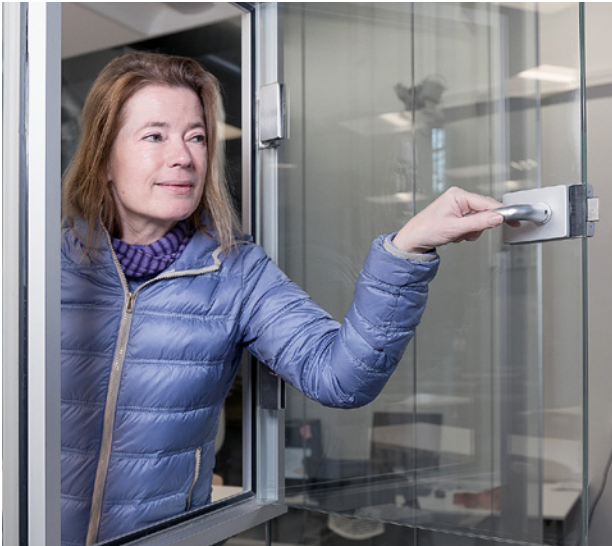


SenseLab: a genuine playground for the senses!



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What is Senselab?

The 'SenseLab', a playground for the senses, is a laboratory for testing and experiencing single and combinations of indoor environmental conditions.

Keywords: Semi-lab environment, indoor environmental quality, integrated perception

The SenseLab is built around the four IEQ factors (indoor air, thermal, lighting and acoustical quality) in a room of the Science Centre in Delft (10.75 m (l) × 9.15 m (b) × 4.70 m (h)), The Netherlands, and comprises of (Figure 1):

- *The Experience room*, for integrated perception of indoor environmental quality (6.5 × 4.2 m²): constructed of a steel frame, walls of 2 × 8 mm laminated glass (inert material) and two plenums (below and above), through which ventilation, heating/cooling, lighting and acoustics can be provided/changed. It is possible to study the effects, positive and negative, of different combinations of environ-

mental conditions (thermal, sound, lighting and air) in different scenario's (office workers in office buildings, children in schools, people in their homes saving energy, etc.), by changing the architectural design and choice of materials and systems.

- *Four test chambers* (two 2.4 × 3.9 m² on the ground floor and two 2.4 × 2.6 m² at the first level), open to the public, where you can take a sniff of materials, feel heat and cold, see how light influences perception and experience how acoustics can be improved.

Additionally, two air handling units, one for the experience room and one for the test chambers, are located in the basement, right under the SenseLab (Figure 2a) and a cooling unit is located outside, near to the SenseLab (Figure 2b).

Why built the SenseLab?

In general people do not realize that they spend 80–90% of their time indoors. Also, they do not realize that they can get sick of staying indoors. Moreover, that indoor environmental conditions can affect people's wellbeing is not common knowledge. Senselab is built to make people aware of this. Senselab is a place where people, in particular children and young adults (students) can experience themselves what air quality, light quality, sound quality and thermal quality is.

The four test chambers are especially created for this purpose, each chamber represents one of the factors. The exhibits in these chambers will be flexible. While the air quality chamber currently contains a CLIMPAQ and a set-up for smelling different sources of pollution (Figure 3a), the acoustical test chamber contains a sound system with two independently controlled near-field loudspeakers. In the thermal comfort chamber an exhibit is currently running that requires VR equipment (glasses + hardware) and software, a fan (to simulate fresh air when in the virtual environment a window opens) and a construction lamp (to simulate sun radiation when in the virtual environment a solar screen is removed), while in the light chamber a mock-up of the exhibition of Jan Schoonhoven is shown (see Figure 3b).

But the lab's role as a research facility is equally important. In the Senselab, in particular in the Experience room, research can be conducted into the perception of all these different parameters together, and their interactions.

In the experience room, three different ventilation principles are present: 1) Natural ventilation through operable windows; 2) Displacement ventilation from floor to ceiling by using a perforated plinth (just above



Figure 1. a+b) Experience room, c) test chambers and d) stairs to first level.

the floor on the long sides of the experience room) and exhaust in the ceiling on the side; and 3) Mixing ventilation from ceiling to floor: air supply in plenum (via 4 ceiling grilles) and exhaust in perforated plinth on the short side of the experience room.

Besides the four air supply grilles, the ceiling of the experience room includes four independently controlled ceiling mounted loudspeakers and a subwoofer above the suspended ceiling, with which it is possible to create different types of sound/noise; and three types of lighting armatures: 4 direct light led, 4 indirect light led and 8 soft light led armatures, which gives the possibility to change the distribution, intensity and diffuseness of light.

In the ceiling and floor of the experience room the panels can be exchanged, while on the inside of the glass walls, panels can be added via a magnetic system.

How was SenseLab created?

First ideas of the SenseLab were ventilated publicly during the inaugural Speech of Prof. dr. Philomena M. Bluysen, at May 22, 2013. At that time, she defined it as: “a semi-lab environment in which people, students, teachers, researchers, but also the general public, will be able to experience different environmental conditions in order to better understand the indoor environment”. Now almost four year later, it is ready to be used.



Figure 2. a) Installations in basement and b) cooling unit outside the SenseLab.

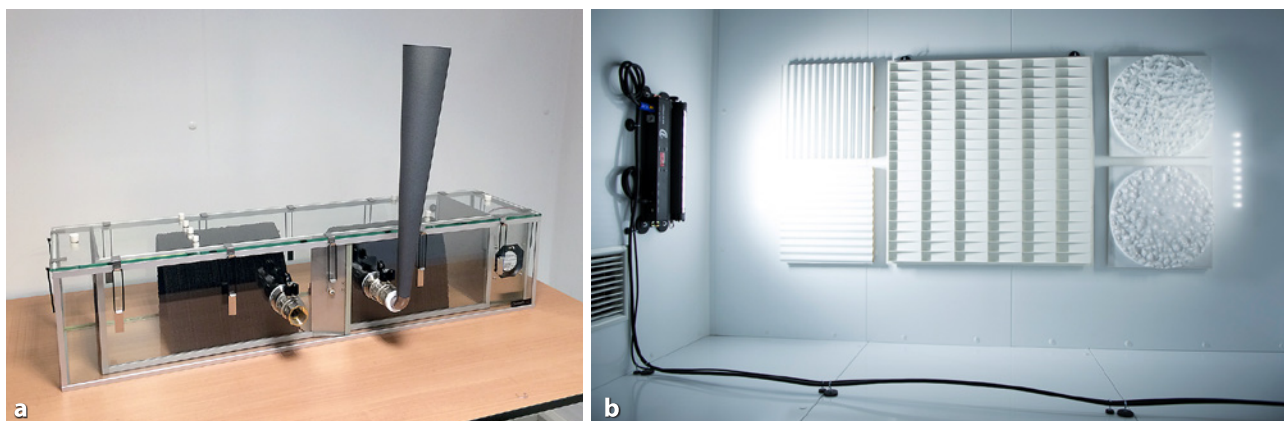


Figure 3. Current exhibits for air and lighting: a) to smell different pollution sources and learn about them b) to perceive how shape, material and space appearance can be influenced by the lighting of it.

Already at the beginning of 2013, a first business plan including a SWOT analysis, was made to convince the dean at that time of the pro's of such a lab. While creating **support** within the organisation was the focus in 2013, 2014 was mainly used to search for the **location** of SenseLab. Where can we built such a thing? How much space do we need? After some touring around the campus, Faculty of Architecture didn't have a suitable space, the Science Centre turned out to be 'the place to be'!

In the meantime, it became clear that the first concept of the SenseLab would cost a bit more than the fellowship of Bluysen, or what was left of it. So, next to finding a location, also the acquiring of sponsors became a must. 2015 was the year for the search of **money!** This was not easy. Fortunately, at the end of 2015, the first sponsor agreement with FORBO was a fact, followed by ENGIE, our largest sponsor, and a couple of important commitments. Many followed!



Figure 4. Operable windows and window-in-window construction in the facade.



Figure 5. Class room set-up in Experience room.

At the beginning of 2016, we had support, a location, financing and the basis of design. The construction finally started at May 9, 2016 with drilling of the holes in the floor for the ducts to get through. SenseLab was officially opened by Tim van der Hagen, the President Executive Board of TU Delft, at December 1, 2016.

What is so special about SenseLab?

Besides that the SenseLab is one of its kind under the labs around the world, because it focuses on the integral perception of IEQ by using the architectural design, choice of materials and systems, and the occupants as assessment instruments, it is also unique because of its possibility to combine education (knowledge transfer) and research. Especially the location, the Science Centre, makes this a reality.

The Science Centre is a technical and scientific museum which exhibits scientific innovations and research of the TU Delft. The Science Centre receives many visitors among which a lot of school children, but also many students of the Delft University of Technology. It is therefore an excellent location to educate and do tests with both school children and students in classroom and office like environments. The SenseLab makes it possible to involve children, but also young adults in another way than via questionnaires or (physical and mental) performance tests, for example through interactive techniques (e.g. using mock-ups, sketches and focus groups), in order to provide more insight in potential causal relationships at individual level, but also insight in the total picture and interrelationships between different environmental parameters and other aspects (e.g. confounders).

Any last remarks?

After four years of planning, lobbying, preparing and building, the SenseLab was created and is now available both for studying integral perception of IEQ under different scenarios in the Experience room, as well as testing and learning in the four test chambers for air, light, thermal and acoustical quality. The design and construction of the SenseLab was possible thanks to the fellowship of Prof. P.M. Bluysen provided by the Delft University of Technology, under the Chair of indoor Environment, as well as the following sponsors: PIT-fonds, Engie, Darellsoffice, ETAP, Unica, Orange Climate, Priva, Cordeel, Viessmann, Forbo, Carrier, Amptec, Saint-Gobain, Ahrend, Trox technik, Gyproc, Interior Glassolutions, Ecophon, The New makers, Li-Tech, Sol4, Seco, Krepla, Garfield Aluminium and Riweeltie and Science Centre. ■