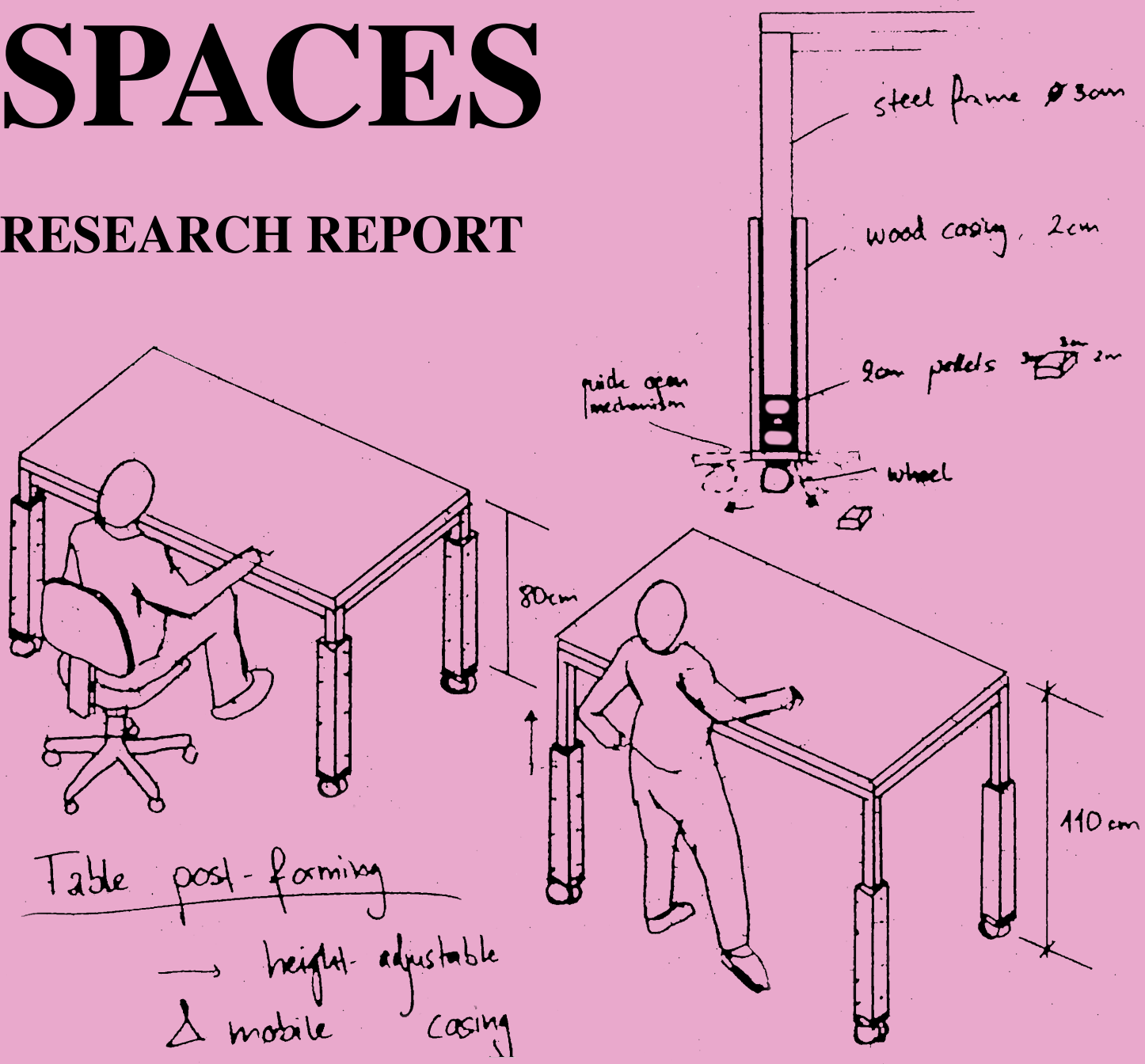
FUTURE LEARNING SPACES

RESEARCH REPORT



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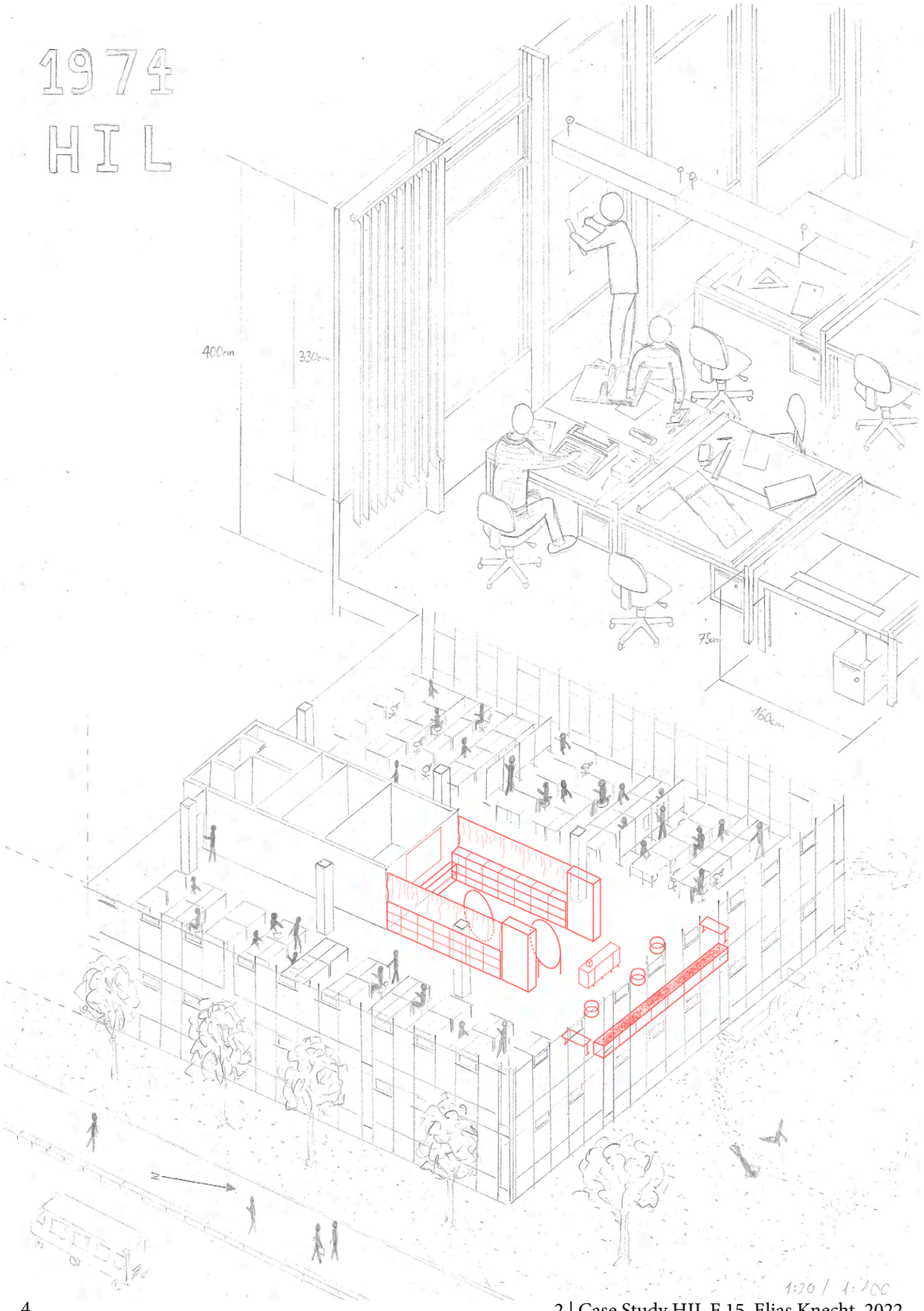
1 | Material research at ETH in 1946, ETH Image Archive



PROLOGUE

This paper presents the intentions, the methodology and results of my research report, which is embedded into a free diploma thesis. The thesis advocates the building of healthy Future Learning Spaces in regards to the planned extension of the D-ARCH faculty building HIL. In order to sustain and upkeep physical but also mental and social wellbeing during education, a case study is executed. The research is framed by the idea of architecture being capable of strategically provoking desirable learning behaviors. The proposed methodology will be presented as well as a description of the research components. Finally, this paper elaborates the expected outcomes and conclusion of the investigation.

CONTENT

1
INTRODUCTION

1.1 BACKGROUND

Study and learning methods are evolving digitally. A majority of learning occurs in places, which are not intended as learning space, (Thomas, 2010). We question how, where and when does learning take place in higher education?

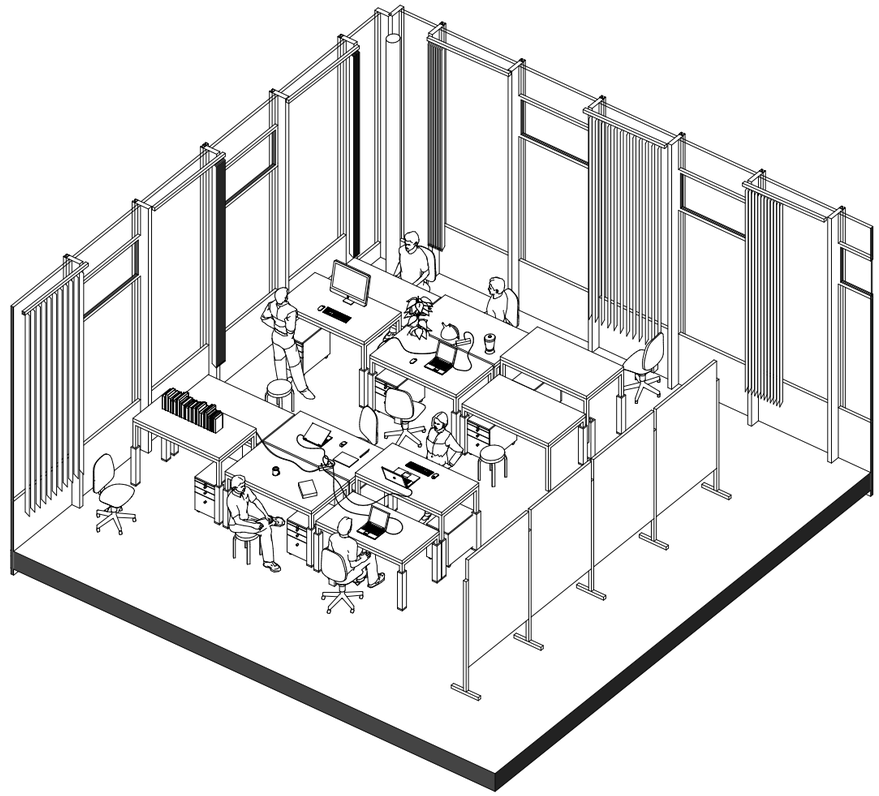
Knowledge is commonly conveyed in standardized spaces, which are characterized by the industrialization of society. Lecture halls have been conceived as an efficient production line of knowledge, thus being designed for one-way and live delivery of content from faculty to student (Biggs, J. B., 2003).

The spatial articulation of designated learning spaces plays a crucial role in study behaviors and the overall performance of students.

"At ETHZ, three out of five students face increasing pressure from stress in class room settings. "

This includes work overload, high stakes testing, peer pressure and competition.
(Survey, #wie gETH's, 2019).

We know, that mental health is closely connected physical well-being. Further, physical movement improves the cognitive capabilities of students and encourages peak performances (Ratey, 2013). Contemporary study methods, such as sitting in front of computer screens for many consecutive hours, do not support the notion of physical movement. We underline the impact of furniture on pedagogical and behavioral patterns in the learning environment and furthermore the importance of physical movement during learning processes (Dr. John Ratey, 2013).



3 | Learning Space with height adjustable tables at HIL, drawing by Elias Knecht, 2022

1.2 DEFINITION

In the context of this thesis, we use the following two references to describe the terminology of a learning environment:

“We define a learning environment as designed space – physical as well as digital – which allows and fosters learning. This incorporates infrastructure, techniques, materials, media and associated teaching- and learning methods. The learning landscape includes various areas for a diverse range of activities on Campus.”

- Definition of Learning Environment, Akademische Dienste (AkD) and ETH-Library, 2022

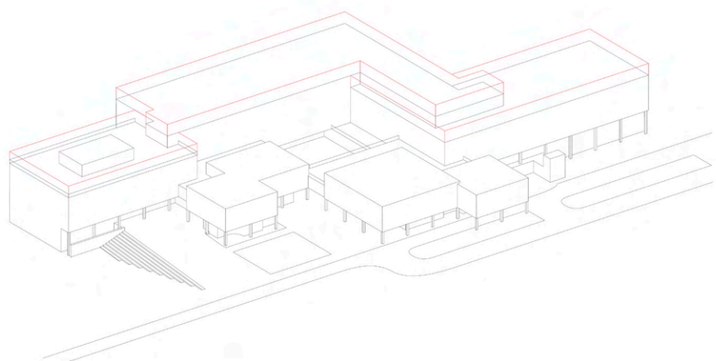
“A learning environment is much like a city. It consist of paths, streets and highways, along which students move at different speeds. Squares, niches and in-between spaces allow students to pause and exchange. Private zones serve students to learn individually and public lecture halls serve experts to teach collectively. Knowledge itself is a vehicle, which is directed mostly by teachers but powered by students.”

- Elias Knecht, 2022

4 | ETH Library reading hall, 1950 (top) and 1955 (bottom), Image Archive, ETH Library

1.3 PROBLEM

5 | Reconstruction of north-wing at ETH Main Campus, 1968, ETH Image Archive



6 | Axonometric view of the HIL building, drawing edited by Elias Knecht, 2022

The thesis presents a main problem, which is addressed by this scientific research and inquiry for architectural transformation:

> “A high occupancy rate within the D-ARCH faculty building HIL has led to an overload of the learning environment.”

Conflicts arise with the dual utilization of space for provisions (food and drinks) and tuitional (teaching) events. The availability of learning spaces varies between the hour of the day, the day of the week and the month of the year. As a result, students face an increasing exposure to environmental factors such as noise, light, air, temperature and social activities.

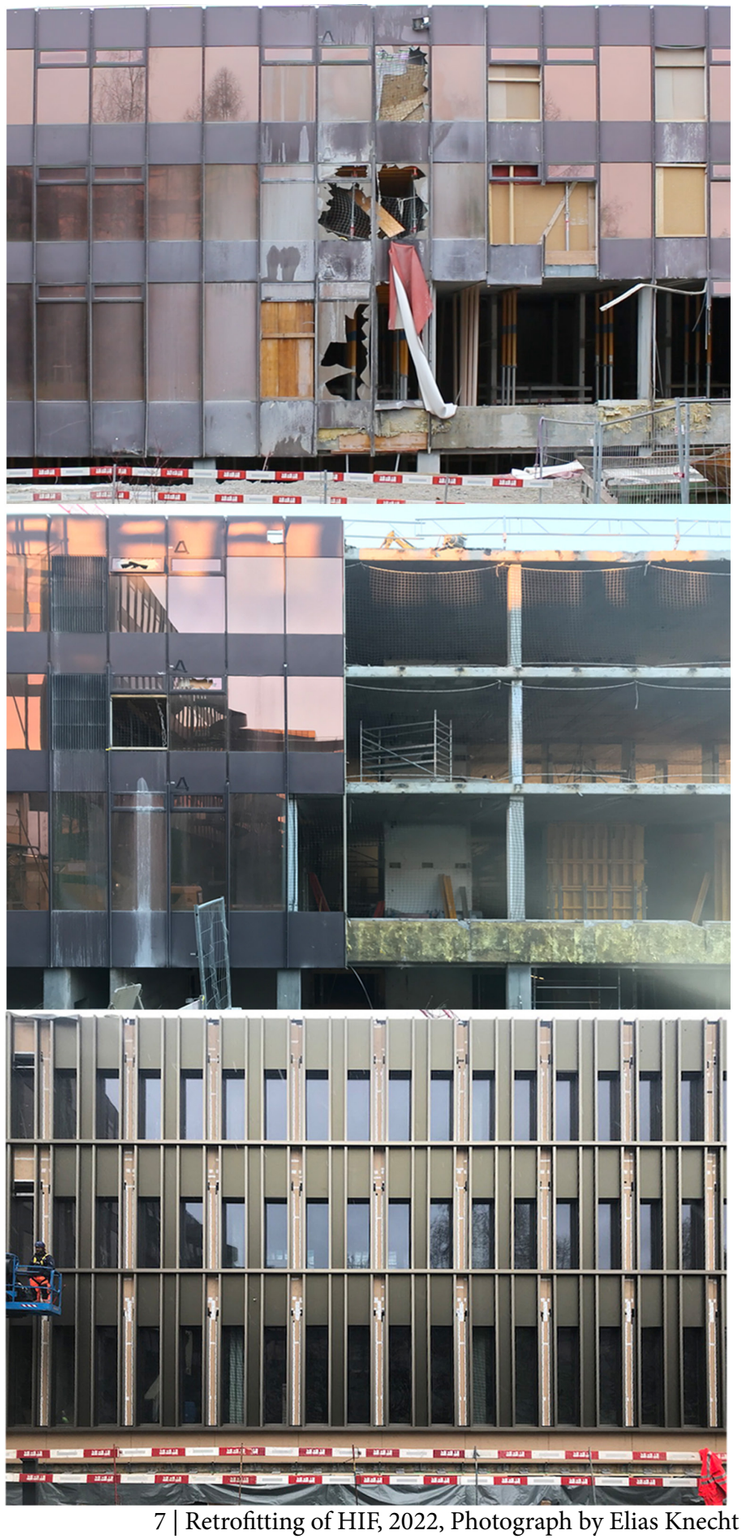
Furthermore, learning spaces are insufficiently fitted in terms of furniture. These issues allude the demand for action and the necessity of upgrading and up keeping the learning landscape at HIL.”

- Bedarf Lernumbgebung, Akademische Dienste (AkD), ETH-Bibliothek, VSETH, 2022

The HIL building was constructed in 1974, and is due for retrofitting and expansion in the coming years. This offers the unique opportunity to re-think and evolve the built environment, without interrupting the core operative elements, such as teaching, learning and research. We consider prevailing failures in the building structure to be a promising starting point for initiating transformation.

The HIL building struggles to offer a habitus to the rapidly growing community of students.

The requirement for additional learning spaces has forced the faculty to spread out into different satellite locations. The HIL building lacks strategic points of encounter and a diversified range of performance rooms, which prioritize student-centered learning. Examples may include mock-up- or simulation labs, exhibition- and presentation spaces, platforms, incubator- and innovation rooms or intimidate in-between moments and spaces for rest.



7 | Retrofitting of HIF, 2022, Photograph by Elias Knecht

1.4 INTENTION

The purpose of this research is, to determine a strategy to transform existing learning landscapes situated at the D-ARCH faculty building HIL.

The focus lies in the spatial articulation of evolving study behaviors in common workspaces. We take into account a cultural shift in teaching, further strengthening a pedagogical tendency towards informal learning methodologies. This includes bottom-up and student-led regulation of human resources and spatial configurations in higher education.

In this research, we attempt to diversify learning spaces with interior and exterior fixtures. The goal is, to offer a change of furniture with institutional-, as well as DIY solutions.

The quality of a study space correlates with the learning progress of students.

The durability and productivity of a university relies on the bodily integrity and health of each individual student and staff.

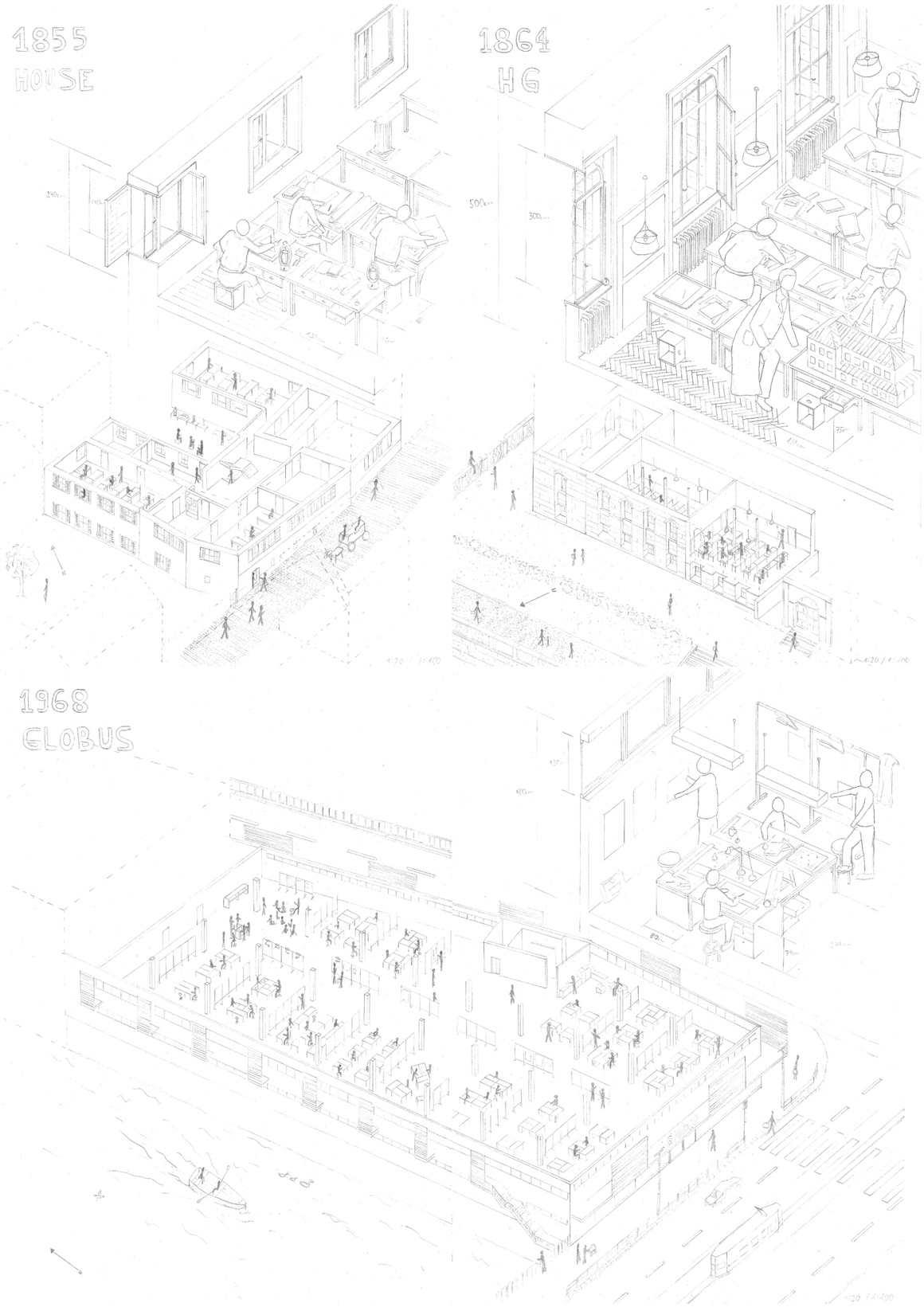
We advocate the fundamental right of students for physical- and mental wellbeing and self-agency in formal university settings. This includes an attempt to reduce the experience of emotional labor, exhaustion and competition amongst students.

We request better access to height-adjustable tables for all community members, particularly students, without requiring a doctor's recommendation or a work contract. Ergonomic chairs and height-adjustable tables may benefit the student experience and comfort.

8 | ETH Library, 1989, ETH Image Archive

1.5 GENEALOGY

To gain a clearer oversight of historic learning environments at D-ARCH, a drawing is produced for each building site since 1855 respectively. Over the course of 170 years, the department has changed location six times, occupying former residential buildings (1855), as well as decommissioned factory (ONA, 2010) and shopping halls (Globus-Provisorium (1968). Only the Main Camous building (1864), the HIL building (1974) and the Huber Pavilions (1989) were designed specifically as learning environment.



9 | Genealogy of D-ARCH since 1855, Elias Knecht, 2022

2
METHODOLOGY

2.1 RESEARCH QUESTION

10 | Student using height-adjustable table, Photo by Elias Knecht, 2022

Three initial questions frame the objective of this research. Each one is directed towards a different scale of the built learning environment and the correlating behavior and activity of users respectively.

- We question the role of civic universities: *What makes a healthy and durable learning environment?*

- We question the mechanism of democratic institutions: *How can students participate in the physical transformation of educational landscapes?*

- Combining the previous two questions we define the core inquiry, underlaying this research as follows:

How can student satisfaction benefit from the installation of adaptive furniture in common learning spaces?

We attempt to answer to this question for the case of **height adjustable tables**, which are already included in the institutional catalogue of furniture for formal learning spaces at ETHZ.

2.2 HYPOTHESIS

We set up three hypotheses as a preliminary response to the research questions posed above:

1. The quality of a generic learning landscape improves, when introducing spatial typologies, which incorporate the option for manipulation and maintenance by the students, teachers, and knowledge itself. Like any urbanized structure, a learning environment becomes more efficient and durable, when it nourishes the basic corporal needs and the desire for self-realization of the embedded users.

2. A participative building process can be achieved through the institutionalization of student organized groups. Bottom-up initiatives promote informal study methodologies, student activism and participatory behaviors. Students will proactively appropriate space, if given the opportunity. Thus, rather than having to rely on their democratic right to objection, students may be invited to raise their voices in real, ongoing processes. Students are capable to propose changes, which support their own comfort and individual self-esteem.

3. Height-adjustable tables promote a change of body posture and impact social group dynamics. The option to stand in learning processes fosters student self-care and impacts peer-exchange. We assume, that the healthiness of a learning environment directly links to the health condition of individual students and staff, who are embedded in this space. Although the official catalogue of furniture at ETH already includes height-adjustable tables, they are generally not made available to students.

11 | Students using a height-adjustable table, 2022, Photo by Joshua Andres

2.3 APPROACH

With the **Chair of Architectural Behaviorology**, the thesis is originally set-up through a preliminary focus work on the topic of “Table Behaviorology”. Research drawings of previous learning locations and furniture layouts of D-ARCH, since 1855, help us to understand the genealogy of learning spaces. Furthermore, a proposal for post-forming the existing furniture of ETH was developed and tested. This Mock-Up allows for the adjustment of the height standardized of tables.

With the **Chair of Cognitive Science**, behavioral methods are utilized, to further enhance our understanding of student satisfaction in their environments. This includes scienific observations of the case study in HIL F 15, as well as online surveying tools and interviews. The collected user feedback allows us to further distinguish programmatic requirements and needs of students, to advance the quality of the learning environment and generate additional spatial resources and comfort.

In collaboration with the supervisors and the **Academic Services** of ETH (AkD), who administrate student workspaces, we identify the site for 1:1 intervention through a change of furniture. This includes the installation of height-adjustable tables, in order to observe their impact on the learning environment. Aside from the case study room HIL F 15, the study space E 29 is equipped with height-adjustable tables, with the support of ETH Immobilien and ETH Hindernisfreiheit.

12 | Surveying exercise in front of HIL, 1976, ETH Image Archive

2.4 CASE STUDY

The recent closure of the Huber pavilions on Hönggerberg has further contributed to an overload of students in the HIL building. Additionally, the numbers of enrolled students have been growing steadily. In response, diploma students of D-ARCH will be relocated into HIL F 15 (fig. 4), occupied so far by engineering students of D-BAUG.

The room HIL F 15 was chosen as a case study subject to test alternatives to the standardized furniture concepts of common workspaces. This space will be shared between the two departments. This decision was not welcomed by the engineering students, who loose a great amount of space. However, sharing one room may potentially harbor interdisciplinary exchange amongst the different students.

Students of the different disciplines at ETH hardly work with one another. Although they spend six years in the same buildings, using the same doors, stairs, lecture halls, bath rooms and buses, there is no shared common work space, where they may meet and exchange. The only exception to this rule are places, where students go, to have a break from their studies, like canteens or outdoor spaces.

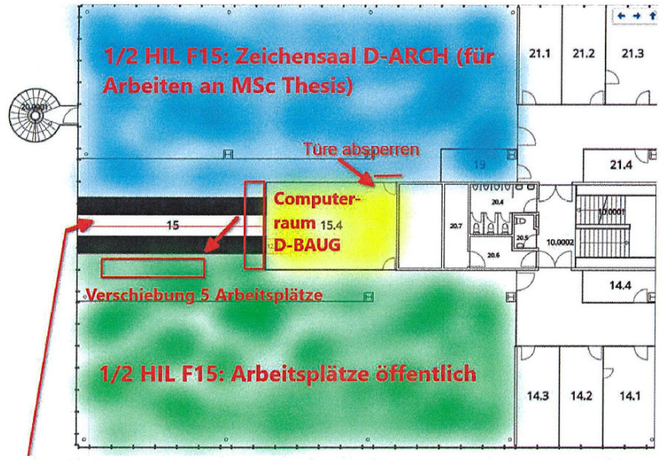
The case study at HIL F 15 therefor provides students with the unique opportunity, to benefit from the expertise and presence of each other. Inter-disciplinary communication is supported with larger group meeting tables, as well as height-adjustable tables, for students to gather about, debate, help each other out with problems or simply have a common break and observing other students.

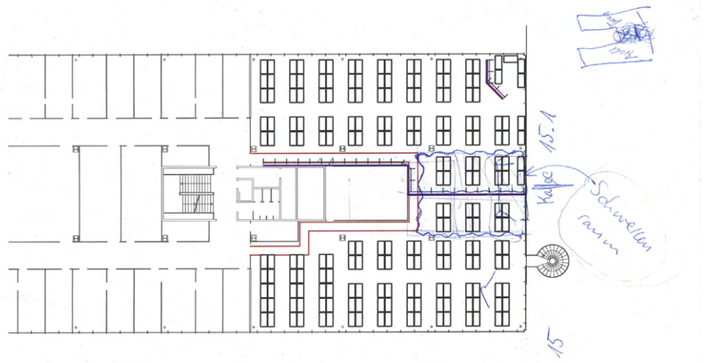
Further, we acknowledge the desire of students for coffee and resting spaces. Students tend to bring and install their own espresso machines, resulting in dozens of small, private coffee machines in HIL F 15. This is problematic, in particular in regards to the old electrical wiring of the HIL building. The excessive use of energy to power individual gadgets, laptops and water cookers, frequently leads to the blowing out of electrical fuses, in need for replacement.

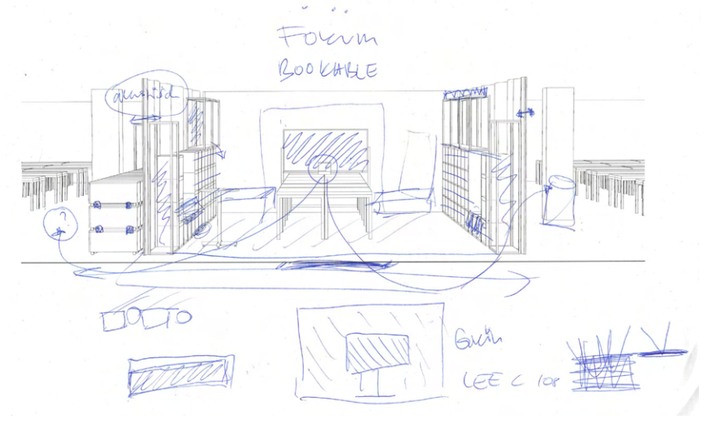
Therefor, we find that, a centralized coffee corner may be appropriate in a learning environment. Aside from being environmentally more sound, a centralized and clearly designated kitchen element may relieve other surrounding spaces from overuse by physically separating study- from provisional activities in the learning environment.

13 | HIL F 15 at the beginning of the semester, Elias Knecht, 2022

2.4.1 GOAL







14 | HILF15 requirements, Akademische Dienste (AkD), 2022
15 | Design process for HIL F 15 case study, Elias Knecht, 2022

The intention of the case study is, too implement a new typology of space and furniture, which has been unaccessible for students so far. Learning from status-quo observations, surveys and interviews, we identify crucial elements, which are missing in contemporary learning spaces. In a next step, we observe the change of student satisfaction after the introduction of an alternative furniture concept.

Most importantly, ergonomic furniture aims at improving the health of the student body. The case study particularly serves the purpose of evaluating the reception of height-adjustable - as well as larger meeting tables. In addition, we introduce more comfortable seating furniture, such as longer and cushioned benches, deck chairs and lounge chairs. The pilot project also includes a more exquisite and inexpensive coffee machine and refrigerator within a mobile kitchen element. Last, but not least, minor decoration is added to the space, with living plants and wall carpets. Ideally, students will start to appropriate and maintain this space themselves.

2.4.2 REQUIREMENTS

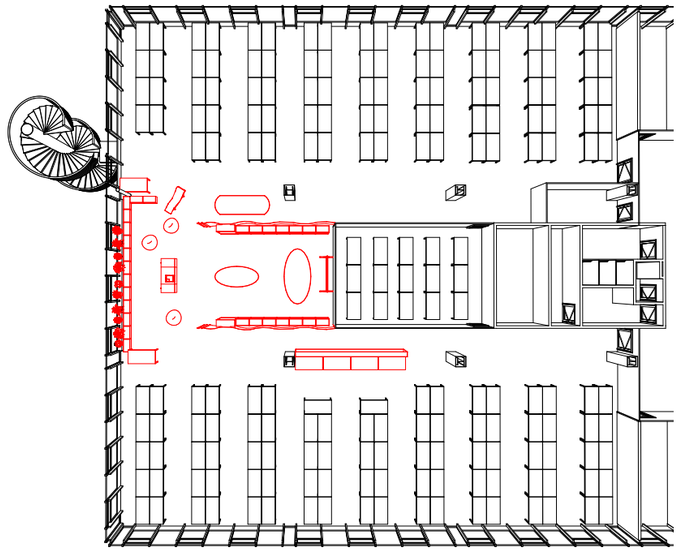
In close collaboration with Larissa Rossbacher of the Academic Services (AkD), we evaluate the spatial and acoustic requirements (fig. 13) as well as fire safety regulations (SGU).

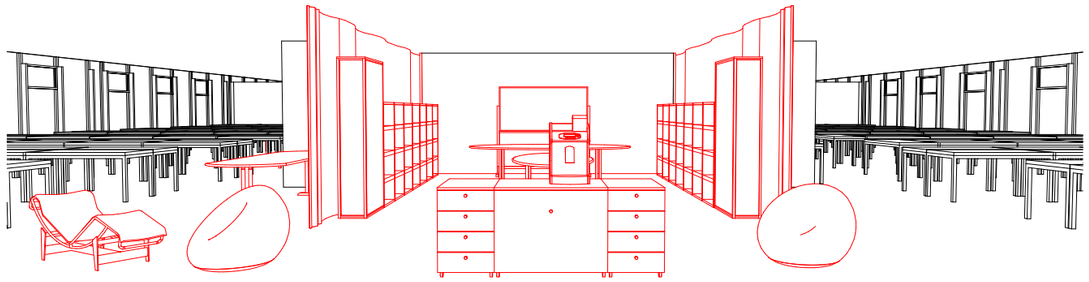
Foremost, a clear visual and acoustic separation between the two areas must be guaranteed, in order to execute all tuitional activities, without bothering the students of the other sides respectively.

Rather than to separate both departments with a central wall, we propose to implement an in-between space, (fig. 8) which is equally accessible to both sides. The effectiveness of the acoustic separation is increased, by introducing two barriers in parallel.

Further, there is no real budget for the execution of this case study. Hence, all resources, such as furniture, curtains, books etc. must be collected from within ETH.

The main objective, aside from offering a higher quality workspace for students, is, not to reduce the capacity of the learning environment. For example, the IT services of D-BAUG are involved, because workspaces with computers needed to be relocated, to ensure the access to required study tools.





16 | Case study HIL F15, top view perspective, section perspective, Elias Knecht, 2022

2.4.3 BUILDING RESOURCES

To execute a project with minimum budget, requires building materials, funding, necessary tools and equipment.

We find, that many materials are unused and in storage, without further purpose or foreseeable use.

To access and utilize these materials (fig. 9), all it takes, is to kindly ask for permission.

Unused curtains were donated by other buildings of ETH (LEE and HPT), and further processed (cut in half) for further use. Carpets from *ETH Kontaktreffen*, which otherwise would have been disposed, were re-used as wall-curtain.

The ETH Library was able to spare books, currently not on display in any library. Besides the literature being educational, books are also a great noise-canceling acoustic absorber.

The *gta* was able to share carpets, chairs and steel cases, which we planked with semi-transparent plastic boards and illuminated with lamps. These materials were formerly used in exhibitions, but then stored away.

With the support of *ETH Mobiliarstelle,* it was arranged, to relocate furniture, previously used in the student secretary office of the main campus building. This includes group tables and book shelves.

17 | Building resources from ETH, Elias Knecht, 2022

2.5 BEHAVIORAL RESEARCH

Considering methods of spatial cognition, we observe the current status quo of the case study location, as well as the reaction of students to the physical change of learning spaces implemented through alternative furniture. The goal of changing the built learning environment, is, to provoke healthier study behaviors and body postures.

Furthermore, we utilize tools of behavioral observations in order to characterize the navigability through HIL spaces. In order to classify learning spaces, we distinguish between quiet individual, group working and flexible spaces (multi-functional). We consider a hierarchy of needs, which prevails for all students and staff, defined by Abraham Maslow (fig. 94).

The method of scientific observations include:

- Occupancy

Counting students, who are present in the learning space

- Gate counts

Defining points of entry and counting the flux of students

- Route traces

Documenting movement through space

- Static snapshots

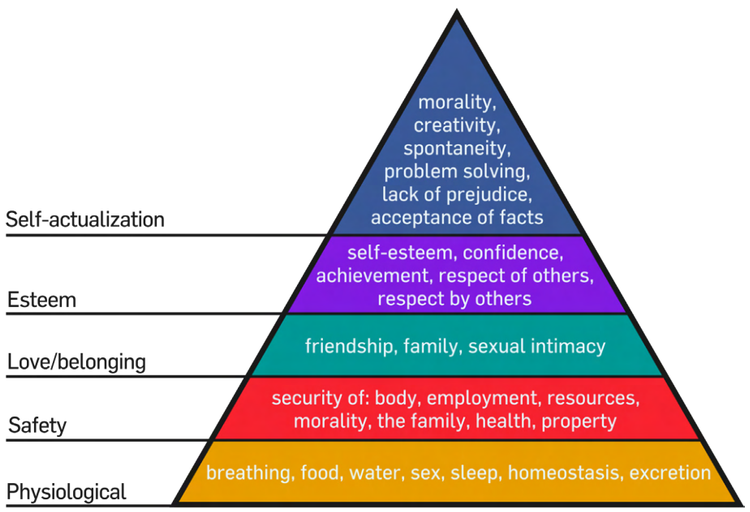
Distinguishing relevant activities and social structures)

- User feedback

Online survey and questionnaire

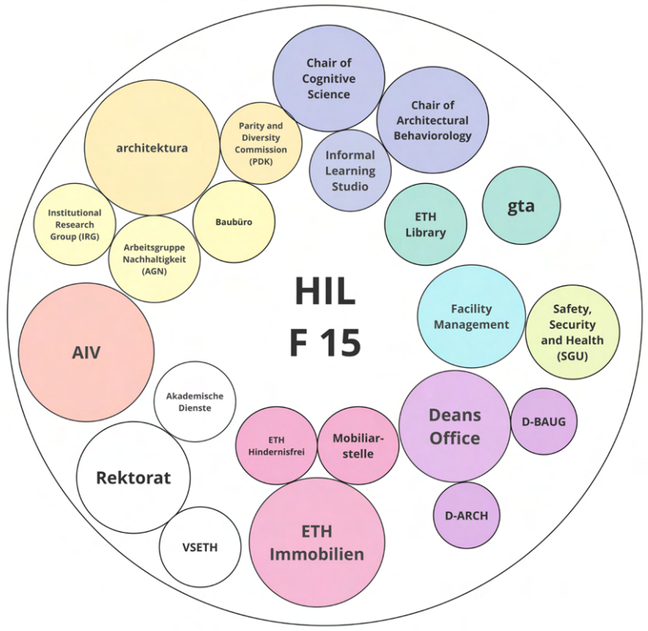
- Interviews

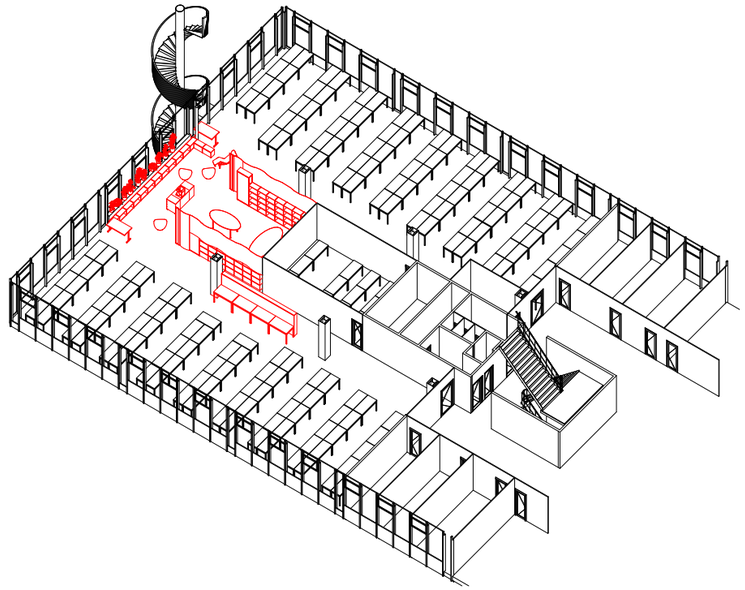
Dialogues with professors, staff and students



18 | Maslow's Hierarchy of Needs, Wikimedia Commons, 2009

2.6 EXPECTED OUTCOME





19 | HIL F 15 Actor Network Elias Knecht, 2022
20 | Case study HIL F15, axonometric view, Elias Knecht, 2022

The case study, introduced as a pilot phase, constitutes a proposal for the change of furniture and thus extension of common workspaces of students. The design, if successful, may serve as future strategy for the expansion of the HIL building. The evaluation of the resulting outcome and satisfaction of stakeholders may further reinforce the above-mentioned strategies.

Due to the necessary re-allocation of student workspaces and the resulting physical changes, HIL F 15 became suitable for testing the application of height-adjustable tables.

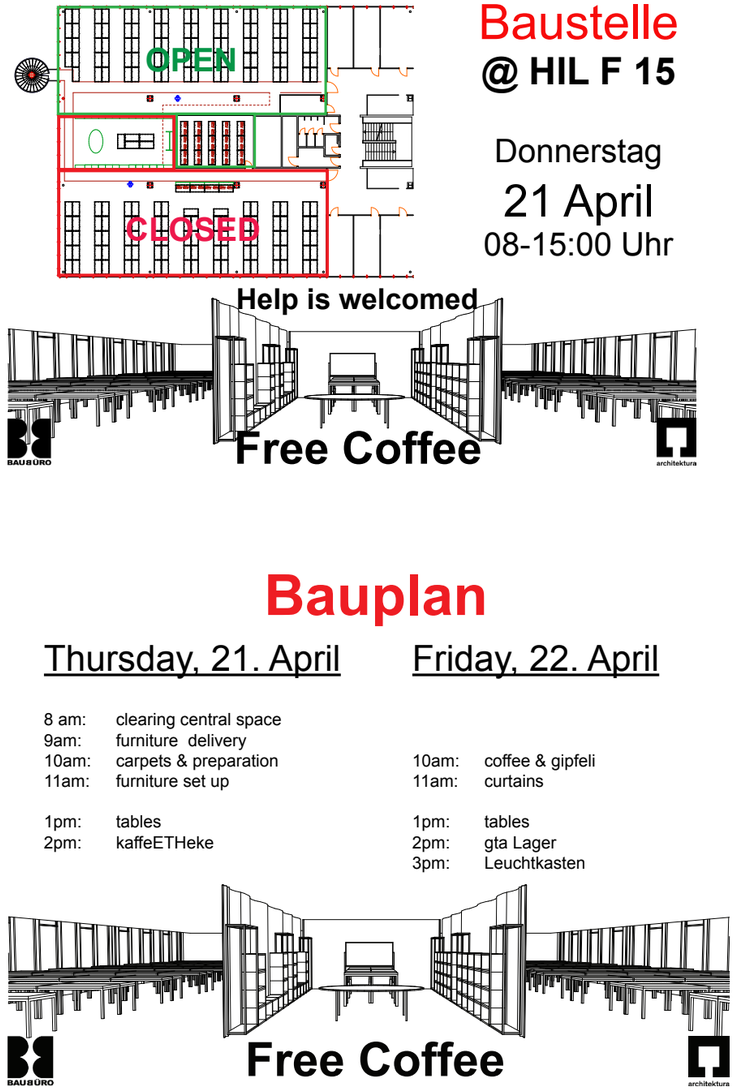
The success of the proposal depends on the many different actors, who are involved in administrating, maintaining and utilizing a learning environment.

Whether or not an intermediate space, as proposed in this theses, will survive the democratic process of debate, becomes to a certain degree irrelevant. More importantly, the proposal for transformation, in itself triggers a process of dialogue leading towards progress. In the execution of the case study at HIL F 15, a network (fig. 19) of vertically and horizontally aligned actors have gathered about the attempt, to further advance the present learning environment.

3
ANALYSIS

3.1 CASE STUDY

The main goal, to create a healthier space for communal and elevated learning activities succeeded. A proposal for an in-between space was introduced, accepted and refined in meetings with all stakeholders. Ultimately, safeguarding as many working spaces as possible, remained at the center of attention.



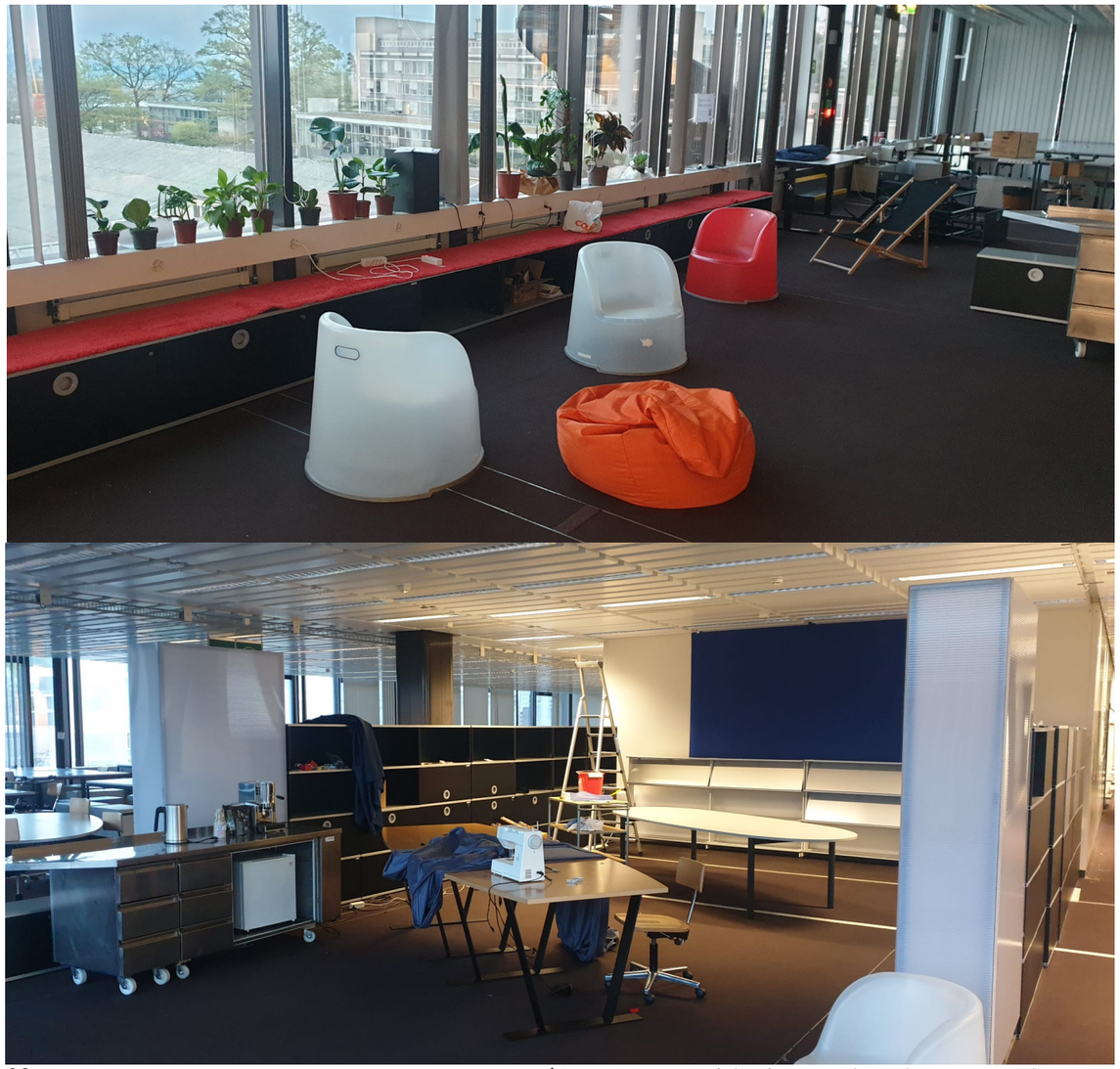
21 | Announcement and schedule for HIL F 15 case study, Elias Knecht, 2022

Fire regulations prohibit the introduction of a closed wall, which would also dramatically reduce the number of students allowed in the room. Further, respecting clear fire safety corridor regulations, the amount and constellation of furniture, acquired through ETH Immobilien, was limited. The building process at HIL F 15 was coordinated and managed together with all stakeholders. The Easter holidays were fixed as date for construction, with fewer students present on site. The facility management of the HIL building are most experienced with the circumstances of the built structure. Hence, impromptu discussions and decisions with the experts refined the final output on site. Furthermore, the transportation (fig.23) and collection of all the necessary materials such as carpets, curtains, plants and tools, was organized in advance, to be available on time. Most tools, such as electrical drills, screws, forceps etc. were provided by the facility services. Some additional materials, such as tensioned wiring for the curtains and magnets, keeping the wire from sagging, are purchased. In collaboration with and Joshua Andres, a prototypical coffee machine and kitchen element was organized for HIL F 15.

An invitation, as well as a schedule (fig. 21) was shared with the students, to ask for their participation. In addition, members of the Baubüro were present, to assist with setting up the space.

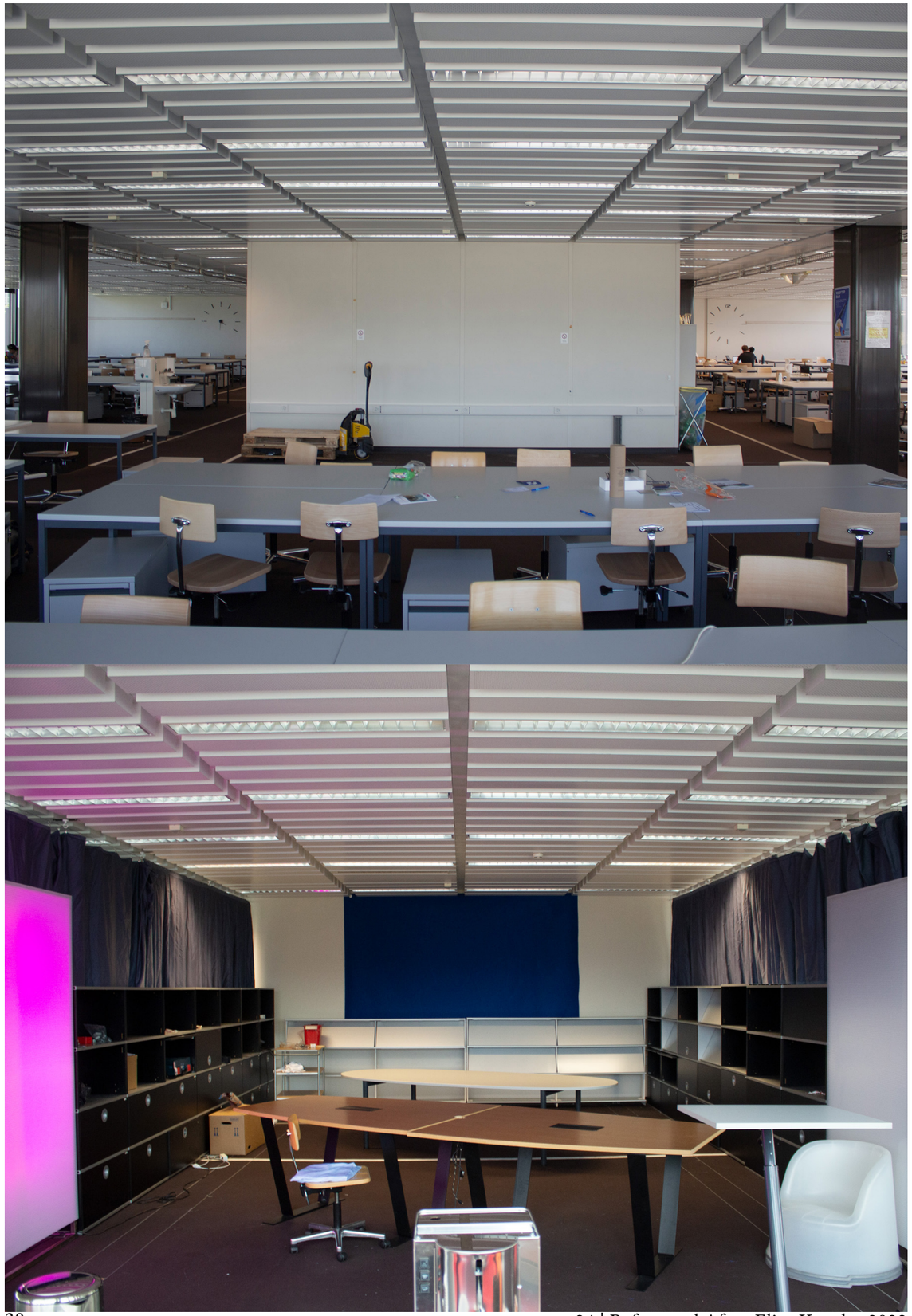
3.1.2 PROCESS

A new space has emerged, intended as space for group discussion, presentations, or moments of recovery from stressful moments and constant sedentary positioning. The “forum” space (fig. 22) is officially bookable for students and staff, as well as being open in a first-come, first-serve principle. Indoor plants further broaden the notion of a healthy and vital space within the learning environment. Height-adjustable tables have proven to be utilized not only by individuals, but also by groups, who enjoy discussion in an elevated position. After the original completion of the case study (fig. 24), the design was refined and changed a few times, reacting to first feedback and problems. For example, the lounge chairs kept blocking the free path for emergency exits and needed to be relocated. For the first time at D-ARCH, a coffee machine, acquired by the student association was made accessible to all students within a common workspace. It has triggered a debate within the different student associations, whether or not this constitutes a luxurious waste of spatial resources. Many students bring their own machines, which requires a lot of energy and produces a lot of waste.

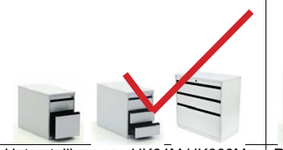


22 | Interior view of the forum, Photo by Raja Stettler, 2022

23 | Delivery of furniture for HIL F 15, Elias Knecht, 2022



BBL, Einsatz K100 an der ETH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			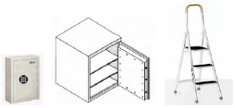
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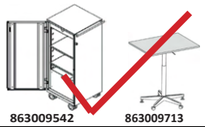
Erstellt 19.01.2018 ETH-Zürich, Immobilien, Heinz Müller

BBL, Nachfolgegeneration für K100 (Verfügbar ab Mitte 2019)

 863010183	 863010474 | 863010502 | 863010385 | 863010394 Rollen weich Gleiter KS	 863009542 863009713	 863010568|572|576|580 863010591
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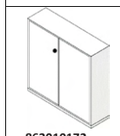
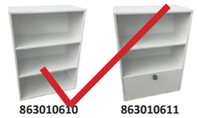
 863010172 863010162	 863010610 863010611	 863010620 863010616 gleichschl. 863010618 verschiedenschl.	 863010612
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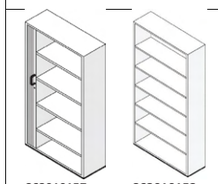
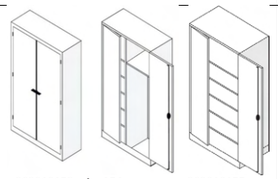
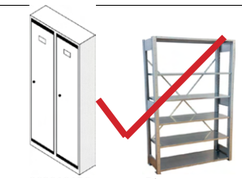
 863010157 863010152	 863010153 | 154 863010155	 863010159 normal 863010158 863010161 Sicherheit 863010160 Si	 863010156 Diverse
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Erstellt 25.06.2018 ETH-Zürich, Immobilien, Heinz Müller

3.2 TABLE DESIGN

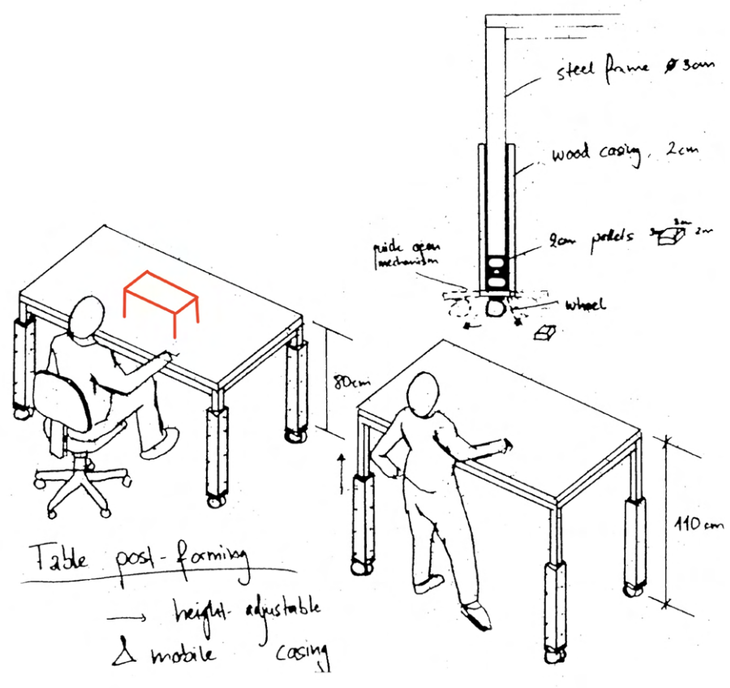
Height-adjustable tables are limitedly available at ETH. For the execution of the case study, three such tables were made available by “ETH Barrierfree”, serving approximately 300 students. Hence, we develop a DIY solution to retrofit existing furniture (fig. 26) with non-intrusive and reversible table post-forming. The method consists of an encasing for the existing metal table legs, with an additional enclosure. This additional, outer leg is equipped with wheels for increased mobility. The mechanism for adjusting the height of the table relies on a simple bolting system. A metal screw or bar is inserted into cross-sectioning openings of the encasing, thus interlocking the inner table leg on a certain height.

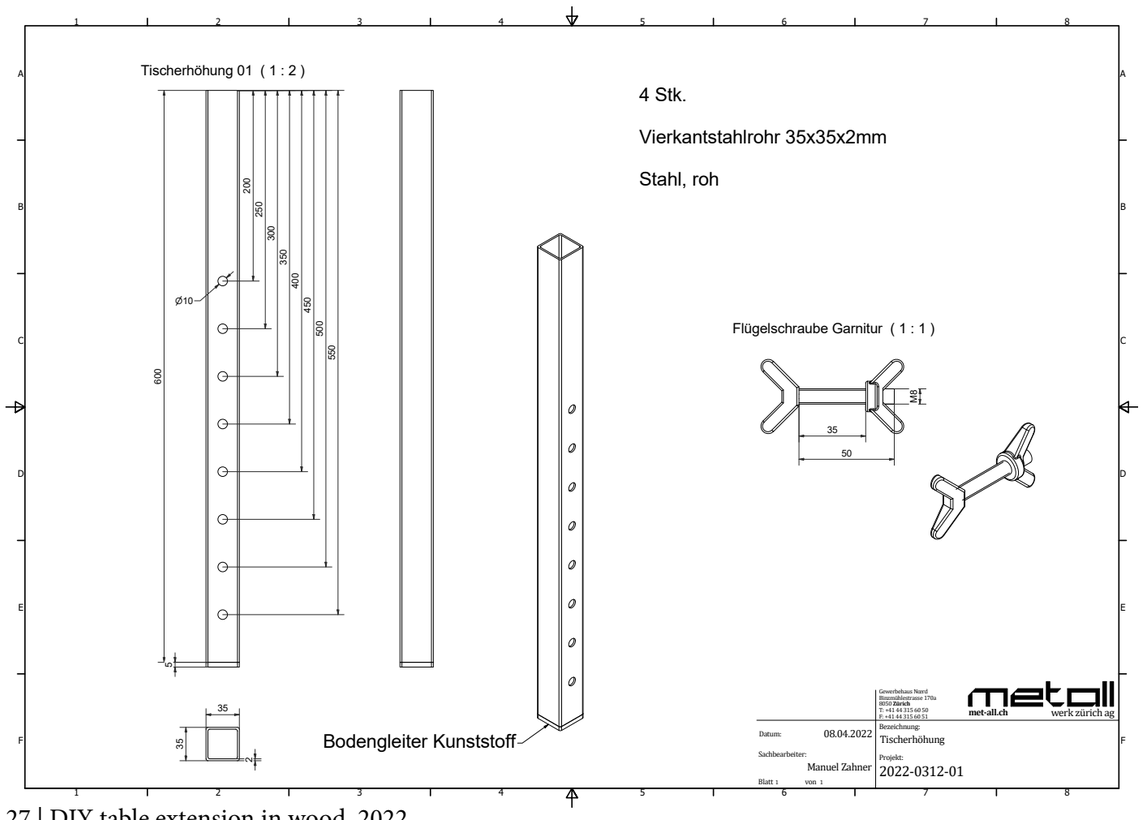
The application of the table extension initially requires two students, to lift the table on its side and apply the encasing. Once installed, a single student may perform the necessary steps to operate the system and change the height of the table.

In a next step, the resulting prototype (fig. 27) is produced professionally both in wood (fig. 28)and in metal (fig. 29) by a local carpentry (rundumholz GmbH) as well as a metal workshop (metall werk AG) in the neighborhood. Both solutions remain making use of the same bolting system.

The metal variant has proven to be most stable, as it is made of a single piece of material, with even cross-sectional proportions for a smooth fit. With wood, there is always an additional need for drilling, cutting and reassembling, which results in a construction less precise and stable.

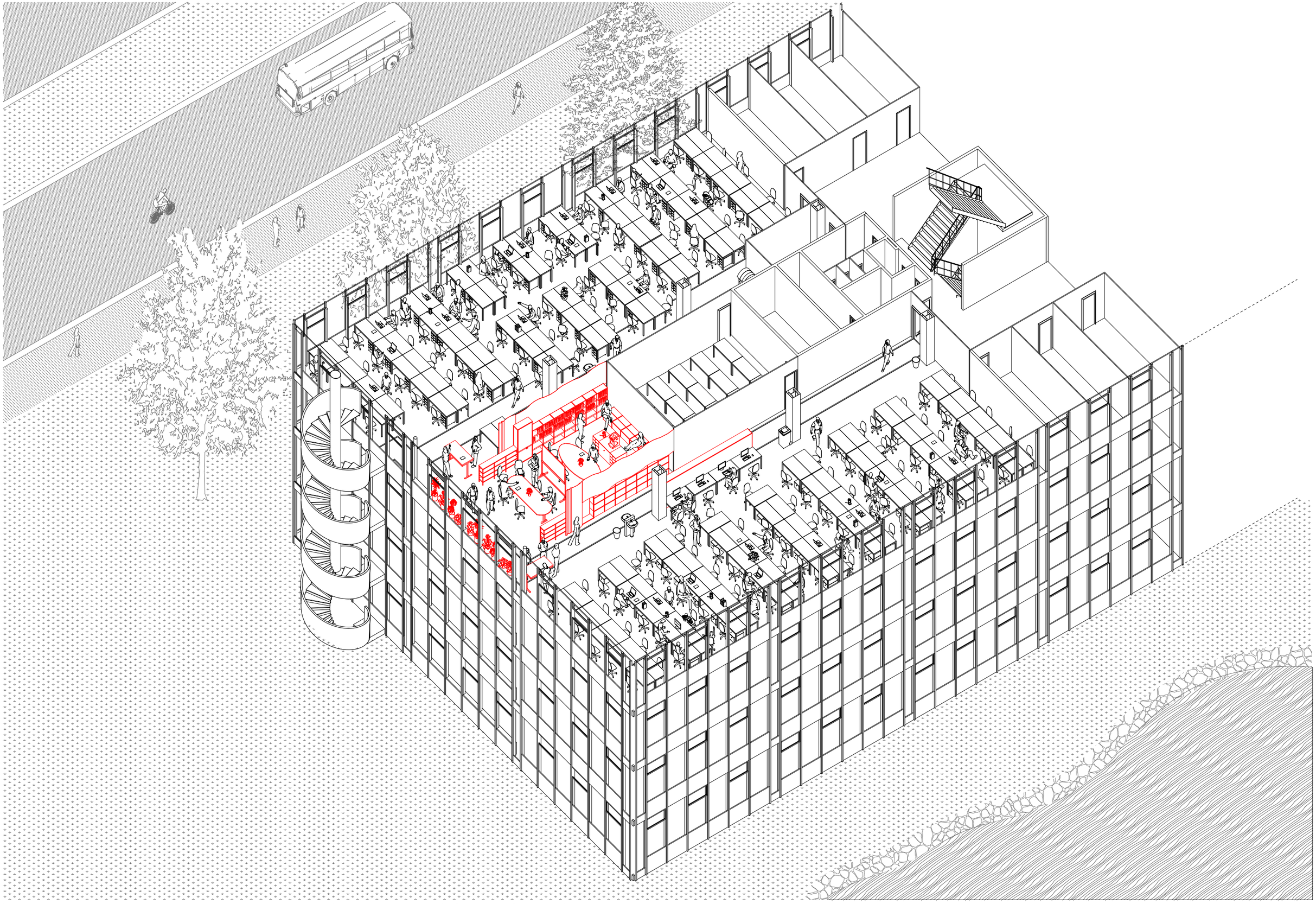
At last, remaining drawers from the shelves obtained by ETH Mobiliarstelle, will be re-used as “tiny desks” (fig. 26), which can be placed on top of a regular table. This allows for standing upright at the table, without the need for changing its height.





27 | DIY table extension in wood, 2022
28 | prototype fabrication by rundumholz GmbH, 2022
29 | table extension in steel, prototype fabrication by metall werk AG, 2022

26 | DIY extension of institutional tables at ETH, Drawing by Elias Knecht, 2022



30 | Axonometric view, case study HIL F 15, research drawing, Elias Knecht, 2022

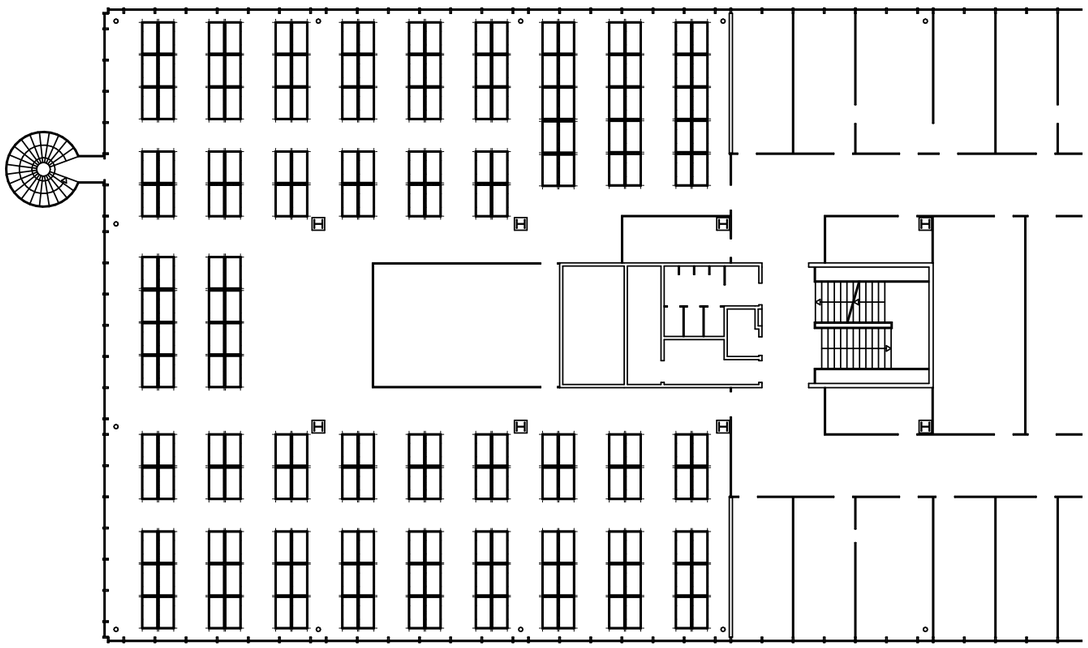
3.3 BEHAVIORAL ANALYSIS

In order to comprehend the impact of the 1:1 intervention, we observe the status-quo (fig. 31) prior to the transformation. After executing the case-study in HIL F 15, we perform subjective mapping of the users, to observe patterns and coping mechanisms of individuals, in regards of new furniture within the learning space. We find (fig. 33), that the in-between space is actively being used by students for group activities. Due to the inviting character of the space, students were taking breaks from performing their formal tasks of study. Further, the forum allowed for a withdrawal from the larger common spaces, into more private zones for (zoom) calls and rest.

In particular, we find, that height-adjustable tables are very popular with students, not only for individual work, but mainly for group discussion in a standing position. Although the larger meeting tables also host group discussion in seated position, we observe, that the smaller, height-adjustable tables are being used more frequently for debates and collaborations between students. Additionally, we find, that larger group tables save space. Standard tables (120cm x 60 cm) occupy more area per person, than a seat at a group table. In regards to guaranteeing as many learning spaces as possible, we argue, that group tables reduce the footprint of individual student.

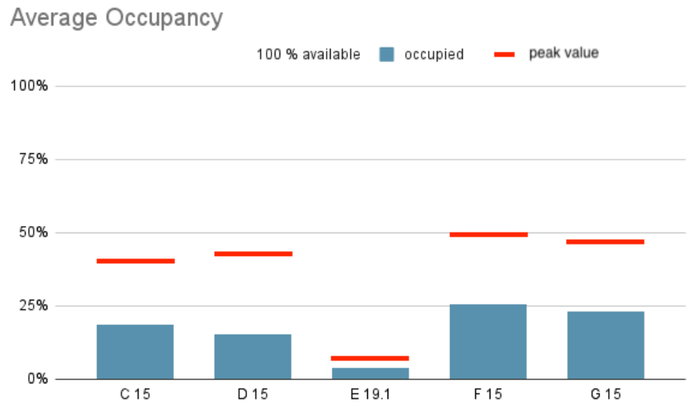
Furthermore, plants, have been installed in the forum, which have attracted bystanders to take a moment and enjoy the different greens. Not only do plants vitalize a space with some color, but also have proven to have a positive impact on air conditions, oxygen levels and thus the overall quality of the environment.

In a final step, we collect the observed behavioral components of the case study in an axonometric research drawing (fig. 30). It represents the new, current situation surrounding the case study at HIL F 15.



31 | Status Quo situation at HIL F 15, Elias Knecht, 2022

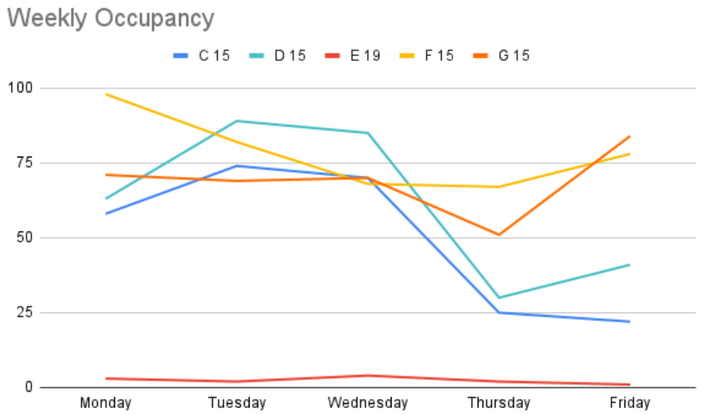
3.3.1 OCCUPANCY



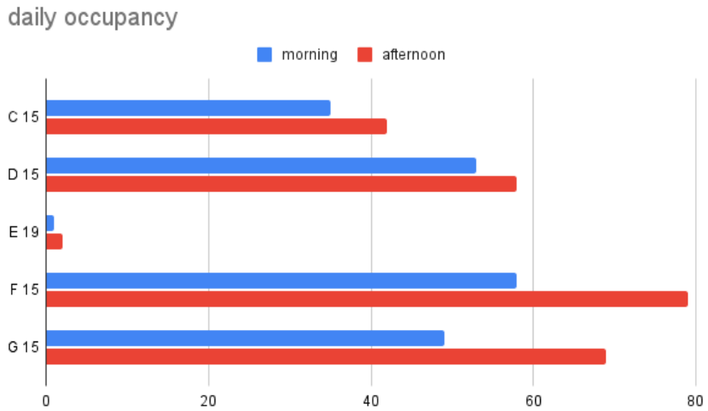
In order to evaluate the availability of student work spaces, we repeatedly count the occupancy rate of various study rooms, assigned to D-ARCH, and D-BAUG. C 15- G 15 are stacked vertically above each other. The classroom density and occupancy varies over the course of the semester (fig. 36). We find (fig. 32), that peak occupancy values never surpasses fifty percent of the maximum space available. Some spaces, such as HIL E 19.1 are hardly used at all. This is due to limited awareness and noisy ventilation systems.

32 | Average occupancy rate, Elias Knecht, 2022
33 | Observation of new furniture concept, floor plan, Elias Knecht, 2022

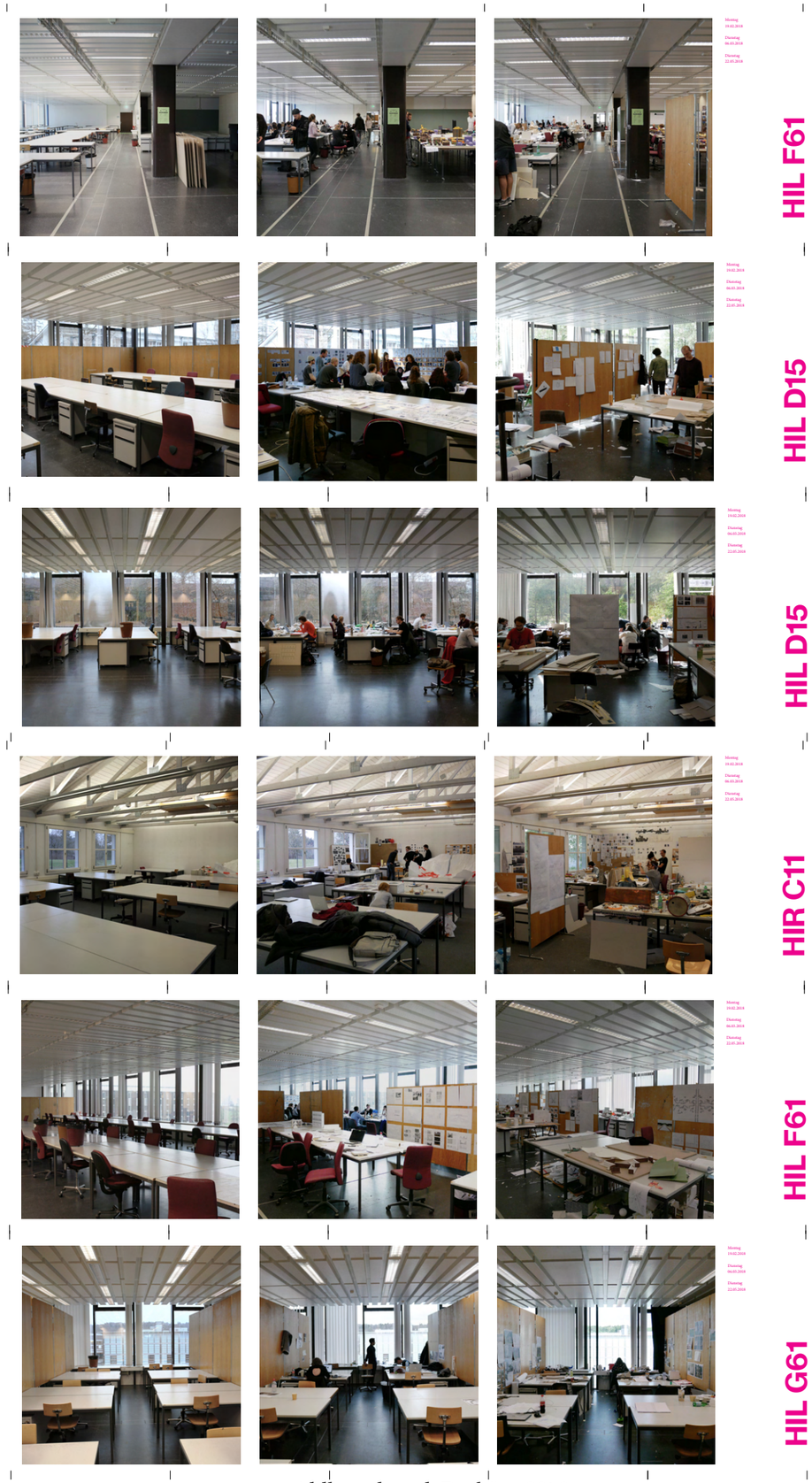
On a weekly basis, (fig. 34) fluctuations of the occupancy can be observed, particularly in the cases of C 15 and D 15. In these spaces, mentoring happens on studio days, such as on Tuesdays and Wednesdays. Hence, on Thursdays and Fridays, the occupancy rate drops to a minimum. On the other hand, the occupation rate in spaces occupied by D-BAUG remains rather constant over the course of the week.



We can also observe daily changes in the use of the study rooms. The availability of study spaces typically declines over the course of a day (fig. 35). Students tend have lectures and mentored classes earlier in the day, thus, many of them occupy common workspaces only later in the day. Often, we find students occupying study spaces earlier in the day and leaving them unattended, whilst going on breaks or being busy with other activities at other places.



34 | Survey chart, Weekly occupancy rate change, Elias Knecht, 2022
35 | Survey chart, Daily occupancy rate change, Elias Knecht, 2022

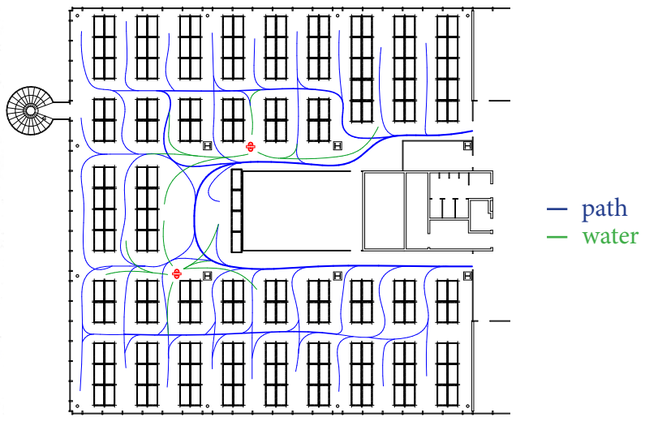


36 |Studio occupancy at semester start, -middle and -end, Baubüro 2018

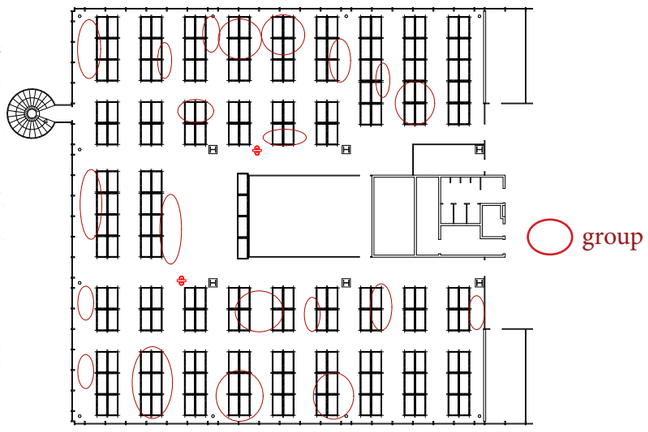
3.3.2 ROUTE TRACE

Tracing the routes of students over the course of a week, we distinguish patterns, with which students move in the learning environment. Water tabs and restrooms are repeated destinations for all students.

We observe (fig. 37), that, when rows of tables are split into multiple islands of three or two neighboring tables, students are likely to utilize new paths in between the tables. Respectively, when rows of five neighboring tables are closed, the freedom of movement is restricted.

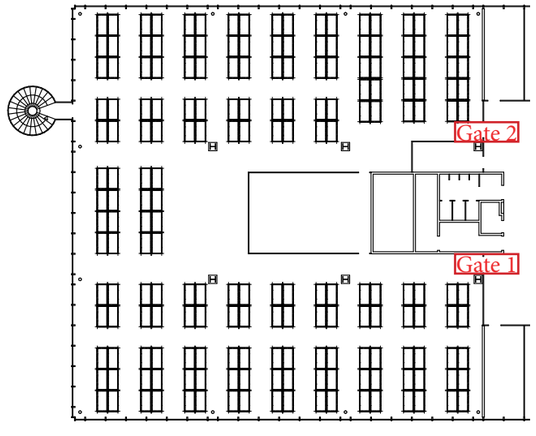


When tracing group activity (fig. 38), we find, that most group assemblies of students are spread out equally within the learning space. Students, who enjoy a more quiet atmosphere for individual studies, as a result, often listen to music, or leave the room, to be less distracted by chatting neighbors. A clear spatial distinction between areas for individual- and group work is yet missing, hence different methods of study are taking place side by side in the room, impacting one another.



37 | Route trace at HIL F 15, Elias Knecht, 2022
38 | Group activity trace at HIL F 15, Elias Knecht, 2022

3.3.3 COUNT



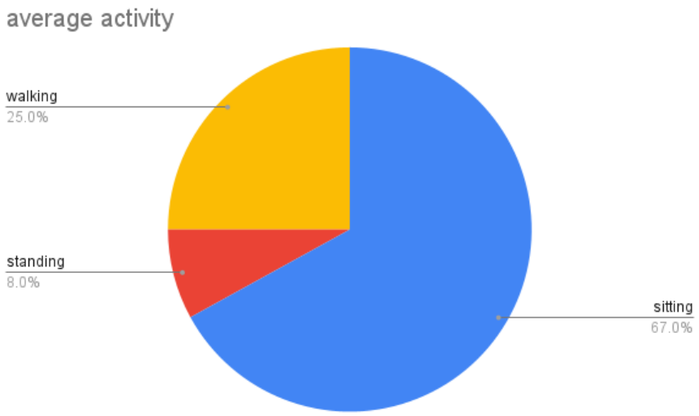
In order to estimate the amount of students who are walking within the learning space, we define points of access and count the students who enter or exit the room (fig. 39) both at 11am and at 3pm. On average, at 11am, ten students access F15 through gate 1, and eight students through gate 2. On average, at 3pm, five students access F15 through gate 1, and six students through gate 2. In general, more students are present in the afternoons, yet they are physically less active. A possible explanation is, that, as students get more tired over the course of the day, they become more comfortable settling in sedentary position.

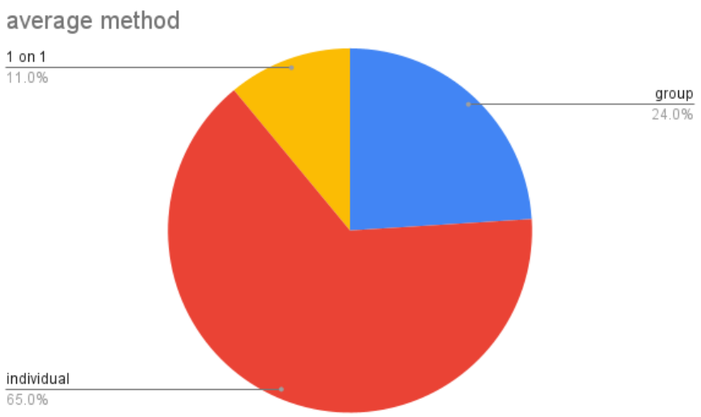
Furthermore, we count more than twenty coffee machines and water cookers installed inside HIL F 15. This amounts to a machine for every five students. Students bring their own, because the coffee which is available commercially is too expensive (minimum of 2.50 CHF) to drink regularly. The electrical wiring in the building is as old as the building itself. Each socket can only handle 6 Ampere. If too many gadgets are connected, the electrical fuses blow out. Thus, a centralized coffee and tea station would be beneficial for the service of the learning space.

39 | Gate count at HIL F 15, Elias Knecht, 2022

3.3.4 STATIC SNAPSHOT

In order to distinguish the different physical activities of students within the classroom setting, we utilize the static snapshot method (fig. 40), and count students in standing position. Taking into account the number of students walking from the gate count, we calculate the amount of students, who consequently must be in sedentary positioning. Within a typical learning environment equipped with standard tables, nearly seventy percent of the students are seated. Physical exercise is most commonly (25 %) achieved through walking around or out of the study space. Only approximately eight percent of students are standing, mostly for a very brief period of time.

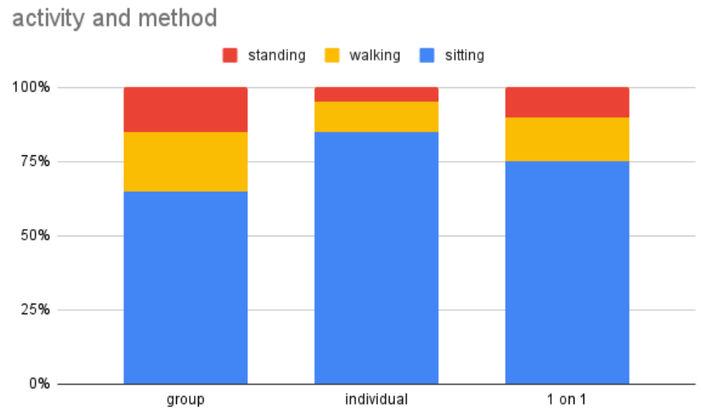


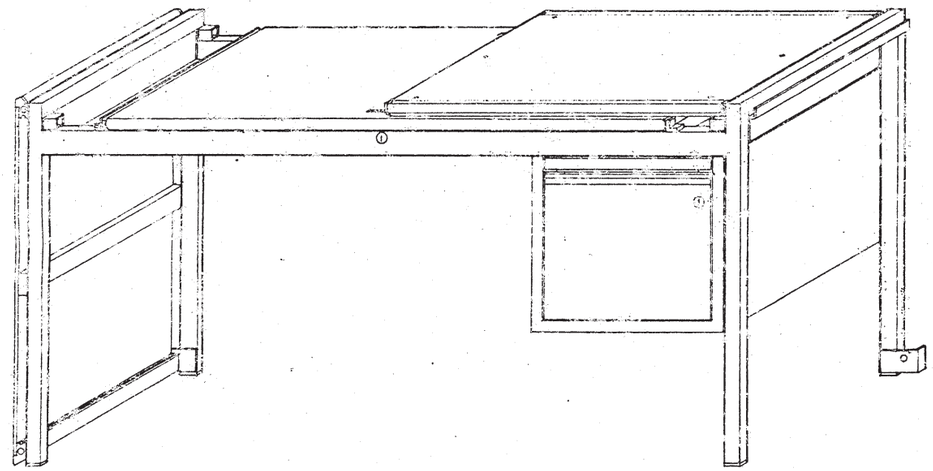


As part of the tracing method, we have located and counted group activity within the learning environment. Groups are either made of two students bilaterally exchanging (11%), or of multiple students gathering in a discussion (24%). We find, that 65 % of students are studying individually (fig. 41). Arguably, height-adjustable tables will invite students, to be standing more often. More-so, it also allows for group gatherings. Although a standard table (80x160 table area) does not suggest to host any group activities, we find, that if standing, students require less space for themselves and enjoy standing side-by-side, in a smaller circle. Thus, group work, in combination with physical activity, can be supported directly, with the introduction of height-adjustable tables.

40 | Static snapshot, average method, Elias Knecht, 2022
41 | Static snapshot, average activity, Elias Knecht, 2022

We can observe (fig. 42), that with more social engagement, comes more physical action, whereas individual study mostly consists of sedentary position, groups of two or more, are more likely to be standing or walking together. Hence, we argue, that a learning space must accommodate group working spaces and thus provoke physical activity.

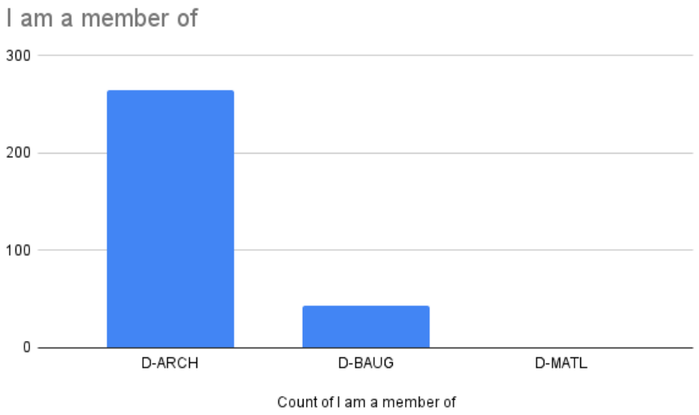


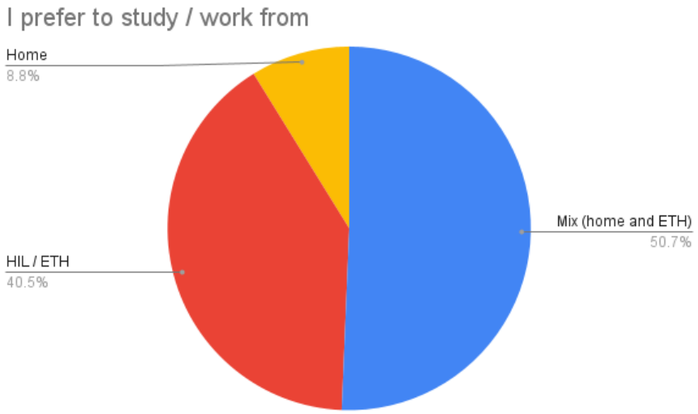


42 | Static snapshot, average method and activity, Elias Knecht, 2022
43 | Student drawing table, 1974, ETH Immobilien

3.3..5 USER FEEDBACK

In order to collect feedback directly from students, we set up an online survey with fourteen questions and send it to all students of D-ARCH and D-BAUG via email. The questions are to be answered in less than five minutes, and consist mostly of multiple choice questions. 311 students have replied, of which 265 are D-ARCH members, 46 are of D-BAUG (fig.44).

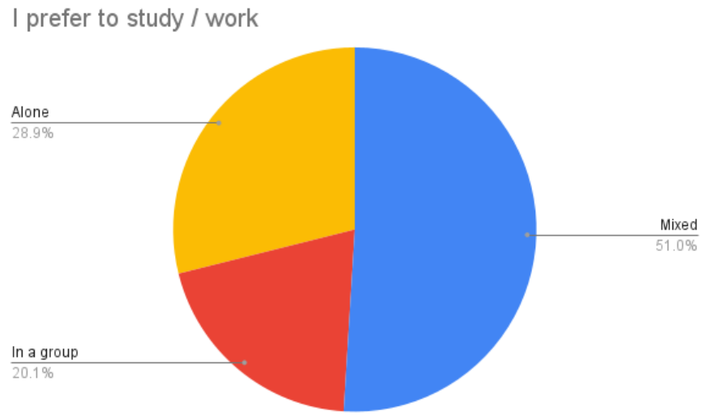


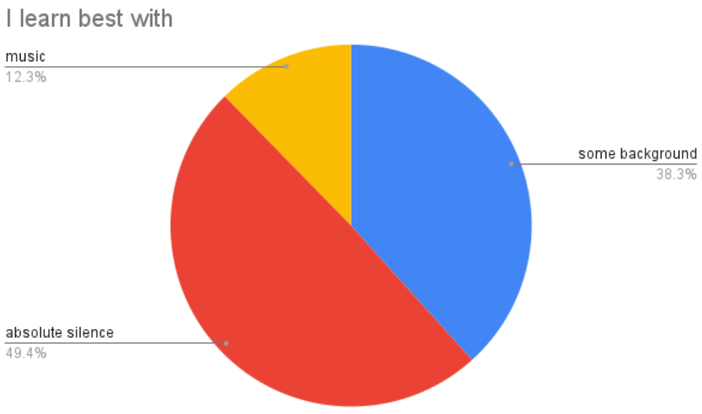


First, we asked students, where they prefer to study (fig. 45). Since the pandemic, the rise of mobile technology and digital communication has given students a choice of working remotely. Fifty percent of all students enjoy the freedom to be able work from home or elsewhere, as convenient in that moment. Another forty percent of students prefer to study and work in the university facilities and nearly ten percent of students prefer to study from home.

44 | Survey chart, I am a member of, Elias Knecht, 2022
45 | Survey chart, I prefer to study from, Elias Knecht, 2022

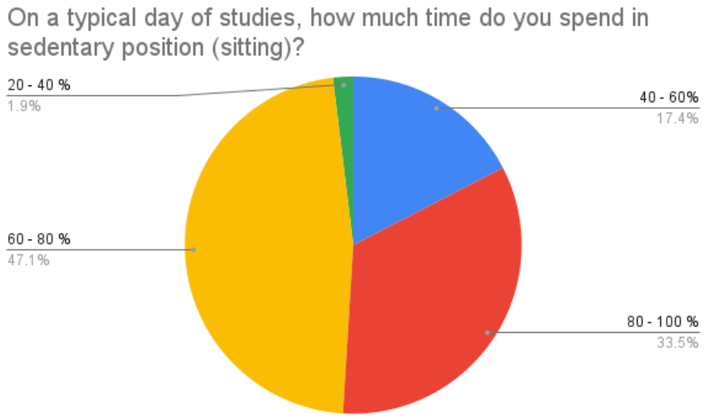
We ask students, whether they prefer to study alone, in groups or mixed (fig. 46). Half of all students tend to do both from time to time. The other half is nearly equally split amongst students, who tend to work alone, or in a group. We argue, that all students will fulfill different tasks either alone or together over the course of their education. Learning spaces can be architecturally articulated specifically to serve either individual or communal study processes and thus propose to separate each from an other. This implies, that different types of furniture may be suitable for meeting spaces, and for quiet study rooms.



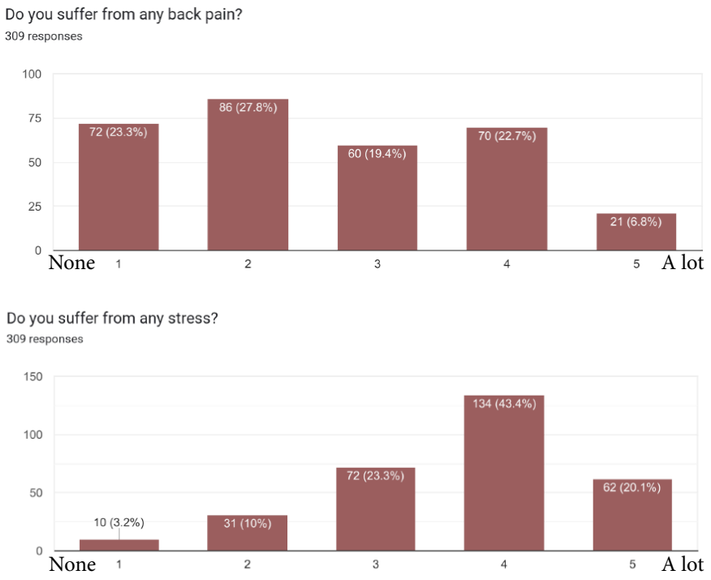


Also, students were asked about background acoustics in learning environments (fig. 47). Half of all students prefer to study in absolute silence, the other half enjoys some background noises or music. We propose, to spatially and acoustically separate the sections from each other. Because, when students work in groups, noise is generated by chatting. This may bother a neighboring student, who wishes to quietly study for themselves.

46 | Survey chart, I prefer to study, Elias Knecht 2022
47 | Survey chart, I learn best with, Elias Knecht 2022



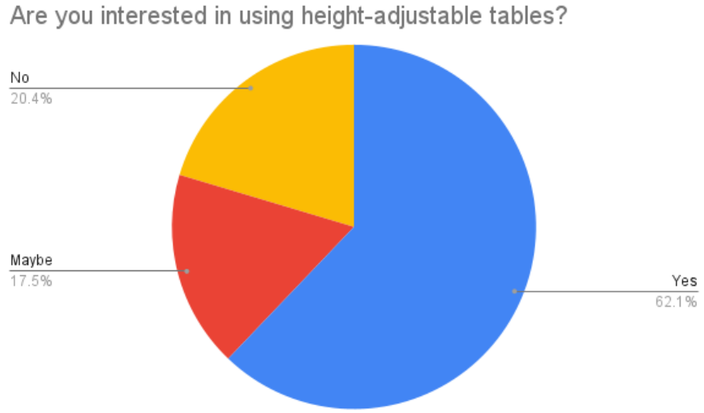
The following three questions aim at physical and mental well-being with regards to sedentary position during the performance of educational activities. Ninety-seven percent of all students are seated during more than half of their time studying (fig. 48).

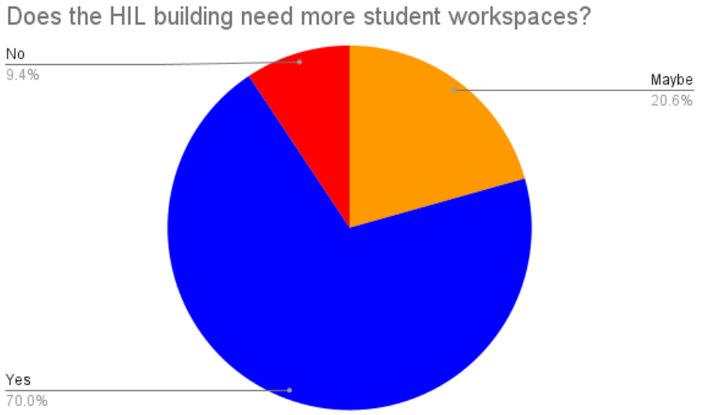


A majority of students suffer from either some, strong or even sever back pain (fig. 49). More so, two thirds of all students are dealing with an increased or even maximum amount of stress (fig. 50). We argue, that changing body posture, and being less seated, can influence pain and stress levels positively. Thus, a change of furniture can enhance the learning experience of students.

48 | Survey chart, sedentary position, Elias Knecht, 2022
49 | Survey chart, back pain, Elias Knecht, 2022
45 | Survey chart, stress, Elias Knecht, 2022

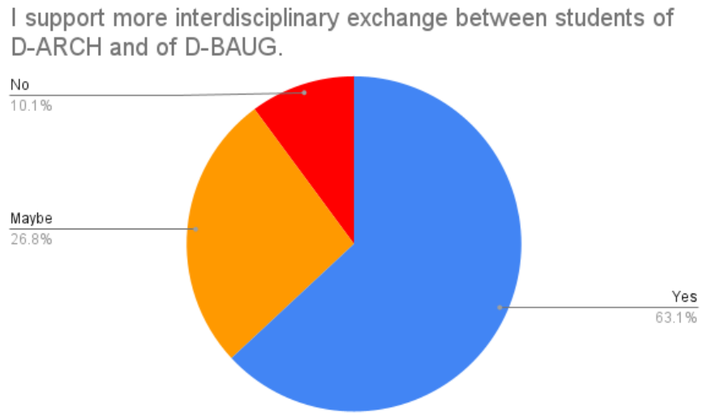
Eighty percent of students are interested in using height-adjustable tables (fig. 51). Whereas twenty percent of students are explicitly not interested. Hence, we argue, that height-adjustable tables mustn't only be made available as a treatment against existing back pain, but also as a preemptive measure for physical alternatives to seating orders.





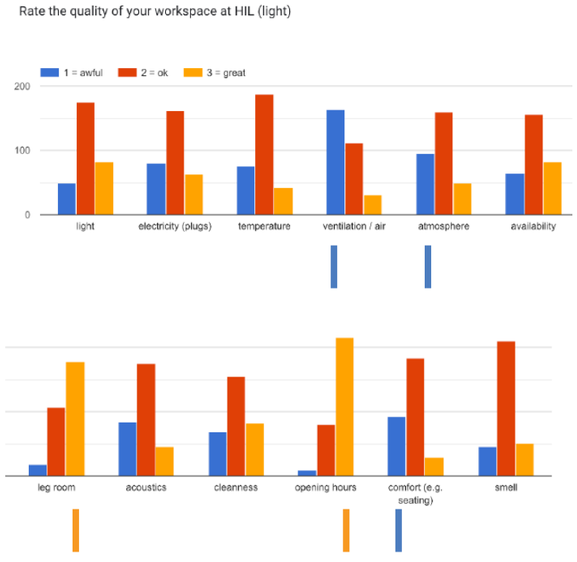
Furthermore, a majority of ninety percent of students are interested in and require additional workspaces at HIL (fig. 52). Whilst the study area for students is declining recently (due to the deconstruction of the Huber pavilion), and student numbers are growing, the faculty must find new solutions to satisfy the demand for student-oriented learning spaces.

Most students are interested in interdisciplinary exchange amongst students of D-BAUG and D-ARCH (fig. 53). Only ten percent are against it. Generally, the fields of study of both departments overlap, and the same building is shared during multiple years of education. Exchange can take place formally, as part of interdisciplinary curriculum, but also informally, where common spaces can be shared in a positive non-classroom environment.

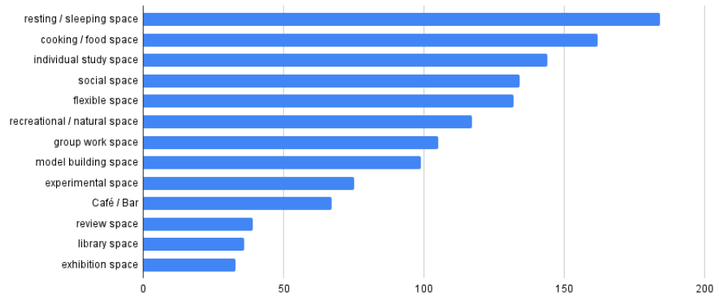


51 | Survey chart, height-adjustable tables, Elias Knecht, 2022
52 | Survey chart, workspaces, Elias Knecht, 2022
53 | Survey chart, interdisciplinary exchange, Elias Knecht 2022

Of all architectural aspects at HIL, the ventilation is rated the worst (fig. 54). This includes the demand of students to be able to open the windows. The atmosphere and comfort (e.g. seating) are also rated very poorly. Arguably, more accommodating in-between spaces, which are equipped with non-standard furnishing as well as hinged windows would therefore improve student satisfaction.



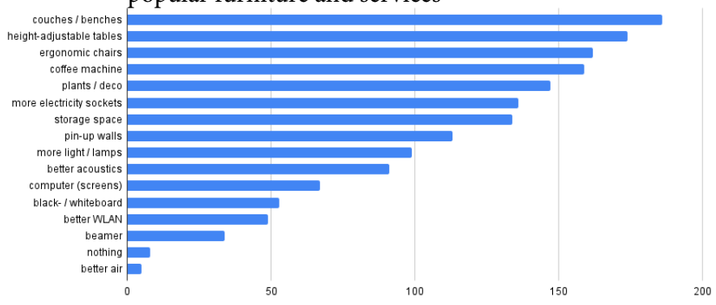
popular typology of space



The most popular typologies of space, which are missing at HIL, are resting/ sleeping spaces (fig. 55). The students demand spaces which allow them to take a break from their studies. This includes spaces for cooking, social- and recreational activities. Also, students require study spaces, which foster and distinguish between individual study and group work.

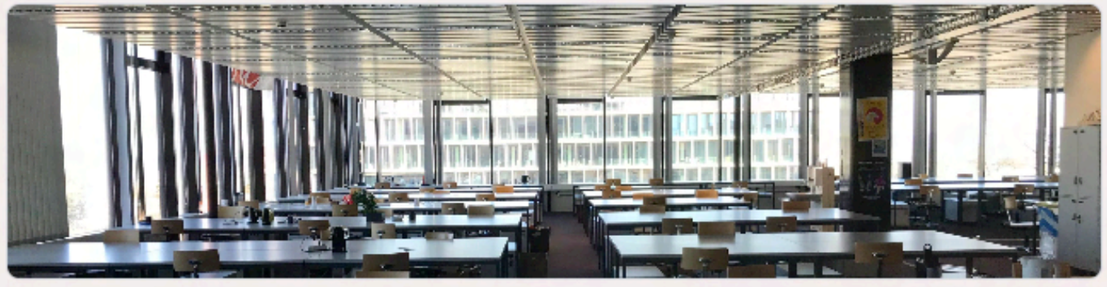
The purpose of a learning space may be defined also through available fixtures. Correlating with the desire of students for resting spaces, the couch or benches underline the importance of physical well-being at university (fig. 56). Height-adjustable tables are second most popular, before ergonomic chairs. All of these furniture typologies support physical self-care and health.

popular furniture and services



54 | Survey chart, rate your space, Elias Knecht, 2022
55 | Survey chart, popular typology of space, Elias Knecht, 2022
56 | Survey chart, popular furniture and services, Elias Knecht, 2022

3.3.6 SURVEY RESPONSES



Satisfied with your learning experience at HIL?

Please give us feedback about your learning environment and help us to transform it.
This survey will take about 5 minutes of your time.

We asked the survey participants to give their view of future learning spaces:

“The HIL building will be renovated soon. Please share your thoughts, ideas, inputs or questions on what makes a proper learning environment. Thank you for your participation.”

93 individual student replies were submitted in response. Some suggestions, made by the students, aren’t new at all. Already in 1987, students informally proclaimed informal activities, as simple as suggesting how to open windows at HIL.

The responses are organized by topic, such as the HIL building, informality, furniture and future learning spaces.

In a table (fig. 58), we group popular responses, such as the necessity to open windows and naturally ventilating learning spaces.

Individuals often lack the opportunity, to evade larger study halls with many students, to withdraw into more quiet and private study zones. Further, many students feel left out of the public discussion, on how the learning environment can be commonly designed and developed.

57 | Survey chart, popular furniture and services, Elias Knecht, 2022

58| Survey responses, Elias Knecht, 2022

3.4 INTERVIEWS

Professors of D-ARCH are interviewed for historic context (fig. 61). We further draw our attention to the users, and interview former, current and exchange students at D-ARCH. We include interviews with architecture students (fig. 60), who have visited ETH from abroad, such as Guilherme Lacks, who is enrolled at FAU Sao Paolo, and Victor Rufart, who is enrolled at UPC Barcelona.

Further we hold an interview a current high school teacher in Zurich, who is able to give us an insight into teaching learning methods, applied to a different educational level and age of students. We also interview the current presidents of the student association at D-ARCH, Miro Kiener and Nikola Nikolov, as well as the president of the student association ASAR in EPFL Lausanne, Louis Conforti.

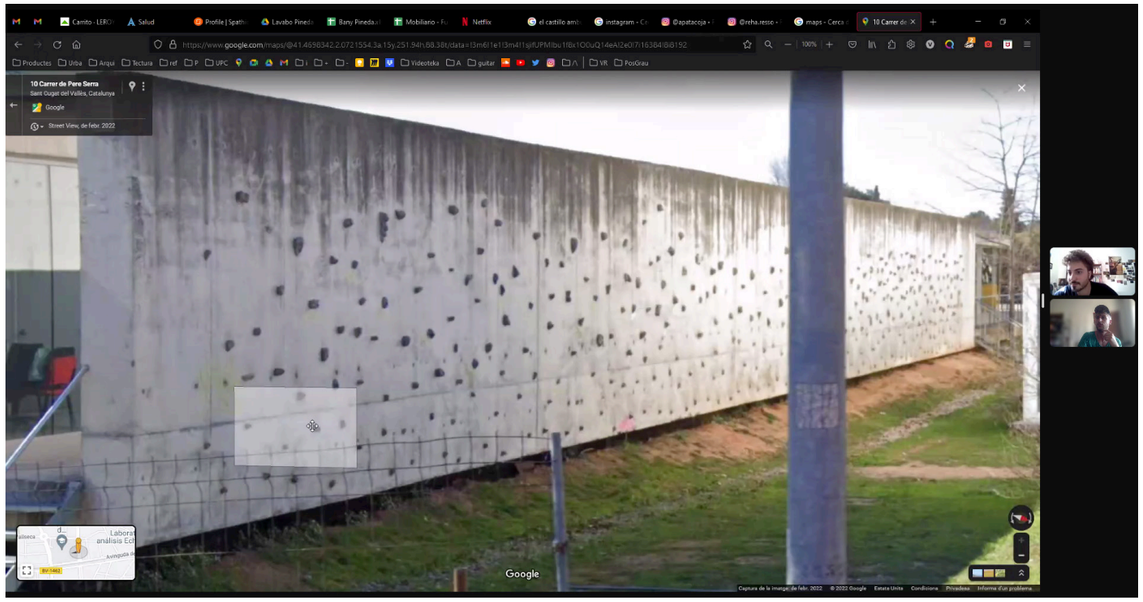
Lastly but not least, we include the interviews with two former students of D-ARCH, Linda Bühler and Sophie Ballweg, who have only recently accomplished their degree. Of all students present, they have the longest experience with the HIL building.

The responses in the interviews are grouped in similar topics, such as spatial resources, the experience of the HIL building, informality, furniture and future learning spaces.

We find, that there are great cultural differences between international schools, and that students in Brazil or Spain, are more likely to be politically active, as well as engaged in constant disputes with the school administration. Also, students at FAU and UPC rely much on activism, such as protest and strikes, even with the support of many of their professors. Interventions are simply executed, prior to receiving permission, if deemed necessary. A great example is the large wall on campus of UPC Barcelona, which students of architecture have transformed into a bouldering wall (fig. 59), by mounting different climbing objects to its surface. This was done, because students were not offered a sports center on campus and desired more physical exercise

The responses given during the different interviews were later organized into subgroups, such as the HIL building, informality in learning processes, students participation, furniture, future learning spaces etc. This allowed for a detailed overview of opinions from different stakeholders on the same matter.

We find, that the opinions of professors and students do not differ by a lot.



59 |Student initiative at UPC Barcelona, Bouldering wall, Interview with Victor Rufart, 2022

Spatial Resources

There are actually plenty of square meters available to the students. However, these spaces are often difficult to appropriate.

The space in between, with the large staircases, is poorly vitalised and rather unfriendly to linger in.

At ETH, the studio was a student-sovereign space, when teaching staff were not present.

However, the school ran out of space, so they had to build an annex building

Students were asked to build large models, but there was literally not enough space.

People are more relaxed and kind in a nicer space.

The different collectives at DARCH need spaces to actively learn and organise themselves.

Student spaces have become overloaded.

In-between areas, which are less defined and exist without clear function, allow a partial withdrawal from larger crowds.

A learning space, or work place, must better respond to the individual needs of students.

Smaller Studios at ETH made it easier to connect with the professors.

A free and democratic atmosphere allows the various students to use spaces differently and put their own ideas into practice.

The more students, the more dense and chaotic it gets.

In the professorship office, we have more space, as the students.

The large drawing halls were great, you share the same space, and everyone is "in this together".

Some students prefer to withdraw from larger crowds. However, there is no real space, to do so, except for the classroom.

For a better work-life balance, it is nice to have separate spaces to be able to pause work, and relax more.

HIL

I like the HIL building because it allows to discover new spaces, and sometimes empty niches.

With cows and tractors right in front of the buildings, it felt like nature.

The circulation area is not enough articulated as habitable room.

The HIL building made a machine-like impression, with multiple entrances and various spheres. I perceived the building as a living object, housing a big community.

Navigating through the building was like a maze, a simple search for laser cutters took me for ever.

I enjoyed working at ETH, because everything is located at the same place.

The longer you stay at HIL, the more confident and experienced you become.

After six years, the building feels like home, because you spend so much time on campus.

Professorships and their respective classes are like capsules.

Interview

Louis Conforti

Victor Rufart

Guilherme Lacks

Miro Kiener

Nikola Nikolov

Linda Bühler

High school teacher

Sophie Ballweg

Informality

Many prototypes were built and placed on campus. Students just proceeded. Permits were given after construction was completed.

There is a class plenary, where students lead one hour of discussion.

When students communicate, knowledge is shared.

Self-organization is a matter of maintenance and size of the group.

Meeting teachers outside of classrooms was particularly beautiful.

Many students, when they start studying, still need to learn, how to learn, and best achieve their own goals.

If you learn on your own, you tend to repeat your mistakes, believing you are right.

Many students are lazy, and it is difficult to force them to participate.

Many parties were organised by the students, which were also joined by the professors.

Friendships make the building feel like home.

The scale of self-organisation needs to be limited to become manageable.

However, most of the positive atmosphere came through the social interactions.

Particularly the students with more learning difficulties profit from learning from other students.

Interaction can be supported with food and beverages.

The school does not want students to hang around in the studio and become too comfortable.

I felt at home at HIL, because of the students and friends.

The school fears students, who appropriate the space, since these pose unknown risks.

In order to take active part in the daily study life, students need to enjoy it, and have fun.

The students have the capacity to self-organise, but the right conditions need to be met.

The designated smoking space was a great space for exchanging with others.

Being connected only virtually, has physical and social consequences.

It would be nice to have the opportunity to be closer to engineers.

Socially, ETHZ gets nine points out of ten.

Without healthy relations amongst each other, students cannot learn

Private life must still be separated from education.

Informal learning happens when you are relaxed, without being in a designated learning period.

Furniture

Ergonomic furniture or height-adjustable tables can already make a practical difference to correct false postures of our bodies.

I would include more alternative spaces and furnishing

All tables at our school are height-adjustable.

The top-down, entre-deux (bilateral) decision to implement tools like a microwave, has left students feel less responsible to maintain the machines.

In front of the classrooms there is a long bench, for students to sit together and communicate with each other, after or in between classes.

I prefer simple rooms, with a lot of light, a table and some aesthetics. I don't need any plants

It is not really essential to open the window, but we prefer to be able to choose ourselves.

There are no height-adjustable tables available at EPFL.

The sofas supplied by the school are rather uncomfortable, small and unpopular.

No matter which chair, if you spend ten hours sitting in it, any chair will start hurting you.

Our studio projects always were first priority, and our body and private life was second priority.

It is important to offer a diverse range of seating opportunities.

Carpets and cushions allow us to effortlessly transform a room and generate a friendlier atmosphere.

We have "decompression spaces", with sofas, which are organised by the students.

Colours are not so important.

Furthermore, the outdoor lawn is an important space to relax in between classes. Here, we do not speak about school work.

Plants are nice, but they don't make a big difference.

There are many pros and cons of different seating orders. For example, frontal teaching does not work with group tables.

I remember the uncomfortable chairs, and turning them around constantly to change my posture

In the studios, fire safety regulations signify an obstacle for alternative furniture, as sofas etc.

Future Learning Space

Each floor should house a kitchen for students to seek their own alternatives to the canteen food.

It's difficult to force people to engage and exchange. But architecture can be less hostile.

In the school of architecture, the process of studying is already very interesting and diverse, here we need a space, which is rather calming.

Less is more? Less must be enough. With only a little, much can be achieved.

Since the students spend so much time at school, we must ask, whether the school will transform into a living environment.

HIL F 15, may end up as a "parloire", as in prison, which allows people to meet, without allowing them to cross the line. The architect will always face an engineer, sitting on the opposite side.

Today, classrooms are more student-centred, whereas they used to be very teacher-centred. This represents a more cooperative learning process.

Students simply want to co-decide.

If there is more space for relaxation, then students start to become more comfortable, and spend even more time on site.

Currently, the first-year students are fighting a battle for the implementation of a kitchen space in the learning environment.

Working spaces shall never become private space, just to keep us working for longer hours.

Spaces must allow people to meet.

When there is no budget, people need to think out of the box.

There is a limit, to how dense, loud and chaotic a learning space can become.

Home - Office

As a student, I used to work from home whenever I could.

I have always had a workstation at home for concentrated work.

I kept using my private atelier spaces outside of HIL for working on my projects.

The lack of proximity to my co-workers and peers has proven to be difficult.

Personally, I still require a personal table, or even two or three, in order to work properly.

A collective arises through mutual awareness and sensing

The pandemic has taught us, that we are able to communicate and work with digital tools.

I can focus on my work in pretty much anyplace, whether in a noisy café or anywhere else

Amnesia is a structural problem of the institution, where students and also their commitment leave after their graduation.

To draw in the presence of others allows for informal learning.

Many students today lack the approach and access to places with informal qualities.

HIL

We perceived the HIL as being a catastrophe. There was no good ventilation, we could not open any windows. I kept falling asleep during lectures.

There are plenty of learning environments, which are much worse than HIL.

I will not condemn this building, as many others do. It's almost alright.

The HIL building does not serve very well as educational tool.

The HIL building is horrible to work in due to the granularity in space.

Future learning environments will look differently in a potential additional floor on HIL.

The provisional spaces at Globus were phenomenal. We appropriated the spaces informally.

The HIL building is confusing.

At FAU, Students took on responsibility to appropriate the spaces with their own fixtures, sofas etc.

The most urgent problem at the HIL building was always, that we cannot open any windows.

A spectacular building only distracts students from focusing.

The HIL foyer is leftover space, nothing more or less.

We don't need to demonize the HIL building. With very little effort, much can be achieved.

The fact, that the HIL building is imperfect actually increases the potential for optimization.

It is too clean and there are too many of the same tables and chairs

A flexible learning concept must include the home office

The HIL building fails to manifest one single space, one identity, one thought within a heterogeneous fabric of diverse individuals.

Some spaces are only used half of the time.

The department was forced into a building, which was not designed for their occupation.

The building remains to allow all activities, to de- and reconstruct spaces for different working periods, final crits, study operations, speeches etc.

It still feels, like we are only tenants at HIL, the building never really belonged to us.

The faculty, having acquired a lot of know -how, is not allowed to touch and change the building themselves.

We have missed a process of appropriation, hence there was no real contribution to, or identification with the HIL building.

The department will benefit from uniting all students in one building.

The huge entry and circulation halls at HIL provide space for absolute exchange

Interview

Fabio Gramazio

Barbara Buser

Annette Spiro

Annette Gigon

Roger Boltshauser

Heinz Müller

Informality

Most of the information is transmitted during the drinking of coffee.

It is important to carry the students automatically from formal moments (crit) towards informal encounters as spatial conceptual idea.

The entire faculty requires informal, appropriable and flexible spaces.

Although students are no experts yet, they must be allowed to jump in, experiment, ask questions and test their own ideas.

Like students, some faculty members also may experience difficulties to bring themselves in and weld together a feeling of a collective.

New students arriving each year will be able to deal with the ideas of elder generations and enrich them with new proposals.

Exchange needs to be longed and searched for, not only forcibly organised.

Furniture

Because the ETH is a federal institution, new submissions and calls for bids are regulated by parliamentarian resolution at the federal agency of logistics.

Every day, the layout of the furniture was changed in a collective hour in the early beginnings of the day.

The furnishing needs to be conceived more openly, introducing budgets for smaller groups.

Desk sharing is a concept, which I believe, is more suitable for a business, than for a school.

A table is a table is a table.

During one school year, we remove a third of the furnishing, clean and repair it, before recirculating the objects within the different facilities.

The reuse of existing furniture must be considered.

Fixtures can be more cost efficient, simple and less perfectionistic.

The real estate office of ETH will not be happy about ever-changing demands and requirements made by professors, employees and students.

A rational fit-out without any palm trees may seem boring and monotonous, but it allows for concentration and peace of mind at the workplace.

In my backpack, I have got a laptop, an electrical cord, paper, a pencil and an eraser. With these tools, I am fully equipped.

Some of the furnishing is at least as old, if not older than the buildings themselves.

Flexibility will always cost, and most likely be expensive.

ETH has collected some experience at Octavio for example, but isn't planning to proceed with individual but rather with more general solutions for the future.

We may have less physical storing space, but enjoy more freedom in reorganising objects.

The fitments need to allow flexible changes in working-, teaching and learning methodologies,

Zoom lectures have a great impact on physical components of future classrooms.

Each project with new and individual program for furniture, is more difficult to maintain, compared to a general solution for workspace furnishing at ETH.

Tables can be smaller, mobile, height-adjustable.

Future Learning Space

Students shall have top priority and have the most space made available.

Adding on top of HIL is a great argument and strategic measure for maximal densification of physical experiences in space.

We need to distance ourselves from the drawing hall character with personal computers, and redirect our efforts towards laboratory and atelier characterization of classrooms.

We are talking about a "multi space" and sharing workplaces.

We need to re-think classroom education.

It was a great mistake, not to involve the faculty and future users in the design of the HIL building, before we moved in.

Learning spaces need to be useful in a multiplicity of different scenarios.

I imagine the parking garage being re-purposed. It is an ideal location to be occupied by an adobe stomping atelier.

Future learning environments need to be less predefined.

To re-purpose the entire ground floor as drawing hall with direct access to the exterior would be particularly beautiful.

As long as I can access a power outlet, I manage to focus and completely fade out my surroundings.

It has always been a battle of handing over the responsibility.

Acoustics can be more communicative than vision.

We need to diversify the supply of spatial typologies

ETH is speaking more commonly about 'less compressed' and confined working stations.

4
CONCLUSION

In this research, we have observed the positive impact of height-adjustable and group tables on the physical and also psychological wellbeing of students. Over the course of this research, relevant components of a learning environment have been distinguished. The furniture, architectural design and urban context of learning spaces impact study methods and behavior.

During nearly 170 years, the faculty of architecture has lived through six different building sites, but only changed furniture on three occasions. Only in 2019, height-adjustable tables have made it into the official catalogue of furniture at ETH.

Most furniture utilized at ETH, is older, than the buildings, they stand in.

Room sizes, in a learning environment, define the granularity of working groups. Large spaces allow for greater accumulations of students and staff. When spaces become too large though, there is an increased risk of disassociation amongst peers, noise disturbances and a lack of spaces for individual withdrawal and privacy.

Formal teaching at D-ARCH is confined to chairs and tables. The furniture hereby structures the interaction between peers and faculty. We consider important criteria, such as table arrangement, orientation, seating density, range of motions and physical abilities.

Table arrangements change with the various conditions of the different classroom typologies. Rows of tables are most commonly implemented, when sunlight influx is spatially oriented and limited in the room. When classrooms and openings respectively become larger, light conditions are more equal across the learning space, allowing for different table arrangements, such as islands, clusters and flexible set-ups.

Larger and adjustable tables encourage discussions and interaction amongst students.

Alternative furniture concepts, such as height-adjustable and meeting tables will bridge social and physical distance between students, foster group dynamics and centrally integrate exchange amongst peers.

This work argues for the prioritizing and upgrading of common workplaces in learning landscapes. Strategic points of encounter must be spatially articulated in a built learning environment, in order to echo minority voices and broaden the positive effect of mutual engagement.

Mutual exchange and shared resources activate peer communication and facilitates student activism.

This work concludes with the need for elevated working positions in higher education. Although fixed personal workspaces remain desired for individual study advancement, sedentary positioning limits the capabilities of students.

Height-adjustable tables are autonomy supportive, allowing changes in body posture and increased movement at the workplace. Physical self-agency and self-care during learning processes benefits the integrity and attentiveness of students. Thus, the physical health of students impacts the efficacy of educational activities and the methods of study. Arguably, a healthy student is a successful student.

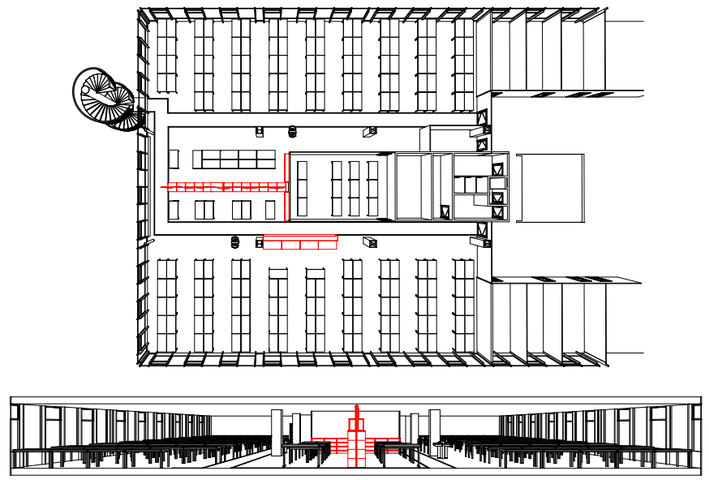
63 | Case study in use, Photo by Joshua Andres, 2022

4.1 CASE STUDY RESULTS

Concluding the pilot phase, the case study of HIL F 15 will be further refined after debriefing with architektura, AIV, AkD, the Dean's Office, and D-BAUG IT Services. The in-between space has proven to be beneficial to the cause, although requiring some further changes. A visitation of the case study with all responsible stake-holders and users has taken place, to discuss further options and necessary improvements. The option of eliminating the forum space, and replacing it with a central wall (fig. 64) has been voted against.

Students, who stand and move more often, are more likely to exchange with each other.

The so-called "*Forum ad interim" (fig. 66)* will remain in place. The coffee machine was moved over to the D-ARCH side, as it gives the forum space too much of a "coffee-break character", which seemed wasteful of space. A round meeting table will stay in the forum, complemented by standard tables and cushioned benches. Most importantly, the height-adjustable tables have proven to become very popular and desirable to the students in HIL F 15.



64 | Options for case-Study refinement, Elias Knecht, 2022

4.2 NEXT STEPS

A design semester will proceed this research as part of the embedded master thesis. The case study indicated a successful model for further extension of the HIL building, and will serve as a model for future interventions. Students of architecture and engineering remain to experience a lack spatial resources and an overload of the current learning environment.

The collaboration at HIL F 15, of involved stakeholders and departments, D-ARCH, D-BAUG, ETH and HIL, may serve as an exemplary actor network to share knowledge, expertise and tools, required for the undertaking of transformational projects at ETH and HIL in particular.

The pavilions on Hönggerberg will serve as a case study, to propose the re-use of building materials for the production of additional spatial resources at HIL.

In particular, this research has shown, that a lack of space, and the effects of thereof, can be mitigated through the introduction of alternative furniture and the sharing of spatial resources.

After sixty years of service, the HIL building will conclude its first life-cycle by the end of the next decade (2030s). It will be subject to retrofitting and extension, allowing for early suggestions and proposals on how to advance the school of architecture and engineering spatially.

The HIL building is located in the center of the campus Hönggerberg, (fig. 67). It fulfills not only an educational role for students of architecture and engineering, but also, serves a gathering - and entry point for the rest of the campus. On a weekly basis, the campus Hönggerberg houses more than 10’000 students, professors and researchers and their activities respectively.

The architectural department requires additional spatial resources, as soon as possible. In order to sustain a durable expansion of the learning environment, it is necessary to re-use and up-cycle as much first generation infrastructure, like furniture, as possible.

In addition to the expansion of HIL, the architectural department D-ARCH is investing into the enlargement of the ONA location in Oerlikon. This further contributes to the fragmentation of the department into several satellite locations.

We continue to promote the “Baubüro” as student initiative and engage in ongoing debates and building processes of D-ARCH. It allows for a continuous flow of proposals from a student-perspective, and further supports the notion of students actively investigating and collaborating with the present actor network of ETH and D-ARCH.

Aside from the Baubüro, there are multiple other initiatives, aiming to advance the quality and quantity of learning spaces at D-ARCH. The Informal Learning Studio concludes a two semester long program with the necessity to be continued in one form or another. A self-organized, autonomous studio will invite students in the upcoming semester, to define their own learning objectives and structure their own study experience. Students will rely on similar actor networks, as activated in HIL F 15, as well as inviting and collaborating with other students and experts.

65 | Case-Study refinement, Elias Knecht, 2022

66 | Student learning space “Forum a.i”, ETH Zürich, Elias Knecht, 2022

4.3 DISCUSSION

Carl Rogers (Freedom to learn, 1969) might argue, that the student cannot be trusted with his/ her own learning. We argue, that students must be trusted with actively regulating and forming the learning environment. This includes a transition towards the built informality. Experts, novices and knowledge itself may appropriate and modify spatial modes, in order to adopt comfortable teaching and learning behaviors. The cultivation of safety and wellbeing is supported by a process of appropriation and transformation of spatial modes. Hereby, the amplification of peer work plays a crucial role for mutual visibility, informal exchange and the strengthening of learning commonalities.

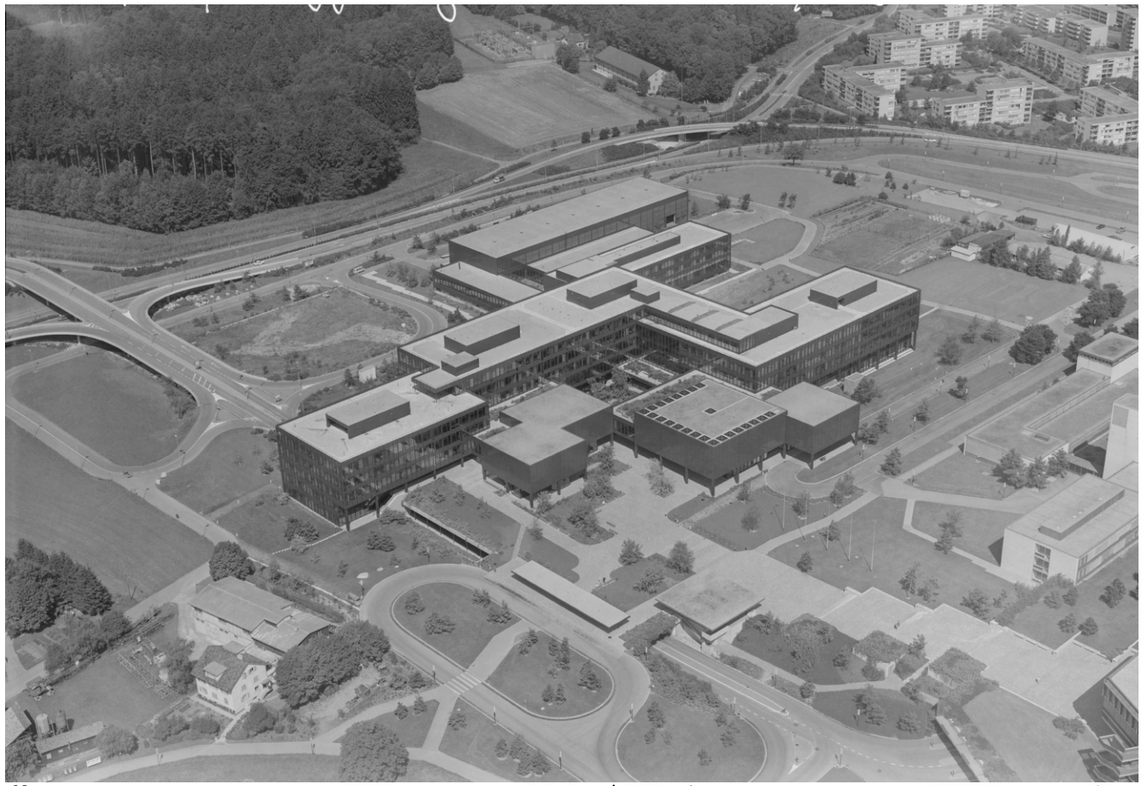
Horizontal peer learning occurs on eye-level, in open participation of debates, team work, and amplified review of results on mobile pin-up boards or partition walls.

The various methods of study at D-ARCH are allocated in a network of different rooms (lecture and study halls, libraries, workshops etc.). Most learning activities require only a few body actions, such as standing, sitting or walking. Students are assigned fixed personal workspaces in drawing halls, where many educational tasks are performed, such as model building, drawing, and the review of work. If physical movement was better incorporated into study methods, they will become more efficient.

Relative to building measures, the introduction of height-adjustable tables is a low-costing capital expenditure. It reduces health risks, medical- and operating expenses, thus enhancing the overall institutional turnover.

> Learning environments must be actively approached with good governance to avoid measures of damage control.

A change in interior furniture allows a spectrum of built informality, without further building measures. Diversified furnishing may accommodate online, flexible or mobile learning and thus maximize the academic experience and achievements of students.



67 | HIL after construction, 1977, ETH Image Archive

68 | Material research at ETH in 1946, ETH Image Archive

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