Digital Empowerment for the "Experimental Bureau"

Work Based Learning in Architectural Education

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This paper describes the concept of the ``Experimental Bureau'' as a didactic environment aiming to deal with real-life design tasks within the framework of architectural education. Its main focus lies on the specific opportunities for digital empowerment of students who learn about the design process - sometimes even in the role of contractors - in real-life oriented project work. Thus the following questions come under scrutiny and discussion from an angle of work based learning: What kind of design problems are tackled in a meaningful way by students through the utilization of a digital strategy? What kind of software (or software mix) is chosen and what problems are addressed by the choice and handling of these digital tools? These questions are answered in a different way applying the format of the Experimental Bureau, driven by its real-life projects and client communication, in comparison to largely artificial tasks confined to the academic realm.

Keywords: *design education, real-life case study, stakeholder communication, real-world experience, didactic approach*

1 INTRODUCTION

One of the central issues of architectural education in an academic setting is its artificiality on one side and separation towards real-life conditions on the other side. Students usually work on design exercises in a rather controlled environment, receiving feedback from the academic staff. They have to trust their supervisors/tutors/teachers, who will specious supply them with second hand experience, especially in regards to the virtual demands and needs of clients. Since the translation of these requirements into spatial concepts and subsequent architectural solutions is one of the main traits of the architects work a certain degree of contact between students and clients/stakeholders deems more than desirable as part of the curriculum in design education. The term "didactic laboratory", although it has been used with different connotations (see e.g. Amirante et al., p. 14), suits the concept of the Experimental Bureau.

In this paper, selected case studies from two different educational sites are presented and expounded, i.e. HafenCity University Hamburg and Technische Universität Wien. Both sites are carrying out design studio assignments nonetheless with a different scope and setting. The main focus of is the the elaboration of "digital empowerment"- in other words, how do students develop their skills to act with an increased ability to steer the design process.

2 THE DIDACTIC LAB ENVIRONMENT

This paper explores the concept of the Experimental Bureau as a didactic approach within the educational settings of a design studio. The format of the working context can be described as follows: Students are learning while working on a real-life architectural design project with actual/tangible principals in a process moderated by a professional architect and/or academic staff. In this regard the term "experiment" requires further elaboration in an academic context.

Experiment as a term is hinting at the secure perimeter surrounding e.g. an individual, the Greek "peri" translating as "around", while suggesting a leave of this secure perimeter. This necessarily contains the element of risk, which can be derived from the Greek "rhizikon" that among other translations has means "cliff". The cliff in this context signifies taking the risk as a step towards daring to leave secured perimeters (on risk and daring see e.g. Hahn 1958 and Röhrs 1966), heading into the unknown. Topographically it may also be the separation between land and water. To move safely in water cannot be learned fully on land. These reflections may be transferred into architectural and design education as the didactic format of the Experimental Bureau.

2.1 Exercise and Experiment

One significant difference between a design exercise within a protected context and an experiment within a controlled environment, is the element of risk. Safeguarding is more extensive if one declares a number of performed tasks an exercise, making the process the prime objective, aimed at the one completing the task and not so much at the outcome. An experiment is primarily concerned with an outcome which is beforehand unknown, the setup is conceived to contain and control possible risks, which, due to the very nature of true experiments, cannot be as safely limited as during an exercise. The predominant risk in the case of the experimental bureau in architectural education is the professional exposure, which is reduced again to a certain degree by academic supervision within the accompanying design studio.

2.2 Taking the Experimental Risk

Felix von Cube has discussed the relationship between risk and security in his publication "Gefährliche Sicherheit" (dangerous security) and pointed out, that human beings strive for both. The learner is intrigued by situations he/she cannot yet fully control, there is an attraction at least to a certain amount of risk. There is an intrinsic notion to turn this risk into security, to gain control over the situation (see von Cube 1990, p. 26 and Warwitz 2016). The Experimental Bureau attempts to use this mechanism among others to trigger an intrinsic student choice of digital strategies by enhancing motivational risk through real-life tasks.

Return of investment is, however, a risk factor for an involved professional architect while supervising students e.g. at the HafenCity University to work on an authentic project situation. Integrating students in a real-life design task may result in time losses, e.g. through essential educational processes and problem/solution discussions. On the other hand there is the possible gain of valuable future employees, the acquisition of a contract through academia and the prospect of dedicated project presentations in the media. On top of this, the issue of competition between work based learning and professional architects needs to be addressed by way of a win-win-strategy. This applies also to the working context of Technische Universität Wien, where (local) stakeholders, such as municipal/communal mayors, councilors, merchants etc. input an investment of time. During the intermediate and final critics the panel may be expanded with professional architects and governing officials. A participation of 20+ students delivers an adequate bandwidth of solutions. Furthermore, the exchange of views and opinions in a public context has proven to be fruitful.

When taking a closer look at digital strategies as part of the design process several lines of implementation can be identified. First of all a noticeable enhancement of a (classical) one-man/woman-setting needs to be mentioned. The power of computing allows to expand the "productivity" of a single per-

son, for example by way of the generation of alternative design solutions. However, individual design work takes places within the setting of a larger studio group. Collaborative activities can and will be set out by way of common access to data and the creation thereof. The issue of subsequent sharing is especially important regarding the representation of the surroundings of a building plot given. A survey of the existing location/situation will most likely make use of digital data and is linked to the creation of a 3D-model of the surrounding context along with existing building structures. It may eventually lead to the delivery of a digitally fabricated physical model, where the participants in the design studio can insert a partial model of their design. The central availability of low threshold tools - such as laser-cutters - is around nowadays at most university locations and their handling is manageable. Although working in a scale (i.e. not 1:1) the relationship between "designing" and "making" receives upwind. Overall, the exchange with a larger group of studio members can work out fruitful and be expected to raise further development on the individual design work.

On top of this, the communication takes place by way of imagery, created by the students themselves, along with transformations of for example analogue drawing entities superimposed by digital sketching and eventually further manipulation.

3 CASE STUDIES IN AN EXPERIMENTAL CONTEXT

By using test cases a collection of digital necessities as a basis for this didactic format is gathered and discussed. The design programs stem from two different universities. Although different framework conditions are given, a number of communalities can readily be identified.

3.1 University Location A-HafenCity University Hamburg (HCU)

Since 2009 student competitions have been deployed by Kulcke et al. to integrate external partners into design-studio work. Especially impromptu

design tasks, where students have to come almost ad hoc to solutions to be presented within the timeframe of two weeks in front of the jury, have been utilized for this strategy. The external partners e.g. companies, institution, NGOs and others are invited to take part in the task development, feedback sessions and most importantly in the final jury. And they supply the need, their real-life task.

Over the last ten years about 70 of these competitions have been organized this way at the HCU and the demand for a follow-up program has grown over the years. This demand is not only driven by students who took part in the competitions, but especially by the external partners. In the first case, which also involved the Hamburg University of Technology (TUHH) a follow-up project has lead to the realization of an interior design by two students (TUHH) at the International Building Exhibition (IBA) in Hamburg Wilhelmsburg in 2013 (fig. 1). The development of the didactic format of the Experimental Bureau stems from this demand and the experience gathered with such follow-up projects.

A student competition from the same year was related to the "Rathauspassage". This second case study proved that the format of the Experimental Bureau can significantly contribute to public relations strategies of the academic institution in charge. The students' rendering was in the end decisive for the

Figure 1
Students Philipp Popp and Ingo Höfert standing in front of their IBA interior design

editor to publish the concept in an extended article of the main city newspaper Hamburger Abendblatt (fig. 2).

In the third test case "BHH Sozialkontor", the student-driven choice of digital strategies within the real-life task of designing the entrance area of a psycho-physical therapy facility has been even more consciously integrated into the didactic approach.
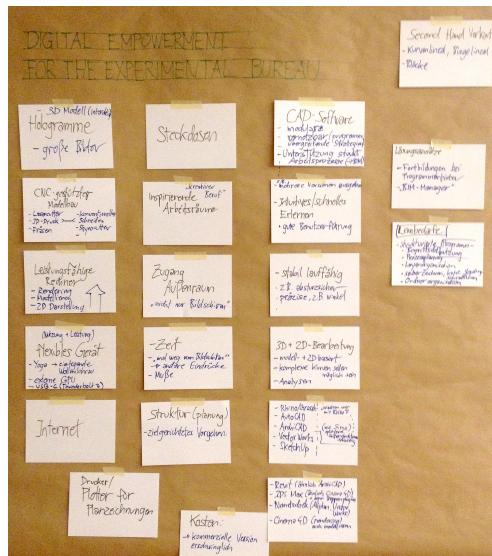
In this case the choice primarily concerned the digital collaborative workflow and the use of computer-aided parametric design.

At first data to discuss the use of digital tools in this didactic strategy has been generated within the format of a moderated group discussion with the two participants of the initial launch of the Experimental Bureau, explicitly labeled as such, as a didactic format with a focus on digital tools (fig. 3).

The group discussion consisted of several parts. In a starting session, the students were asked at first, what kind of digital support and tools seemed necessary for them to work in a conceptual environment like the experimental bureau. The second part of the starting session focused specifically on software issues. The students mentioned several CAD software solutions known to them through their curriculum and their work experience so far, while comparing traits that mattered to them and their work in general.

For projects worked on in this format it is vital that they are conducted in a real environment and with a real contract, only in this way the necessary sense of risk can be established, which supplies the format with its experimental character.

Regarding the implementation of digital strategies student versions for CAD software are in certain cases out of the question, since the software is commercially used. This applied e.g. to the project "BHH Sozialkontor". On the other hand the projects are small scale, among other reasons so as not to go into competition with professional bureaus, and thus don't justify the purchase of expensive digital tools.

3.2 University Location B - Technische Universität Wien (TUW)

The main theme of the study cases is related to the structural vacancy of abandoned buildings. The local community is not necessarily the owner of these buildings, but has a dedicated interest to shift the potential decay. Within the setting of a design studio, approx. 20-25 students are working on a project theme and this delivers an adequate band with re-

Figure 2
Article on the project "Rathauspassage" in Hamburger Abendblatt 13.06.2013, rendering by Oskar Görg and Ferdinand Leser

Figure 3
Collection of aspects as a result of a group discussion on digital necessities, students: Sandra Luu and Tom Ehlers

garding the solution space (pool of ideas). The focus is laid on building program development on one side and to support decision-making processes regarding future use on the other side. Besides at least one local visit an exchange with on-site potential demands can be identified and translated into a design concept. In addition the communication with local representatives culminates on the occasion of the midterm and the final critique. After the termination of studio work once again an on-site presentation of a subset of the created designs takes place and intends to keep the discussion in the local community alive. Eventually realization as an option may occur.

Risk has another dimension in this regard. For the participating students there exists a risk not to complete their studio work with a sufficient grade. However, this type of risk is in other studio settings existing as well. On the other hand, the local community may consider risk in the sense of unsatisfied expectations, uncontrollable reactions from the part of the local residents, or simply waste of time of decision-makers. This type of studio work has been executed for a number of years and the work with 20+ students (level: master studies) did not lead so far to bitter disappointments at all. The aim is not to bypass professional architects, but to take up design tasks, which are otherwise neglected (too small; not paying off etc. in a professional office environment). However, when it comes to realization several options exist to link up participation students with professional architects.

3.3 Digital Necessities as Part of the Design Process

In regards to teaching digital strategies and workflows in architectural planning, the strength of the didactic format of the "Experimental Bureau" lies first and foremost in being a catalyst for intrinsic prioritization and choice of the digital tools deemed necessary by the students (fig. 4 shows a workflow generated within case study example III). This process can be moderated and supervised by academic staff but it is primarily fueled by the reference to the necessities that are inherent in the real-life project and the needs of the external partners. Thus the pressure to decide what software and hardware is put to use is based on real needs, thus adding motivation on part of the students in getting to know and implementing them, and not a curriculum that may be looked upon by them as artificially imposed.

As an element of meta learning, or as Bateson called it deutero learning (Bateson 1978) students re-

Figure 4
Digital workflow
necessities in the
Experimental
Bureau

3D model
-parametric
-data-driven

facades,
sections
floorplans

layout

perspective

automated
layout
adjustments

print-out
and
data export

steep learning curve

collaborative data exchange
cost efficiency
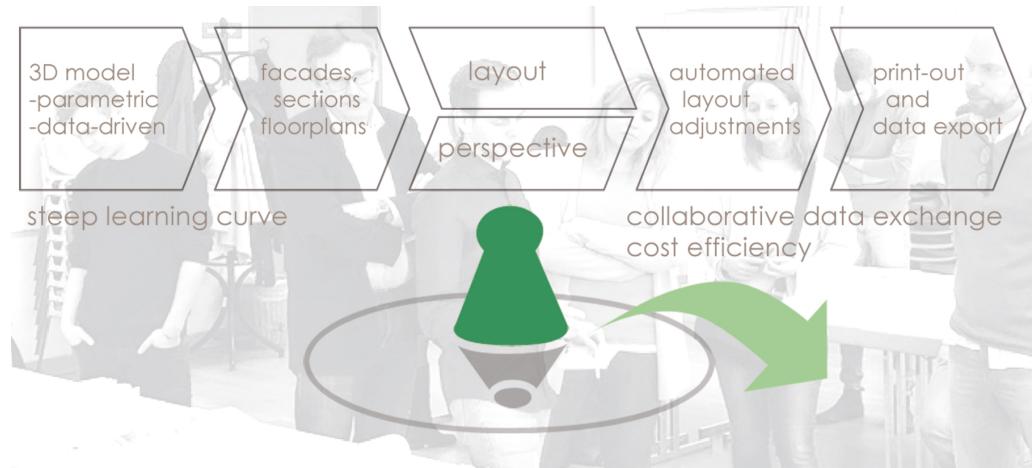
alize (if guided accordingly) that a choice of digital tools may be sensible in regards to one project and futile in regards to another. In the following examples this variety of prioritization of digital necessities per project becomes obvious.

Example I: CAD / CAM Strategies - "IBA Musterwohnung" (HCU / TUHH). The process of realization of the interior design of the "IBA Musterwohnung" called for digital strategies involving among others computer-aided manufacturing by CNC-milling machines. The authors of the winning concept in the student competition had to deepen their knowledge about CAD/CAM APIs to see their design ideas materialize.

Example II: Public relations by digital imagery - "Rathauspassage" (HCU). Setting out to design the interior of the "Rathauspassage", a social workplace right next to the Hamburg's city-hall, but underground with no immediate contact to public space on the surface, it soon became clear, that the customer not only wanted a design solution addressing this problem, but also imagery to use in a public relation strategy. This was communicated to the students by the customers themselves and further discussed within the group that wanted to take part in the preliminary student competition. As expected, the group with the best pictorial communication, as well as a high quality design, succeeded with the jury. Finally their image, as a result of 3D modeling, rendering and collage technique in image refinement software, was used as intended by its creators to communicate the customers intentions.

Example III: Digital workflow / parametric design - "BHH Sozialkontor" (HCU). Digital strategies, which were agreed upon by the group and put to use in the course of the design-development were e.g. digital enhancement of sketches and 3D models (fig. 5) with image refinement software and 3D modeling and rendering (fig. 6). These techniques were used in different stages of design development and customer communication.


Figure 5
Coloring of a 3D model with image refinement software (digital sketch)

Figure 6
Rendering of the situation presented in fig. 5 by Tom Ehlers

The curvature of the facade of the entrance area justified the application of parametric modelling in Rhino and Grasshopper (fig. 7).
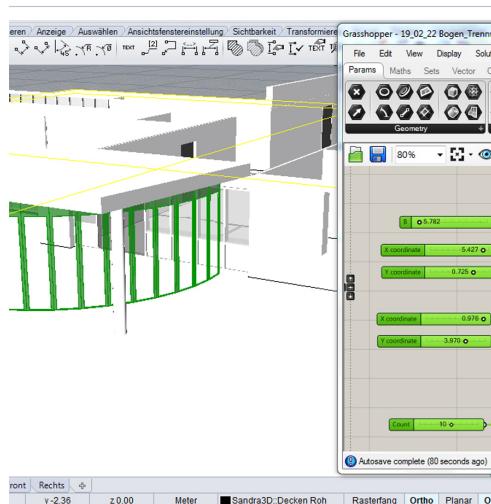

Figure 7
Parametric design for curvature and grid of the new entrance facade

Figure 8
Raw data of the
laserscan

Example IV: Use of laserscan data - Design Studio "Wine & Space" (TUW). In many places, wine cellars have lost their original function. Many a "Kellergasse" (Austrian expression for a lane or hollow way lined by wine cellars on one or either side) is on its way to dereliction, as most of the cellars are no longer in use. How can the abandoned premises be put to best use? How can they be filled with more daylight, which might be needed for new functions? Looking at the site from a design perspective also had to include issues of zoning and developing economically viable concepts of use.

A building survey comprising of plans etc. did not exist and it would have been rather cumbersome for an individual student to work this out.

However, surveying data is rather meaningful to support the design process of the relatively complex geometry and allows to explore a common ground when working out design alternatives and solutions. For this reason a laserscan (fig. 8-9) was carried out in the beginning of the term and made available to the participating students.

Figure 9
Result of the
laserscan - digital
representation of a
cellar corridor

Example V: Walkthrough representation of a final design (TUW). This design program focused on the old smithy at the centre of Mühlbach am Manhartsberg in the Weinviertel region. While the location is certainly attractive, the building has long ceased to fulfill its original function and has been vacant for quite some time. The first task was to devise a meaningful use for the building, but also think about how to animate the entire centre of Mühlbach in the vicinity of the local castle. The design concept is not to end at the outer walls of the smithy but should make an impact on the village fabric including the impressive castle grounds.

One of the participating students developed a presentation of his concept in a walk-through environment (fig. 10), in order to facilitate the understanding of the design by laymen.
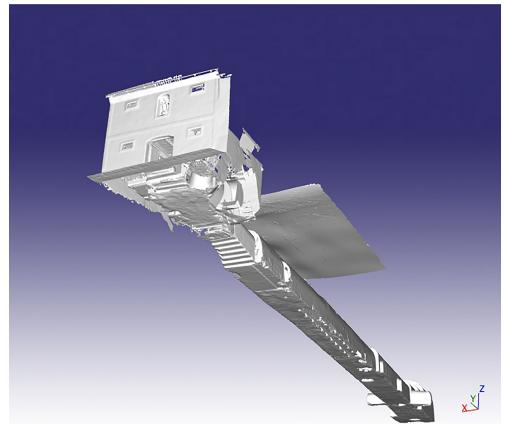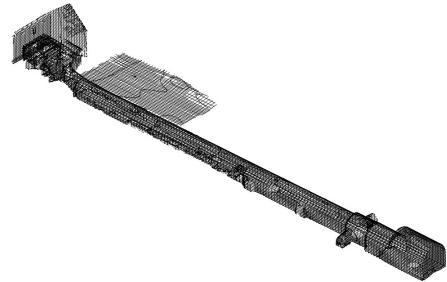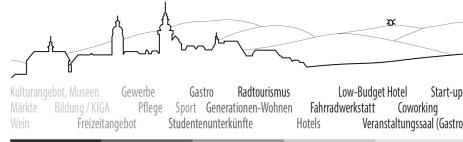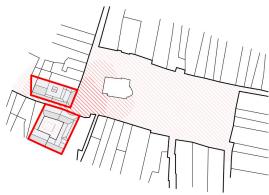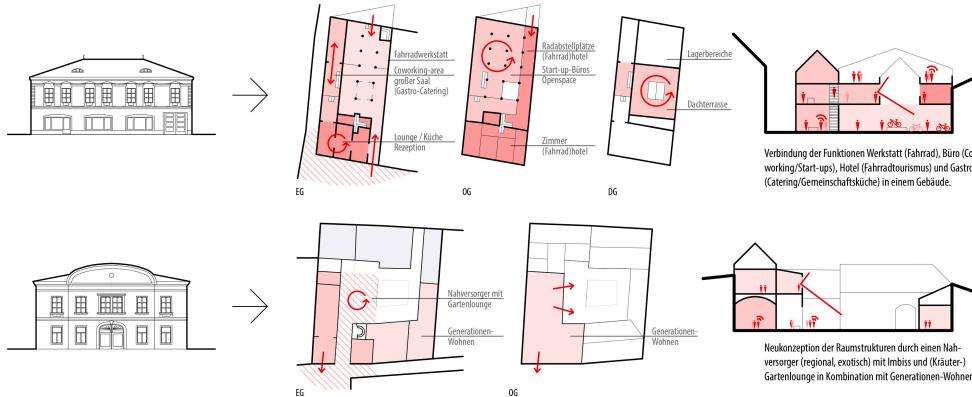
Figure 10
Exploration of the
design by way of a
walkthrough-
representation on a
tablet (TUW -
Alexander
Schaukowitsch)

**Example VI: Visual communication of early design stage concepts (TUW).** At the very beginning of design studio a typical issue is to engage all students. It does not surprise that watching and observing what others are doing is more than tempting instead of a pro-active attitude to develop design concepts. For this reason a novel start of the design studio was developed by way of a mandatory assignment. Preceding to the first supervision meeting students have to work out an A3-sheet with a comprehensible concept idea (fig. 11). This document has to be submitted to the e-learning environment before the meeting and will be projected on a large screen. Although the procedure sounds too easy it has proven to be beneficial as anybody has to participate and cannot "hide" with for example a small sketch. Overall it leads to engage-ment and common discussion. This step may be - depending of the overall design assignment - repeated once again, if needed. From here on individual supervision takes place in the setting of the whole group of participants, i.e. presentation and review one by one.

4 CONCLUSION AND OUTLOOK

In this paper the laboratory environment of the "Experimental Bureau" aiming to explore and steer real-life design tasks has been elaborated by way of accumulated experiences at two different institutions. Several different types of assignments in the context of architectural design have been presented in order to show the meaningful implementation within the context of a design studio. The overall aim is not to completely replace previous "abstract" assignments,

but to achieve a balanced mixture between fictitious and real-life exercises. Particularly issues of scale and dimension require sincere guidance as the accompanying framework conditions are predeter-mined and adaptation is restricted.

The process of self-organization - with a certain degree guidance - serves the teambuilding within the group students and does not ignore the requirement of delivering individual contributions. Sharing data, but also common model building (typically: urban fabric model) play a central role. On top of this, the settings do reinforce the intrinsic choices of digital tools as well. The issue of software usage is sensitive especially when a commercial context comes into place.

Within the group discussion an exchange on the effect of imagery ("idiosyncratic impact") and the communication with stakeholders delivers invaluable insights regarding perceptional phenomena.

The inquiry into the characteristics of each example from the viewpoint of digital necessities required to solve real-life design tasks, mainly identified by the students confronted with these projects, may be regarded as a qualitative study on digital strategies in architecture and design. It reveals first and foremost that the digital necessities are diverse and their diversity is the result of the individual framework, demands and needs related to the project as well as the digital strategies to tackle the task are chosen according to individual characteristics of the team determined to meet it.

Within the format of the Experimental Bureau supervisors can positively confine themselves to the role of coaches and moderators - as questions arise on how to proceed they can reference the real-life problems and settings of the projects as well as the stakeholder statements during critiques and discussions.

The motivation to work on the real-life design task is more directly devoted to its problems that need solving - it is less attached to grades, titles and the desire to meet the teachers' expectations. If an actual customer is convinced of the helpfulness of a design concept, among others through the choice of the right digital strategy, a different kind of professional confidence can be learned by students. Digital empowerment in this context means also that, according to Bateson reflections on deutero learning, students not only learn to work with digital tools but to chose what they need to learn at the time they need to learn it.

To trigger this kind of learning the Experimental Bureau resorts to real-life, even adventurous experience (see on the didactic potential of experience and adventure e.g. Boeger et al. 2005 and Miles et al. 1990). As contracts with customers are involved, so is an individualized learning which has been described as characteristic for contract learning (Gilbert 1976, p. 25). Although Gilbert refers to an individual agreement between teacher and student, contract learning may serve as a base for reflection on customer contracts within the format of the Experimental Bureau. Digital empowerment in this context is also a reference to empowerment education (Shor 1992) and its underlying concept of a democratized pedagogy as teacher and student mutually investigate and solve problems at hand.

All in all it is hoped that the readers of this paper might be encouraged to explore similar educational experience at their institutions.

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